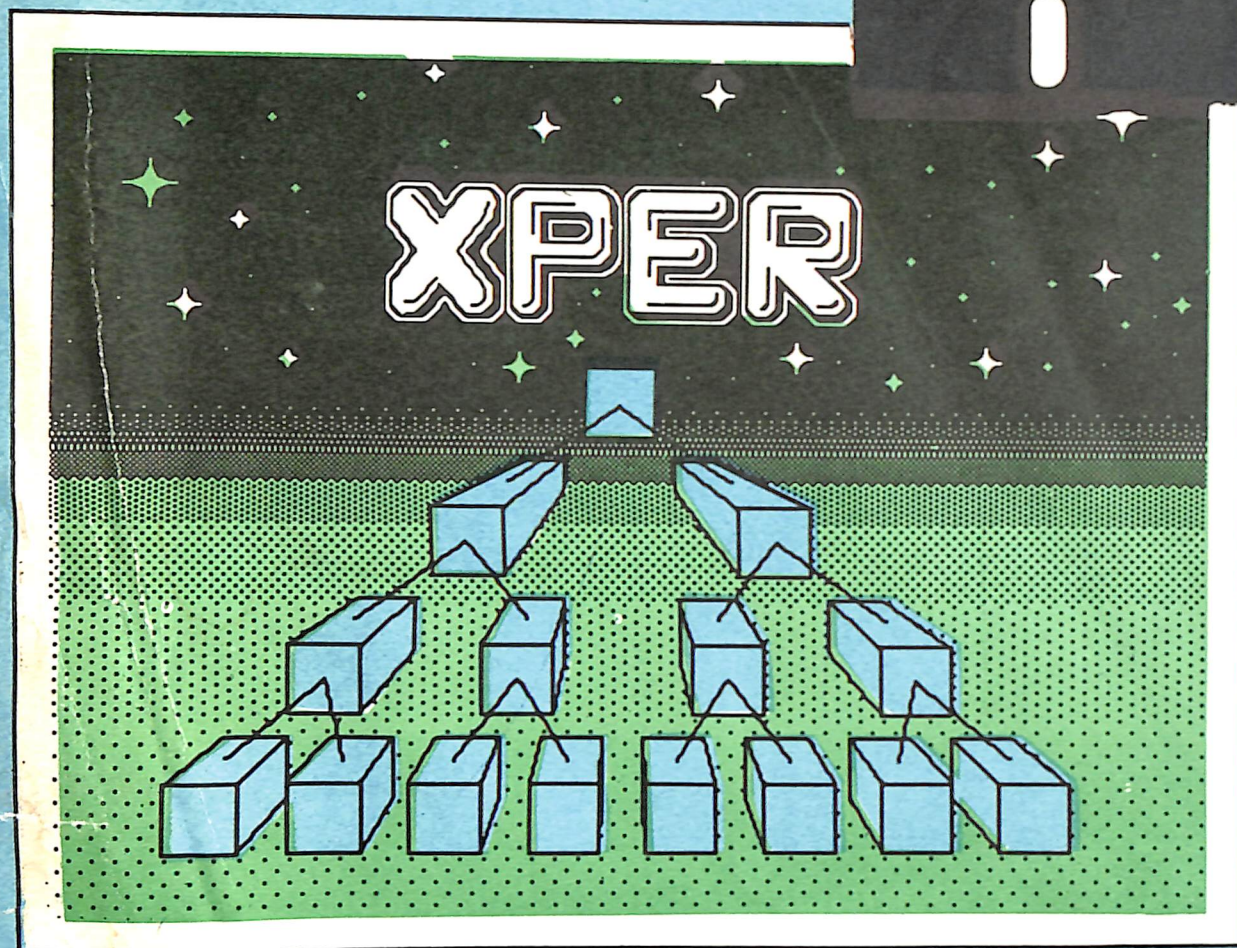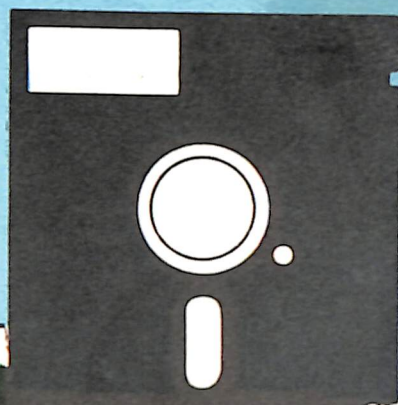# XPER KNOWLEDGE BASE SOFTWARE

FOR THE COMMODORE-64 AND -128

Abacus Software

Abacus Software

(C) 1985 MICRO APPLICATION

XPER

SN: 39337

MFD: OCTOBER 7, 1985

Abacus Software • P.O. Box 7211 • Grand Rapids, MI 49510 • (616) 241-5510

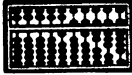# XPER

Knowledge Base Management System for Microcomputers

Designed by Dr. Jacques Lebbe

39337

A Micro Application Product

Published by:

Abacus ▓▓▓▓ Software

Table of Contents

TUTORIAL

REFERENCE

PREFACE

THE SOFTWARE

XPER is a knowledge-base management system. It is one of the first Computer Assisted Identification packages available on microcomputers.

THE MANUAL

This manual is divided into three main parts. The first--OVERVIEW--introduces you to the main concepts of XPER, showing you what a knowledge base system is, what to expect from one, and how to use this system. XPER's structure is presented and the main functions are explained.

The second part of the manual--TUTORIAL--consists of 9 lessons. Later lessons build on the information already presented. You'll be gradually introduced to XPER by creating and working with a sample knowledge base.

Finally, the third part--REFERENCE--serves to answer specific questions that may arise when using XPER.

A set of appendices includes a summary of XPER commands, a description of XPER's internal organization, and an index.

XPER ON THE COMMODORE 64

KNOWLEDGE BASE SIZE

Maximum number of features	: 50
Maximum number of attributes	: 300
Maximum number of attributes per feature	: 14
Maximum number of objects	: 250

REQUIRED HARDWARE

Central unit   : Commodore C-64
Display   : Monitor or TV
Disk drive   : 1 Commodore 1541
Printer   : Optional, C-64 compatible

Central unit   : Commodore SX-64
Display   : Included
Disk drive   : Included
Printer   : Optional, SX-64 compatible

GETTING STARTED

For the Commodore C-64, all parts of the system must be connected together
including the computer, the disk drive, the display unit (monitor or TV) and the
optional printer. If you have difficulties please consult the installation section of
your computer manual.

LOADING AND EXECUTING XPER

It is first necessary to turn all components on. The following message is
displayed on the screen:

**** COMMODORE 64 BASIC V2 ****

 64K RAM SYSTEM   38911 BASIC BYTES FREE

READY.

If you do not receive this message, turn the power off and check the connections
between the different components of your system. Turn the power on again. (The
message is slightly different for the SX-64).

Insert your XPER diskette into the disk drive and close the drive door. Type:

LOAD "*",8   and press [RETURN].

After a few seconds, an XPER screen is displayed and you are ready to start working.

CHOICE OF COLORS

It is possible to choose the background, border, and character colors. This is done from the XPER main menu by using the [F1], [F3] and [F5] keys. The colors can be modified ANY time the main menu is displayed.

THE XPER DISTRIBUTION DISKETTE AND
KNOWLEDGE BASE DISKETTES

The knowledge bases must be saved on diskettes previously created for this use.

While using the system, it is necessary to insert the BASE diskette before loading or saving, and to re-insert the XPER diskette after these operations.

CREATING A KNOWLEDGE BASE DISKETTE

To execute this operation, the computer must be on; when the cursor blinks, insert a new diskette and type:

OPEN 15,8,15,"N0:XPER BASE,XP" [RETURN]
CLOSE 15 [RETURN]

(OPEN 15,8,15,"N0:... - N0 corresponds to N zero)

When the red light on the disk drive turns off after a minute, the diskette is ready to receive a knowledge base. If the red light blinks right away, check the spelling of the command for a syntax error. If the red light blinks after a minute, there is a problem. Start the same operation with another diskette. If the problem arises again, you may have a problem with your disk drive.

DISK ERRORS

If you want to load a knowledge base and the system displays "BASE NOT FOUND," it means that you do not have your BASE diskette in the disk drive, or the knowledge base name is wrong.

If you want to get back to the main menu, or load one of the main modules, and the message "Loading in progress" is displayed and then the previous menu is displayed again, it means that the XPER diskette is not in the disk drive.

PRINTING

XPER is compatible with all the printers that can be connected to and succesfully used with a C-64 and a SX-64.

SYNTAX

[----] indicates a specific key, other than alphanumeric.

Example : [RETURN] or [<-]. [<-] is the left-arrow key and is referred to as ESC by the program.

<----> indicates a reference to an XPER menu. These menus are highlighted in reversed-video in the program.

Example : <M Ed>, <C fe>

LOADING

Insert the XPER system diskette into the drive and enter the following:

LOAD "*",8
RUN

OVERVIEW

ONCE UPON A TIME

The first microcomputers appeared in the Seventies and brought data processing power to everyone. New software products revolutionized the way people work. Among them, word processors simplified writing, editing, documentation, and text creation by eliminating most of the repetitive tasks. Spreadsheets solved number-related problems in many ways. Last, but not least, database management systems optimized file-related procedures - customers, products, telephone lists - in ways nobody had thought possible a few years ago.

The mid-Eighties mark a new step in the computerization of the world. Thanks to new developments in computer hardware, artificial intelligence, and mathematics, new tools have become available that greatly improve the fields of communication, productivity, education, and knowledge acquisition. More powerful and inexpensive systems are introduced almost every day and the communication between users and computers has improved markedly. Applications that once were possible only on huge, specialized computers are beginning to appear on personal systems, opening new doors and allowing more people to be creative and to share new knowledge.

EXPERT SYSTEMS AND KNOWLEDGE BASES

A very exciting new application is the EXPERT SYSTEM or KNOWLEDGE-BASE MANAGEMENT SYSTEM. "Expert system" is a generic term covering different types of software products based on the latest research on artificial intelligence. Expert systems act like experts and allow others to share the knowledge of the experts.

Expert systems can derive new information, knowledge, or rules that were previously unknown from existing information, knowledge, and rules. A data base can only reproduce facts. For example, it can "display the address of Mr. Smith" or "print the name of all ski resorts in Montana" if the corresponding information has been entered in the data base.

EXPERT SYSTEMS AND KNOWLEDGE BASES

On the other hand, software such as XPER is able to find or to deduce a fact such as "all African felines climbing trees have retractile claws," an impossible conclusion for a conventional data base system. This information was not entered into the knowledge base as such, but it was derived by the system from knowledge already included in the base.

Expert systems that run on mainframe computers are often specialized, and can only treat one subject or one type of knowledge; in this, their creation and inquiry functions are distinct. We'll see that XPER has a creation module and an inquiry module that make its use easier.

KNOWLEDGE BASE APPLICATIONS

There are many applications that can be handled by knowledge base systems such as XPER. They can be used for Computer Assisted Education and Computer Assisted Identification. This last technique has many applications in scientific fields and research (biology, zoology, chemistry, geology, ect.). Knowledge base systems are also useful for solving diagnosis problems (mechanics, medical, ...), decision-support aid, and hypothesis evaluation. Home computer users can ask XPER to help them predict tomorrow's weather, help their children's education, handle complex personal files, solve logical puzzles, and so on.

In the following tutorial, we'll see more precisely how to create knowledge bases and how to use them.   But first, let's look at the main concepts behind XPER and its knowledge base.

XPER DEFINITION

XPER is the first knowledge base management system available on microcomputers. It is an intelligent easy to use interactive system able to solve most diagnosis and determination problems. All applications that have been previously described can be solved using XPER.

XPER AND ITS KNOWLEDGE BASE

XPER's knowledge base is structured and composed of three types of elements: objects, features, and attributes. Using these three elements, you can represent and encode your information in order to incorporate it into the base.

By definition, an object is the reference element, or the title of an information variable. A feature describes an object and an attribute is a possible state or value of the feature.

For example :
"The fur of the tiger has stripes." "Tiger"'is an object, "Fur" is a feature and "stripes" is an attribute.
"When one can see low, black clouds in the sky, there is a good chance of rain." "Rain" is the object, "cloud" is a feature, and "low, black" are two attributes of "cloud."

MAIN FUNCTIONS

XPER has two main parts: a part for the creation, codification, and acquisition of the knowledge, and a part for inquiry.

Creation is performed by the EDITOR. Each item of information is represented as an element of the structure and "questioning" is performed within the structure. The editor allows:

- the creation and modification of objects, features, and attributes,
- the creation and comparison of object groups (object related rules determination),
- the calculation of the distances between objects (similarity index).

Inquiries are performed by the INQUIRER. Diagnosis and identification are performed simply by answering questions with the knowledge that:

- the determination is chosen by the user,
- the search is done step-by-step, backward and forward,
- irrelevant features and attributes can be automatically disregarded,
- XPER can justify its choice at any time,
- unknown facts are permitted.

Let's take a look at all these concepts in more detail.

KNOWLEDGE BASE STRUCTURE

The knowledge base contains three types of elements: objects, features, and attributes.

OBJECTS

Objects are references to the knowledge that is determined by the inquiry system. To make it simple, we can compare a knowledge base with a file system. An object is like a record. Records are defined as objects. But an object is not only "Mr. Smith," it can also be the result of a psychological test, a type of hand-writing, a weather forecast, etc.

FEATURES

Features describe the object. They are defined as qualitative because thay can represent almost any kind of information. In a file system, features are similar to fields. For XPER, a feature is a description of a characteristic of an object. During an inquiry (or determination), it becomes a question that can be answered by yes, no, maybe, or any type of data. For example, "What is the weather like today?" is a valid feature.

ATTRIBUTES

Attributes are the different states of features, depending on objects. To put it another way, all features have a finite number of possible states, or attributes. "Nice," "Fair," "Grey," "Windy," "I don't know" are the attributes of the feature "What is the weather like today?". They will become possible answers to that question during the inquiry or determination.

XPER FUNCTIONS

XPER has four independent modules. An **EDITOR** performs the creation and modification of the knowledge base. An **INQUIRER** or Query system identifies the objects by answering questions. A **PRINTER** module puts the knowledge on paper. A **REORGANIZER** modifies the structure of the base and merges different bases together.

EDITOR

XPER's first module is the EDITOR. It lets you create knowledge bases by transforming the raw knowledge into XPER-usable information.

The bases are dynamic and can be expanded by adding new information--new features and attributes and new objects. Previously entered features, objects, and attributes can also be removed or modified, depending on their use.

The editor has more complex and powerful functions. For example, XPER's editor can compare objects, or a group of objects.

Using a knowledge base about the cat family, for example, you can create a group with all African cats that climb trees, and then ask for their common features. XPER might find out that they all have retractable claws. This illustrates the kind of research possible with the editor.

INQUIRER

XPER's second module is the INQUIRER. It searches the knowledge base and identifies those objects that have certain features and attributes.

The INQUIRER is interactive. XPER displays a list of questions and the user can select the questions to be answered. Based on the answers, XPER reduces the number of possible solutions. XPER can also support its decision at any time so that the user can validate the choices.

INQUIRER - EXAMPLE

Let's use XPER to forecast tomorrow's weather. A sample knowledge base might have a large number of features such as today's weather, the wind direction, the humidity factor, the atmospheric pressure, the month, and the geographical location. Six features describe our knowledge base.

During the inquiry, the user chooses the order in which he will answer the questions. The order is important, since not all of the answers to all the questions may be known. The user can also start with the most important feature. XPER displays a single answer to the completed inquiry (in most cases). For our example: tommorow's weather as predicted by our knowledge base is displayed.

But XPER might conclude that the answers provided by the user do not allow a single solution, or the answers provided do not match any object contained in the knowledge base. For example, there is a fair chance that in our weather forecast base, the answers "Sahara desert", "Snow", "90% humidity" and "July" will produce what is known as an 'Impossible combination of characteristics' unless our weather base is faulty.

NOTE: A knowledge base is only as good as the user who enters the information. If the user's information is incomplete or inaccurate, the knowledge base reflects this.

USAGE

The inquiries are performed in the following manner.

First all the main features are displayed. Not all of the features are displayed, since some questions are dependent on the answers to previous ones.

The user chooses a question/feature and the possible answers/attributes are displayed. The user then selects from among these. This operation is repeated until:

- a unique solution is found, i.e. there is only one object in the base corresponding to the entered criteria. For example, according to our knowledge base, the weather will be fair tomorrow.

- it is not possible to find a unique solution, that is, more than one object corresponds to the selected criteria.

- no solution can be found. This is our Sahara example.

At any given time, and especially when the user wants to modify an answer, it is possible to return to any previous question without having to restart the search.

INQUIRER

POSSIBILITIES

At each level of the search, it is possible to get the following information:

- the list of all remaining objects (possible solutions),

- the list of all discarded objects with the reason(s) for their elimination,

- the list of the disregarded features (questions) with the reason for their elimination.

XPER can be asked to order the features so that the most discriminating ones for a given object/solution are displayed first, thereby reducing the length of the search.

A trace of an inquiry can also be printed.

All of these concepts are reviewed in the nine TUTORIAL lessons and are fully detailed in the REFERENCE part of this manual.

REORGANIZER

XPER's third module is the reorganizer which allows you to restructure existing knowledge bases, modify the order of the objects, features, and attributes, and combine the information in different knowledge bases.

PRINTER

XPER's fourth and final module lets you print part or all of the information in the knowledge base. It is possible to print the list of objects, the list of the features with or without their attributes, and the structure of the complete base.

Now let's start using XPER. If you're still a little confused by all the new ideas and concepts, don't worry. The following lessons are designed to help you understand and to use all these new features by experimenting with XPER.

TUTORIAL

SECTION

XPER - Knowledge Base Management System - Tutorial

LESSON 1

OVERVIEW

The previous chapter introduced the main concepts behind XPER. The following practical exercises will ease the learning task. Each lof the following nine lessons builds on information from earlier ones.

The first lesson presents a reduced knowledge base on Feline Species around the world. It is designed to show you how to structure knowledge to be used with XPER.

KNOWLEDGE ORGANIZATION

Before creating and manipulating data, you must first understand the data structure so it can be entered easily and efficiently into XPER.

EXAMPLES

Let's start with knowledge such as "Tigers have stripes on their fur", "The IBM PC computer has between 64 and 512K RAM", "If swallows fly low in the sky, it's a sign of rain" or "Natives from Switzerland can speak German, French, Italian and Romansch".

This knowledge must be transcribed into objects, features, and attributes. To put it another way, we must define the list of <u>what</u> has to be described and <u>how</u> it is going to be described.

CHOOSING THE OBJECTS

Objects in the base correspond to what we are going to describe, search, and make inquiries on.

EXAMPLES

In the previous examples, we are trying to identify cats and computers according to their characteristics, forecasting the weather by following scientific or rules of thumb, and identify nations by historical and geographical data. Establishing the list of objects is the first step in formalizing or structuring the data.

CHOOSING THE FEATURES

The second step is choosing the features. The features correspond to the characteristics of objects. The elements describe and differentiate objects from one object to another.

EXAMPLES

One way to distinguish a cat from another is by its fur. Other possible features are: the cat's body size, the continent where the cat lives, or the cat's tree-climbing ability.

The memory size is an important factor in the choice of a computer. The size of the screen, the price, and the available software are other main features.

The sparrow's flight altitude is a good rule of thumb to predict the weather in the short term. The wind direction, the size and height of clouds, and the atmospheric pressure can also be used to define the weather and are, therefore, features for our base.

And of course, the language(s) spoken in a country is one determining element when searching for a nation. Other factors are its location and the population.

You must define your features carefully because some characteristics which seem obvious do not help determine objects. We sometimes refer to these as non-discriminating features.

For example: a possible feature in a zoology base is the number of legs. This is an important feature when describing shell fish. But in the cat-family base, all cats have 4 legs, thus making this feature totally useless. The answer 4 to the question "Number of legs" wouldn't help in the cat determination.

Therefore, a study must be done in order to define useful features. Remember that you can add or delete features at any time during the life of the base.

CHOOSING THE ATTRIBUTES

The last step consists of defining for each feature, the list of all possible attributes, answers, or different states for each of the objects.

EXAMPLES

The fur appearance of a cat can be spotless, with spots, striped, mottled, etc.

The memory size of a computer is a numeric or quantitative value. XPER only understands qualitative values. Qualitative values, continuous or discontinuous, are divided into classes or ranges of values. In the computer case, the attributes would be "Less than 32K," "32K to 64K," "64K to 128K," "128K to 256K," and "More than 256K." The IBM PC computer is then defined by categories 4 and 5.

The sparrow's flight altitude can be low, average, high, over or under telephone wires, etc. The answer format is left to the designer of the base.

And it is easy to define the list of all possible languages used by the nations of our base.

NOTE:

Each feature can have up to 14 attributes. If a feature needs more, use the father/son feature that we will see later. (See Reference Section, page R-11.)

OUR FIRST KNOWLEDGE BASE

Our first example describes the well-known felines. We'll enter the information
into a knowledge base about 6 of these big cats. Here they are:

- the lion
- the tiger
- the jaguar
- the cheetah
- the panther
- and the lynx.

OBJECTS - THE FELINES

The 6 felines represent our 6 OBJECTS for the knowledge base. They are the
nucleus of the base. It will still be possible to add many others as we learn more
and increase our knowledge about them.

Additional objects will be added later during our inquiries in Lesson 4.

FEATURES - THE FELINE CHARACTERISTICS

The feline descriptions, or their main characteristics are the FEATURES. In this
first example, we will create 5 features:

- the fur appearance
- the weight
- the tree-climbing capability
- the main hunt method
- and the continent

ATTRIBUTES - THE CHARACTERISTICS OF ONE FELINE

Each description or feature has different possible attributes.

For example, the fur of the tiger is striped, the jaguar's is spotted, and so on. Stripes and spots are ATTRIBUTES of the Fur Appearance feature. For each feature, we have to define the list of all possible attributes from the raw data on the felines.

FELINES - RAW DATA

This is the descriptive information on felines that we will use in our knowledge base. The data may come from a dictionary, pictures, or the memory of an expert.

LION
Fur Appearance   : Spotless
Weight   : More than 80 kilos (175 pounds)
Tree climbing   : No
Main hunt method   : Running
Continent   : Africa

TIGER
Fur Appearance   : Striped
Weight   : More than 80 kilos
Tree climbing   : No
Main hunt method   : On the watch
Continent   : Eurasia

JAGUAR
Fur Appearance   : With spots
Weight   : More than 80 kilos
Tree climbing   : Yes
Main hunt method   : On the watch
Continent   : America

CHEETAH
Fur Appearance   : With spots
Weight   : Less than 80 kilos
Tree climbing   : No
Main hunt method   : Running
Continent   : Africa

PANTHER
Fur Appearance   : Mottled
Weight   : Less than 80 kilos
Tree climbing   : Yes
Main hunt method   : On the watch
Continent   : Eurasia

LYNX
Fur Appearance   : With spots
Weight   : Less than 80 kilos
Tree climbing   : Yes
Main hunt method   : On the watch
Continent   : Eurasia

LIST OF ATTRIBUTES

From this information, we can define the list of all existing attributes. We can see that the lion is spotless, the tiger has stripes, the panther is mottled, and the others have spots. So, the Fur appearance feature has 4 attributes: spotless, with spots, striped, and mottled.

In the same way, we know there aretwo attributes for the Weight (more or less than 80 kilos); two attributes for the Tree climbing ability (yes or no); two attributes for the Main hunt method (running or on the watch) and three attributes for the Continent (Africa, Eurasia, and America).

CONCLUSION

This concludes our first lesson which has shown the main steps in formalizing knowledge (structuring the data). We can now start to define the database on the computer.

LESSON 2

KNOWLEDGE BASE CREATION - FEATURES

In the next lesson we'll see how to create the knowledge base on the cats that we described in the previous chapter. We will detail some of the general and practical principles of XPER. We'll show the ease of editing and we'll create the features and their attributes. Finally we'll learn how to save the knowledge base on disk.

XPER LOADING

First, XPER must be loaded in the computer using

```
LOAD "*",8
RUN
```
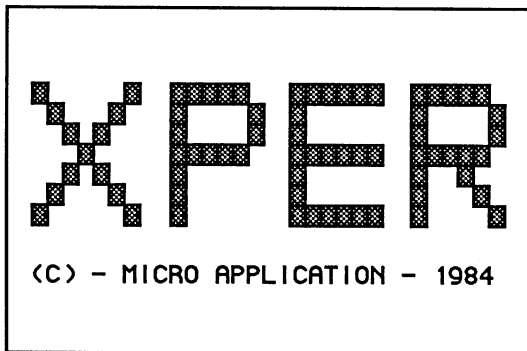

When this picture is displayed on the screen, press any key to start XPER.

MAIN MENU

```
                   XPER  V1.03
           (c)  Micro  Application  1984

                  -  MAIN  MENU  -
      1        -  Editor
      2        -  Inquirer
      3        -  Reorganizer
      4        -  Printer
     ESC       -  End  of  session
```

This is the main menu.

The four main XPER functions are displayed. If you have read the overview, you know their functions. In summary: the Editor (1) allows you to create, review, and change the knowledge bases; the Inquirer (2) manages the inquiries, the determination of an object amongst the knowledge in the base; the Reorganizer (3) is responsible for reorganizing the base and merging separate bases together; and finally, the Printer (4) allows you to print the base information.

NOTE:

[<-] - END OF SESSION OR BACK TO PREVIOUS MENU

1 - The [<-] (left arrow) key is important, it brings you back to the previous menu (or function). If you are lost and do not understand what's displayed on the screen, press the [<-] key a few times. Higher-level menus and more familiar messages will be displayed. Note that this key is referred to as the ESC key in the program.

KNOWLEDGE CREATION - EDITOR

Let's create the knowledge base. Press **1**. A short message **Loading in progress** is displayed, followed by the Editor Menu. Four options are shown.

```
┌─────────────────────────────────────────────────┐
│  ┌───────────────────────────────────────────┐  │
│  │             XPER  V1.03                    │  │
│  │       (c) Micro Application 1984           │  │
│  └───────────────────────────────────────────┘  │
│  ┌───────────────────────────────────────────┐  │
│  │              - EDITOR -                    │  │
│  │  1          : Loading                      │  │
│  │  2          : Initializing    Creating     │  │
│  │  3          : Saving                       │  │
│  │  4          : Consulting      Revising     │  │
│  │  ESC        : Main Menu                    │  │
│  └───────────────────────────────────────────┘  │
│  |M Ed|                                          │
└─────────────────────────────────────────────────┘
```

The cursor is positioned towards the bottom of the screen.

The reverse-video rectangle indicates where we are in the program. The main menu above shows <M Ed> in reverse video, which means <Main menu of the Editor>. All four main functions have a main menu. Can you guess the meaning of <M In>, <M Re> and <M Pr>?

KNOWLEDGE BASE - INITIALIZATION

A knowledge base must first be created. Press **2** [RETURN].

When the cursor is displayed, XPER waits for a command followed by the [RETURN] key. As long as the [RETURN] key is not pressed, XPER waits for more characters (some commands can have more than one letter).

```
 ┌─────────────────────────────────────────────┐
 │  ┌─────────────────────────────────────────┐ │
 │  │  -CONSULTING   REVISING   CREATING-     │ │
 │  └─────────────────────────────────────────┘ │
 │  ┌─────────────────────────────────────────┐ │
 │  │ 1                                        │ │
 │  │ 2        : Title Parameters              │ │
 │  │ 3        : Features                      │ │
 │  │ 4        : Objects and Frame             │ │
 │  │ ESC      : Menu                          │ │
 │  └─────────────────────────────────────────┘ │
 │   |CorR|                                      │
 └─────────────────────────────────────────────┘
```

The menu appears and is referenced by <CorR>. It is now possible to give a title to the base (1), to create features (2), to create objects (3), and return to the Main menu ([<-]). Let's give our knowledge base a title. Press **1** [Return].

KNOWLEDGE BASE - TITLE AND MAIN PARAMETERS

```
- TITLE PARAMETERS -

Parameters

  0      Features    Max. = 50
  0      Objects     Max. = 250
  0      Attributes  Max. = 300

 Available memory  = (zzzz) bytes

 Title = ?


 |TandP|
```

This menu tells us that the base has no name.

How do we give it a name? Use the HELP command.

HELP PAGE

Press: **h [RETURN]**

The following text appears and remains on the screen up to the time another key is pressed:

=(title   text)

HELP shows all the available commands you can use at this point. Only one command is possible here--the name of the base. HELP will also give you the syntax of the command. To get details about the command, look in the REFERENCE part of the manual, or in the summary of commands in the APPENDICES. The INDEX at the end of the manual can ease the search if only the action of the command itself is remembered. To continue press: **[SPACE]**.

KNOWLEDGE BASE - TITLE

Let's name our knowledge base. Enter the title after the "=" sign. To name our
base "Feline Species," just type:

=Feline Species   [RETURN]

And the title is displayed.

If you have mispelled the title, you can either repeat the previous command, or
type:

=   [RETURN]

The old title is displayed on the command line and can be easily modified by
using the usual editing keys.

KNOWLEDGE BASE - MAIN PARAMETERS

This menu also displays other parameters. The total number of existing features
(0 right now) and the total number of objects and attributes are displayed.

Now we are finished with this menu. Let's go back to the previous level by using
the [<-] key.

Press:

[<-]

The CONSULTING REVISING CREATING menu reappears on the screen. Let's
create the features using the second option. Press: **2** [RETURN]

FEATURES - CREATION

```
- FEATURES -
No features




|Fea. |
```

A "No features" message is displayed, which makes sense. Let's call up our HELP screen. Press:

h [RETURN]

The following commands appear:

r(fn)=ft   -(fn)   +(ft)   t(fn)=(ft)
cf(fn)   cs(fn)   a(fn)   ob   ef

The letters in parentheses correspond to alphanumeric values. For example, (fn) means Feature Number and (ft) means Feature Text. The other characters indicate the command itself such as ob - OBject, t - Twin, + - Create or Add. These commands will become clearer as we go along.

(Check the REFERENCE section, pages R-3 and R-9).

Press:

[SPACE]   (or any key)

to clear the HELP page.

To create a feature, give the add command "+" followed by the feature name (or text). Type:

+Fur Appearance [RETURN]

On the HELP page, this syntax corresponds to +(ft).

+   means Create or Add
(ft)   means Feature text

The Fur Appearance feature is automatically numbered as 1 (1 is the feature number, abbreviated by "fn"), an action that will make our work with the base easier.

Let's create other features. Type:

+Weight   **[RETURN]**
+Trees climbing [RETURN]
+Main hunt method   **[RETURN]**
+Continent   **[RETURN]**

We now have 5 features. The Features Menu now looks like this:

```
- FEATURES -

1 - Fur appearance
2 - Weight
3 - Trees climbing
4 - Main hunt method
5 - Continent




|Fea. |
```

FEATURES - REVISING

We can add new features, modify, or delete them. To delete the 5th feature, enter "-" (the deletion command) and the feature number 5. Type:

-5   [RETURN]

The following message is displayed:

Are you sure (y/n) ?

Because we still need this feature, answer "n" for no. Type:

N   [RETURN]

We can also revise features using the command:

r(fn)=

r   means   revise,
(fn)   means   feature   number
=   is a display command.

Let's change feature number 3 from "Trees Climbing" to "Tree Climbing." Type:

r3=   [RETURN]

The following line is displayed:

r3=Trees   climbing

Now move the cursor (using the cursor keys) and modify the text, then press the return key. Before continuing with the tutorial, please try a few of these commands. Create and modify the title of our base and the features, go from a menu to the next or the previous one, and display the HELP screens.

When the manipulation of these functions is clear, go on to the next section.

ATTRIBUTES - CREATION

Let's return to the Features Menu of the Editor. Use the [<-] key to return to the main Editor menu. <M Ed> is displayed in the reversed-video rectangle at the bottom of the screen. Type the following sequence of commands:

4   [RETURN]
2   [RETURN]

The Features Menu is now on your screen, the reversed-video rectangle at the bottom of the screen now shows <Fea.>. We are now going to give the features their attributes. Start with the first feature, "Fur appearance." Enter the command "a" for attribute and "1" for the feature number, then press the return key:

a1   [RETURN]

The syntax for this command is **a(fn)**. The command will display the list of attributes of feature (fn) and will allow you to create or revise them.

a   **means   attribute**
fn   **means   feature   number**

The following screen is displayed:

```
┌─────────────────────────────────────────────┐
│ Fur  appearance                             │
│                                             │
│   1 - * ???                                 │
│   2 - * ???                                 │
│                                             │
│                                             │
│                                             │
│                                             │
│                                             │
│                                             │
│ |F at |                                     │
│                                             │
└─────────────────────────────────────────────┘
```

This feature does not have any attributes yet. The first line states the feature name (Fur appearance). The second and third lines will contain the attributes after we have created them.

Attributes 1 and 2 correspond to 1 and 2. A feature MUST have at least 2 attributes so a choice between them is possible. For example: black and white, 1 and 0, known or unknown.

Definition of characters that appear on the Attributes screen:

"-" separates the attribute number from the text.

"*" is a special character that means neutral. We don't need to worry about it now, but we'll see it again before the end of this tutorial.

"???" indicates there is no text in attributes 1 and 2.

Create the attributes in the same way the features were created. You must revise the first two attributes because they are already listed for you, and then add any additional attributes. Type:

r1=Spotless   **[RETURN]**

r2=With spots   **[RETURN]**

We have 2 more attributes to create. Type:

+Striped   **[RETURN]** .
+Mottled   **[RETURN]**

The Attributes screen for the feature "Fur Appearance" now looks like this:

```
Fur  appearance

  1 -  Spotless
  2 -  With  spots
  3 -  Striped
  4 -  Mottled




|F  at  |
```

ATTRIBUTES - EDITING

Four attributes are listed for this feature. The revisions and deletions are done the same way as for the features. Try these commands:

-4   [RETURN] n [RETURN]   Delete the fourth attribute.
                                    The answer "n"
                                    corresponds to the non-
                                    execution of the Delete
                                    command.

r3= [RETURN]   [RETURN]   Modify the 3rd attribute.

Enter the remaining attributes. Starting from the <F at> menu, type:

[<-]
a2   [RETURN]
r1=Less than 80 kilos   [RETURN]
r2=More than 80 kilos   [RETURN]

[<-]
a3   [RETURN]
r1=Yes   [RETURN]

r2=No   [RETURN]

[<-]
a4   [RETURN]
r1=Running   [RETURN]
r2=On the watch   [RETURN]

[<-]
a5   [RETURN]
r1=Africa   [RETURN]
r2=Eurasia   [RETURN]
+America   [RETURN]

ATTRIBUTES - REVISION

Two remarks about the features and the attributes:

1) To describe the features with their attributes, we have used the following cycle from the Feature menu:

a1   [RETURN]   Access to feature # 1.
Attributes editing   Enter attributes of feature.
[<-]   Back to the feature menu.
a2   [RETURN] etc....   Access to feature # 2.

From the Attributes menu <F at>, you can go from one feature to the next or to the previous feature, without switching back to the Feature menu. From the Attribute menu <F at>, type:

[F3]   Go to the attributes of the
                   next feature.

Repeat the same command as many times as you wish. To go to the previous feature, press:

[F4]   Go to the attributes of the
                   previous feature.

2) To check that we have correctly defined the base features and attributes, display the base description, Title and Parameters. Start from the <F at> menu and type:

[<-] [<-] 1 [RETURN]

SAVING THE KNOWLEDGE BASE

Having entered the information, let's save it onto the diskette. Return to the <M Ed> menu, or the Editor Main menu to get to the Save option. If you are still in the Title and Parameters menu <T and P>, type [<-], [<-]. From the main editor menu, type:

3   [RETURN]

```
┌─────────────────────────────────────────┐
│ - Saving -                               │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│ Base name                                │
│                                          │
└─────────────────────────────────────────┘
```

You must name the knowledge base in order to save it to the disk. It must be no longer than 8 characters. Type:

kitties   [RETURN]

When the operation ends, the Editor menu is back on the screen and the KITTIES knowlege base is safely saved on your diskette.

This concludes our second lesson.

LESSON 3

KNOWLEDGE BASE CREATION - OBJECTS

The second lesson defined features and their attributes. In this third lesson, we will create objects. In order to do so, go to the Editor Main menu <M Ed> and press:

4   [RETURN]
3   [RETURN]

The following screen appears.

```
- OBJECTS -                    |g1|    $:g2

No  objects












|Obj. |
```

Definitions:

1 - G1 and G2 are group indicators, and they will be discussed later. A group is a collection of objects that are defined by the user in order to compare their characteristics. It is possible to compare the objects within a group, or to compare one group to another.

2 - The "No objects" message means just that, we will now create them.

Type **h**   **[RETURN]** to obtain the **HELP** screen.

OBJECT - CREATION

You already know most of the commands that are used to create and modify objects. They are used in the same manner as the features and the attributes commands: +, -, r(fn)=. The other command will be used when working with groups. To erase the HELP page, press any key. We are now ready to enter the objects.

+Lion	**[RETURN]**
+Tiger	**[RETURN]**
+Jaguar	**[RETURN]**
+Cheetah	**[RETURN]**
+Panther	**[RETURN]**
+Lynx	**[RETURN]**

The Objects screen now looks like this:

```
- OBJECTS -                          |g1|    $:g2

     1 - Lion
     2 - Tiger
     3 - Jaguar
     4 - Cheetah
     5 - Panther
     6 - Lynx




 |Obj. |
```

To summarize: all features, attributes, and objects have been described. What's left? We still have to define the possible attributes for each object. For example, the tiger has stripes, i.e. the object "Tiger" has the attribute "Striped" for the feature "Fur appearance."

To complete the definition of the knowledge base, use the frame representation command. Type:

x1   [RETURN]   Frame (or cross reference table) for the first
                          object.

This command displays the frame representation for the first object (see the next
page).

FRAME REPRESENTATION - FEATURE

What is a frame? For each object/feature pair, we must define the corresponding
attribute(s). The object/attribute pair is represented as an element of a frame (or
matrix). One or more attributes may define the relation between the feature and
the object, which is the intersection of a feature and an object. That is why the
"X" command has been used.

The x1 command previously entered will display this screen (1 refers to the first
object, "lion"):

```
-  FRAME  -

   1  -  Fur appearance
   2  -  Weight
   3  -  Tree climbing
   4  -  Main hunt method
   5  -  Continent




|O x F|
```

The label, <O x F>, means the object can intersect with these features, <Object
intersects Features>.

The HELP key can show us that only one command is available. Enter a number
corresponding to a feature number. Type:

1   [RETURN]   for the first feature.

Remember, we are still dealing with the first object - the lion, and the first feature is fur appearance.

FRAME REPRESENTATION - ATTRIBUTES

```
Fur  appearance

Lion

  1 -  |Spotless|
  2 -  |With spots|
  3 -  |Striped|
  4 -  |Mottled|




 |O x F|
```

This menu's label, <O x A>, means <Object intersect Attributes>.

All the possible attributes are displayed in reverse-video for the object/feature pair displayed on the screen.

DEFINING AN OBJECT'S ATTRIBUTES

Let's enter the fur appearance of the king of the jungle by typing:

=1   [RETURN]

Now, only the first attribute is represented in reversed- video. The information on the screen can be read as:

(The) Fur appearance (of the) Lion (is) Spotless.

You can edit attributes with these commands:

-(an)   : Delete attribute number (an).
+(an)   : Add attribute (an).

You can define more than one attribute at a time by separating the attribute number with the slash key (/).

In our example, =2/3 would mean that the lion's fur has spots and stripes.

To define the second feature, press:

[<-] 2   [RETURN]

To enter the following information: A lion weighs more than 80 kilos, type:

=2   [RETURN]   or
-1   [RETURN]

This operation can be tedious because it must be done for all features for all the objects.

Short cuts are available to ease the task. We'll check a few of them in this lesson.

OBJECT'S ATTRIBUTES - SIMPLIFICATIONS

Recall the use of the [F3] and [F4] keys to display the different features while editing the attributes (Page T-19). These keys move you from one feature to the next, or back to the previous feature. Type:

[F3]

The next feature "Tree climbing" appears for the lion.

Type either:

        =2 [RETURN]   or
        -1 [RETURN]

Let's completely define the lion. Enter the following commands:

[F3]
=1   [RETURN]
[F3]
=1   [RETURN]
[F3]

We're back to the Fur appearance attribute and the definition of the lion is successfully completed. Before going on with the definition of the base, you should practice using the [F3] [F4] keys for a while to become familiar with their use.

We now have to enter the data corresponding to the other cats. Two methods are available, one complex and the other simple. The complex one consists of coming back to the Object Frame representation menu, choosing a new object and a new feature.

From the <O x A> menu - Fur appearance of the lion - you could perform the following sequence of commands to define the fur appearance of the tiger. You would have to go back 2 menus, and then access to the first feature of the second object. DO NOT type:

[<-] [<-] x2 [RETURN] 1 [RETURN]

Use the easy way instead, type:

[F5]   [RETURN]

The [F5]/[F6] key allows movement from object to adjacent object for the same feature.

FRAME REPRESENTATION - CHANGING OBJECTS

You can now enter the remaining data into our knowledge base. We have provided a solution for you, but try to enter the data without looking at it. Many other paths can be used to fill the base.

This solution is only possible if all features, attributes and objects have been created in the same order indicated in this tutorial, and if the actual menu displayed on the screen is the Frame representation - Attributes <O x A> describing the Fur appearance of the tiger.

"KITTIES" KNOWLEDGE BASE - FILLING THE BASE

Tiger

  =3 [RETURN] [F3] =2 [RETURN] [F3]
  =2 [RETURN] [F3] =2 [RETURN] [F3]
  =2 [RETURN] [F3] [F5]

Jaguar

  =2 [RETURN] [F3] =2 [RETURN] [F3]
  =1 [RETURN] [F3] =2 [RETURN] [F3]
  =3 [RETURN] [F3] [F5]

Cheetah

  =2 [RETURN] [F3] =1 [RETURN] [F3]
  =2 [RETURN] [F3] =1 [RETURN] [F3]
  =1 [RETURN] [F3] [F5]

Panther

  =4 [RETURN] [F3] =1 [RETURN] [F3]
  =1 [RETURN] [F3] =2 [RETURN] [F3]
  =2 [RETURN] [F3] [F5]

Lynx

  =2 [RETURN] [F3] =1 [RETURN] [F3]
  =1 [RETURN] [F3] =2 [RETURN] [F3]
  =2 [RETURN] [F3] [F5]

SAVING THE BASE

This concludes the lesson on the EDITOR. We have just completed the creation of our first knowledge base. Let's save it on disk before starting our work with the INQUIRER.

Return to the the main Editor menu <M Ed> which can be done from the <O x A> - Object - Frame representation by Attributes, by pressing:

[<-] [<-] [<-] [<-]

Then type:

3   [RETURN]   To access the Saving function.
[RETURN]

The second [RETURN] corresponds to the base name. Since XPER displayed the name previously used, [RETURN] is enough.

The question "Existing base. Replace? (y/n)" offers protection against possible destruction of the base. It is asked only if a base with the same name resides on the disk (which is our case). Therefore, press:
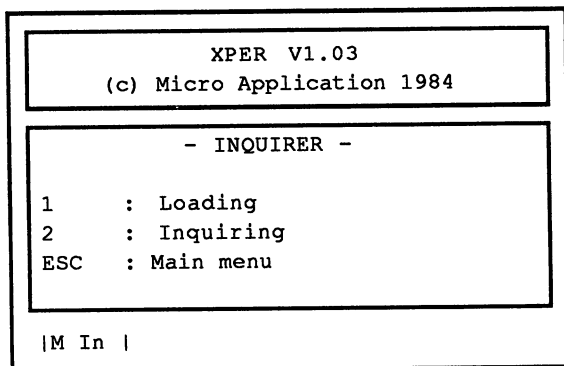
y   [RETURN]

LESSON 4

INQUIRY

In this fourth lesson, we are going to leave the editor and the create / revise / edit part of the knowledge base in order to make inquiries. Time to really see what XPER is all about, so return to the XPER main menu and load the INQUIRER module. From the <M Ed> menu, type:

[<-]   2

```
┌──────────────────────────────────────────┐
│  ┌────────────────────────────────────┐  │
│  │          XPER  V1.03               │  │
│  │    (c) Micro Application 1984      │  │
│  └────────────────────────────────────┘  │
│  ┌────────────────────────────────────┐  │
│  │         - INQUIRER -               │  │
│  │                                    │  │
│  │  1     :  Loading                  │  │
│  │  2     :  Inquiring                │  │
│  │  ESC   :  Main menu                │  │
│  │                                    │  │
│  └────────────────────────────────────┘  │
│                                          │
│  |M In |                                 │
└──────────────────────────────────────────┘
```

This is the INQUIRER main menu <M In>. It has two options: load a knowledge base, and the inquiry system itself. It should be fairly obvious that inquiries are not possible unless a knowledge base is in memory. To demonstrate, press:

2   [RETURN]

If "No base" is displayed, then a knowledge base must be loaded by using the first option.

KNOWLEDGE BASE - LOADING

To load a knowledge base into memory from the main menu, <M In>, press:

1   [RETURN]

This process is similar to saving the knowledge base.

```
┌──────────────────────────────────────────────┐
│ - LOADING -                                    │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│ Base name                                      │
│                                                │
└──────────────────────────────────────────────┘
```

Now enter the name of the base by typing:

kitties   [RETURN]

If the base name is wrong, the disk does not contain the base, or the disk is not
in the drive, appropriate error messages are displayed. If a knowledge base is
already in memory, XPER asks for the confirmation of the order that will destroy
the base in memory and waits for an OK.

If you make a mistake, [<-] allows you to quit the "Base name" question without
executing the option. The base in memory will not be destroyed.

Once the base is loaded, we are back to the inquirer main menu <M In>. It is now
possible to make our first inquiry by typing:

2   [RETURN]

INQUIRY - PRINCIPLES

```
Qn= 1   Rf= 5   Ro=6                    EAD   NDFD

  1 - Fur appearance
  2 - Weight
  3 - Tree climbing
  4 - Main hunt method
  5 - Continent




|I rf |
```

What is an inquiry? It consists of describing a subject so that XPER can compare it to the objects of the base and will identify it as one of them, if possible. We must choose the features that we want to describe (choose the questions we want to answer) and give the possible or true attributes for the subject (answer the questions).

In our example, we have the list of 5 features in the knowledge base. We are going to be able to determine a big cat, without knowing its name, by entering the data we know about the animal (in any order).

Three indicators are on the first line of the screen:

- **Qn** - Question number, or level reached during the search.

- **Rf** - Number of Remaining features available for the inquiry. We have 5 features in the base and we haven't used any of them yet.

- **Ro** - Number of Remaining Objects compatible with the actual determination. In our case, we haven't started, so all our felines are still in the base.

Two more indicators are located on the right part of the screen: **EAD** and **NDFD**. In order to avoid too much complication for our first inquiry, we will forget about them and even erase them by typing:

a-   [RETURN]
f-   [RETURN]

These commands will be explained in the seventh lesson.

INQUIRY - FIRST QUESTION

Press:

5   [RETURN]

to answer the first question concerning the habitat of the cat we'd like to
discover.

```
Continent

  1 - Africa
  2 - Eurasia
  3 - America

                    .




|I at |
```

<I at> - Inquirer - Attribute. The screen can be read:

From which continent does our feline come from ?

Let's choose Europe and Asia. Type:

2   [RETURN]

The previous menu is back with a few modifications.

In case you want to start again, type :

sa   [RETURN]

This command will start with the first question again.

```
┌─────────────────────────────────────────────┐
│                                             │
│  Qn= 2   Rf= 4   Ro=3                       │
│                                             │
│    1 - Fur appearance                       │
│    2 - Weight                               │
│    3 - Tree climbing                        │
│    4 - Main hunt method                     │
│                                             │
│                                             │
│                                             │
│                                             │
│                                             │
│  |I rf |                                    │
│                                             │
└─────────────────────────────────────────────┘
```

Modifications on the menu are : **Qn**, the question level indicator went from 1 to 2; **Rf**, the remaining features indicator went from 5 to 4; and **Ro**, the remaining objects went from 6 to 3.

To summarize, these indicators mean we have answered one question (four questions are left) and from the cats in the knowledge base, only 3 originated in Europe or Asia.

INQUIRY - SECOND QUESTION

Go on to the next question with the information that our feline weighs less than 80 kilos (175 pounds).   Press:

2   [RETURN]   to choose the WEIGHT feature.

```
Weight

  1 - Less than 80 kilos
  2 - More than 80 kilos












|I at |
```

And the answer is 1. Press:

1   [RETURN]

```
Qn= 3   Rf= 3   Ro=2

  1 - Fur appearance
  2 - Main hunt method
  3 - Tree climbing









|I rf |
```

Qn went from 2 to 3. The number of remaining features went from 4 to 3 and the number of remaining objects decreased to 2.

This indicates we have answered 2 questions (resolved two steps in the inquiry) with 3 questions remaining and only 2 cats in our knowledge base weigh less than 80 kilos (175 pounds) and are from Europe or Asia.

INQUIRY - THIRD QUESTION

Let's suppose our animal has spots on its fur. Press:

1 [RETURN]   to choose the Fur appearance feature.

```
Fur  appearance

  1 - Spotless
  2 - With spots
  3 - Striped
  4 - Mottled




|I at |
```

The answer is 2, so type:

2 [RETURN]

INQUIRY - THE SOLUTION

The following screen results:

```
Object  found

  1  -  Lynx





|I ro |
```

We have just completed our first inquiry. We have discovered (using our reduced knowledge base) that the only feline living in Europe/Asia with spots on its fur and with a weight of under 80 kilograms is the lynx.

A new menu appears, <I ro> stands for <Inquirer - Remaining Objects>.

We can find out why XPER answered our inquiry with "lynx."

First, ask why the other felines have been eliminated. Press:

eo [RETURN]   for Eliminated Objects.

LIST OF ELIMINATED OBJECTS

```
5 eliminated objets

  1 - q1 Jaguar
  2 - g1 Lion
  3 - q1 Cheetah
  4 - q2 Tiger
  5 - q3 Panther




|I ef |
```

XPER displays a list of objects with the corresponding question that has caused the elimination. For example, the panther was the feline eliminated after the third question. Why?   Press: **5 [RETURN]**   to select the 5th object.

REASON FOR ELIMINATION

```
Not : Panther   $

If fur appearance =

  1 - Spotless
  2 - |With spots|
  3 - Striped
  4 - $ Mottled




|I er |
```

This new menu <I er> means:

(It is) not the Panther if Fur appearance equals With spots (in reversed video on screen).

The panther (shown by the dollar sign) is mottled.

The fourth lesson is now over. We have seen the main concepts behind XPER, created a knowledge base, and performed our first inquiry. The following lessons will give more detailed information on the advanced features and will show more sophisticated uses of the system.

If you do not feel at home with XPER, read the overview chapter again and go over these first lessons. Experiment with the menus and the HELP keys. Try to add new cats, to imagine your own bases, to make different inquiries, and use different answers. XPER is easy to use and fun to play with. You'll quickly master the system.

EXERCISES - INQUIRER - KITTIES KNOWLEDGE BASE

1 - Which is the only feline to live in America ?

2 - Which is the only feline over 80 kilos that can climb trees ?

3 - Which is the only feline with stripes ?

4 - List of felines that run to hunt and that climb trees ?

5 - List of felines from Europe or Asia which hunt on the watch ?

6 - Why is the jaguar on that last list ?

SOLUTIONS

1 - Jaguar
2 - Jaguar
3 - Tiger
4 - None of them. No corresponding objects.
5 - Lynx, Tiger, Panther.
    Qn=3 Rf=3 Ro=3. Press:
    ro [RETURN]   to display the list of remaining objects.
6 - The jaguar is an American cat.
    See the **eo [RETURN]** command.

LESSON 5

COMPLEX BASES - DISTANCES - OVERVIEW

The fifth lesson teaches the more advanced functions of the editor. It introduces the Father/Son feature, called Parent/Child.

We will use a new knowlege base called "cats", which looks much like our old "kitties" base, but is more complete (containing many more objects, features, and attributes). The "cats" base is found on your XPER program diskette.

Load the Editor module and the "cats" knowledge base. If you need some help, check back to the pages describing base loading.

The editor and the "cats" base are now loaded. You can check the main parameters of the base, the number of objects, features, and attributes by accessing the Title and Parameters menu.

From XPER main menu, press:

1	1 [RETURN]	cats	[RETURN]
	4 [RETURN]	1	[RETURN]

We have 17 features, 43 attributes, and 30 objects. Type:

[<-]

to return to the Consulting menu <CorR> of the Editor.

FEATURES

Let's check the new features. To do so, type:

2   [RETURN]

```
- FEATURES -

 1 - Fur appearance
 2 - Fur length
 3 - Ear shape
 4 - Withers height
 5 - Weight
 6 - Body length
 7 - Tail relative length compared to
     the body length
 8 - Canine length
 9 - Presence of a hyoid bone
10 - Presence of retractable claws
                              Page # 1/ 2
|Fea. |
```

A new message "Page # 1/ 2" appears in the lower right-hand corner of the screen. It means more features exist but cannot be displayed because there is not enough room on the screen. To see the other features, i.e. the next page, press:

[F1]

and the next page appears.

```
┌─────────────────────────────────────────────┐
│  - FEATURES -                                │
│                                              │
│  11 - Hunting hours                          │
│  12 - Prey size                              │
│  13 - Tree climbing                          │
│  14 - Main hunt method                       │
│  15 - Continent                              │
│  16 - * Morphology                           │
│  17 - * Behavior                             │
│                                              │
│                                              │
│                                              │
│                              Page # 2/ 2     │
│  |Fea. |                                     │
│                                              │
└─────────────────────────────────────────────┘
```

(The * in front of the two features will be discussed later in this lesson. They are called Star Features.)

The remaining features are displayed. As usual, it is possible to use the

[F1] and [F2]

keys to move you from one page to the next or to the previous page. The same principle applies for the list of objects.

You can also go directly to any page by using its number. For example, type:

p2   [RETURN]

This command displays the contents of page # 2--if the page exists.

Let's take a look at one of those new features: Behavior.

The screen now displays Page # 2/2 of the Feature menu <Fea.>. Enter the following command to display the attributes of Feature 17:

a17   [RETURN]

```
┌──────────────────────────────────────────────┐
│ *  Behavior                                    │
│                                                │
│  1  -  Known                                   │
│  2  -  Unknown                                 │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│                                                │
│ |F at |                                        │
│                                                │
└──────────────────────────────────────────────┘
```

The "Behavior" feature has 2 attributes called "Known" and "Unknown". This feature is the "parent", or "father", of a number of features described in the following pages on your screen. These features won't appear during an inquiry unless the "known" attribute has been chosen in answer to the "Behavior" feature. If "Unknown" is answered, the "child", or "son", features disappear from the inquiry. "Unknown" is the attribute of the parent feature which excludes the child features--the Exclusion Attribute (explained later in this section).

The attributes "Known" or "Unknown" do not apply to the felines themselves but to the features. To find out the child features, type:

[<-] cs17 [RETURN] [F1]   to display the child features of feature # 17.

Return to the <Fea.> menu and display the second page of the <F sc> menu.

FEATURES - PARENT AND CHILDREN or FATHER AND SONS

```
Son of : * Behavior

11 - |Hunting hours|
12 - |Prey size|
13 - |Tree climbing|
14 - |Main hunt method|
15 - Continent
16 - * Morphology
17 - * Behaviour




                                    Page # 2/ 2
|F cs |
```

The features highlighted in reverse-video are all the child features of the Behavior feature. They are features 11, 12, 13 and 14.

When the "Behavior" feature is answered "Unknown" during an inquiry, the child features ("Hunting hours", "Prey size", "Tree climbing", and "Main hunt method") are not displayed and therefore cannot be asked.

EXCLUSION ATTRIBUTES

When an inquiry is made using the "cats" knowledge base, the only features displayed are: "Continent", "Morphology", and "Behavior". All the other features will be displayed only if the answer "Known" is given to both the "Morphology" and "Behavior" features. The "Unknown" attribute is called the Exclusion Attribute because it excludes the rest of the features from being displayed. To set up the display of the other features press:

[<-] cf8 [RETURN]   Parent connection of feature # 8

EXCLUSION ATTRIBUTE - PARENT (FATHER) FEATURE

The following menu is displayed:

```
Canine  length

 Father = * Morphology

    1 - Known
    2 - |Unknown|




|F fc |
```

We are in a new menu--<F fc> for <Feature - Father connection>. The attribute in reverse video ("unknown" in our example) is the exclusion attribute, that is, its use during an inquiry eliminates the corresponding child feature(s).

The reasoning behind this exclusion is that if the behavior of the feline we're looking for during an inquiry is not known, there is no point in asking the corresponding questions.

NOTE:

A feature can have many child features, but can have only ONE parent feature.

PARENT / CHILD FEATURES - CREATION

How do we create this connection between parent and child? First, we need a feature and its attributes. We know how to do that from the <Fea.> menu. Check lesson 2. (Example - Morphology - Known, Unknown).

Then we need to tell the future child feature which feature will be its parent feature, which we do in the <F cs> menu by giving each feature in question the number of one parent features. One and only one parent can exist for each child feature. You can check the parent/child relationship by displaying the <F cs> menu which allows you to view all the child features of any feature.

Finally, you must define the exclusion attribute(s) of each "parent" feature in the <F fc> menu, using familiar syntax such as =(exclusion attribute number), + or -.

Use the following commands to create two features in our "cats" base: the Morphology and the Presence of a Hyoid bone, and their Parent/Child connection.

1   <Fea.>   Creation   features - Presence..., Morphology
          +Presence of a hyoid bone   [RETURN]
          +* Morphology   [RETURN]

2   <F at>   Creation attributes for Presence...
          r1=Yes   [RETURN]
          r2=No   [RETURN]

3   <F at>   Creation attributes for Morphology
          r1=Known   [RETURN]
          r2=Unknown   [RETURN]

4   <F fc>   Presence... Morphology as Parent
          16   [RETURN]

5   <F fc>   "Unknown" is the exclusion attribute.
          =2   [RETURN]

NOTE: The presence (or absence) of a completely ossified hyoid bone in a feline makes it purr (or roar).

FEATURES - STARS

The little "star" (*) in front of features 16 and 17, "Morphology" and "Behavior," denotes a STAR FEATURE.

"Star" features can be used in two ways. They can be used for comments or remarks that can be displayed without having any role in an inquiry. They are also used to structure features for the inquirer in the case of parent features.

Parent features without the star are also possible and are often used. For example, we could have a "Sex" question in our "cats" base. Each animal would have two objects, the male and the female. The answer to the "Sex" question would lead to new features/questions such as "Mane shape" for the male or "Litter size" for the female.

The "Sex" feature (which is a parent) will have an exclusion attribute, either "Male" or "Female" after the specific attribute is answered during an inquiry.

This concept is important when structuring a sophisticated knowledge base. Ideas are harder to explain with words than with examples. We urge you to experiment with a knowledge base such as "cats" to understand the parent/child connection, and to compare the parent feature attributes using the Object Frame representation <O xf> and the Feature Parent connection <F fc>.

DISTANCES BETWEEN OBJECTS

You can determine how similar objects are to each other by calculating a number called the Distance of Jacquard. It is based on the number of points which the objects have in common. The number obtained is between 0 and 1.

The principle is simple. The common attributes between two objects make them more similiar, while the different attributes separate them. The absent attributes do not count.

Using this calculation, identical objects have a distance of zero. To simplify the display, the result is multiplied by 10000 so that the number shown is between 1 and 10000. Two objects are considered close when their distance is under 2000.

From the <F fc> menu, go back to the Object menu <Obj.> by typing:

[<-] ob [RETURN]

Let's calculate the distance between the lion, the first object, and the remaining felines. Type: **d1   [RETURN]**

Something similar to the next menu appears:

```
Distance to Lion

  2 - 3478 Tiger
  4 - 4800 Leopard
  3 - 5384 Jaguar
  6 - 5925 Cheetah
  7 - 6428 Puma
 13 - 6428 Viverin cat
 16 - 6428 Golden cat
 19 - 6428 Andean cat
 12 - 6896 Caracal Lynx



 |Dist |
```

The cats closest to the lion are displayed, the closest one being the tiger.

The fifth lesson covered different types of features (father, son, and star) and the distance between objects. Now, on to groups.

LESSON 6

GROUPS - OVERVIEW

The topic for lesson 6 is the group. Return to the object menu <Obj.> of the
"cats" base. There is a short cut you can use when going from the feature menu
<Fea.> to the object menu <Obj.> and vice versa. When in the feature menu,
type:

ob   **[RETURN]**

and if in the object menu use:

fe   **[RETURN]**

Let's go back to the object menu <Obj.>:

```
- OBJECTS -                    |g1|    $:g2

    1 - Lion
    2 - Tiger
    3 - Jaguar
    4 - Leopard
    5 - Ounce
    6 - Cheetah
    7 - Puma
    8 - Panther
    9 - Serval
   10 - Ocelet
                                       Page #1/ 3
 |Obj. |
```

Three pages of felines are available. Use any of the following commands:

[F1]   **[F2]**   **p(pn)**   **[RETURN]**

to see the complete list of the cats.

We know the power of inquiries, but another way to study a knowledge base is to
use the object group.

GROUPS - OVERVIEW

You can put any of the objects in one of three groups: G0, G1 or G2. When a base is created, all objects are in group 0.

Groups allow you to combine objects having the same criteria so they can be studied and compared. There are commands to create and edit groups, compare objects inside the same group, or compare two groups together.

For example, let's compare the felines born in Africa with their American relatives to find their common points, differences, and even rules.

GROUPS - CREATION

Let's put the lion in the first group and the cheetah in the second one. To do so, type:

g1=1;g2=6   [RETURN]

A new screen appears. Note the semi-colon between the two commands. As a general rule, any number of separate commands can be entered in the same line, each separated from the others by a semicolon.

```
- OBJECTS -                    |g1|    $:g2

    1 -  |Lion|
    2 -  Tiger
    3 -  Jaguar
    4 -  Leopard
    5 -  Ounce
    6 -   $ Cheetah
    7 -  Puma
    8 -  Panther
    9 -  Serval
   10 -  Ocelet
                                        Page #1/ 3

|Ind. |
```

The phrase "g1=1" means that group 1 is composed of object 1 and "g2=6" means that group 2 is composed of object 6. Objects in reverse-video are in group 1 while the dollar sign signifies objects belonging to group 2. This is indicated in the upper right-hand corner of the screen.

GROUPS - COMPARISON

Now type:

cp   [RETURN]   to compare the two groups.

After a few seconds of calculation, a new menu appears:

```
OR - COMPARISON -                 |Abs. |  $ Rel.

   1 - |Fur appearance|
   2 - Fur length
   3 - Ears shape
   4 - Withers height
   5 - |Weight|
   6 - |Body length|
   7 - |Tail relative length compared|
        |to the body length|
   8 - |Canine length|
   9 - |Presence of a hyoid bone|
  10 - |Presence of retractable claws|
                                   Page #1/ 2
 |C fe |
```

The Comparison Features menu <C fe> is displayed. We're not going to worry about this first comparison right now; we'll come back to it. Features in reverse-video show an absolute difference between the groups; none of the attributes for this feature in group one are possible in group two. For example, the Fur appearance feature is displayed in reverse-video. This characteristic differentiates the lion from the cheetah. The lion is spotless and the cheetah is covered with spots. We can check that by typing: **1   [RETURN]**

```
┌─────────────────────────────────────────────────┐
│  Comparison OR                       |g1|   $:g2 │
│                                                  │
│     1 -  |Spotless|                              │
│     2 -   $ With spots                           │
│     3 -   Striped                                │
│     4 -   Mottled                                │
│                                                  │
│                                                  │
│                                                  │
│                                                  │
│                                                  │
│   |C  at  |                                      │
│                                                  │
└─────────────────────────────────────────────────┘
```

The objects in group 1 (the lion) are spotless, shown in reverse-video, while the objects in group 2 (the cheetah), shown with the dollar sign, have spots.

GROUPS - EDITING

Return to the object menu <Obj.>. Type: [<-] [<-]

From the <Obj.> menu, press: eg   [RETURN]

"eg" means Erase Group. Two important rules concerning the groups are: 1) no object can be a member of two groups at the same time, and   2) all objects are members of group 0 unless otherwise indicated. The "eg" command erases groups 1 and 2 and puts all objects into group 0.

To place the objects into corresponding groups, type:

g1=1/2/3/4   [RETURN]   The / character
g2=7/8   [RETURN]   separates objects.
g2>1   [RETURN]

The last command means place all the members of group 2 into group 1.

Let's reinitialize the whole thing by typing:

eg   [RETURN]

GROUPS - OBJECTS - STAR

Objects with common characteristics can be grouped together. For example, we can group all cats having these three features in common: lives in Africa, weighs less than 80 kilos, and climbs trees. We can create a "star" object. This star object has all the required attributes for the new group, is transparent for all other features, and does not enter into the inquiries or research.

Let's create a star object having all three characteristics: African, less than 80 kilos, and a tree climber. All other attributes do not matter, so they are accepted.

Type:

1 - <Obj.>   Creation Object Star test

   +* Test   [RETURN]
   [F2]
2 - <Obj.> Access to the Object frame for Test # 31.
        (31 is an arbitrary test name for the object that
        will become our new group.)
   x31   [RETURN]
3 - <O xf> Definition of the Test attributes for the
        Weight, Continent and Tree climbing features
        which are the three features chosen to
        characterize our object group.
   5   [RETURN]
   -3   [RETURN]
   [<-]
   15   [RETURN]
   =1   [RETURN]
   [<-]
   13   [RETURN]
   =1   [RETURN]
   [<-] [<-]

That's it.

Now we can create group 1, containing all African felines climbing trees and weighing less than 80 kilos by giving this command from the <Obj.> menu:

g1o31   [RETURN]

Group 1 now contains all objects compatible with test object 31.

GROUPS - LIST OF OBJECTS

We can skim through the 4 pages of objects reviewing the group 1 members. However, an easier method is to ask for the list of objects in group 1. From the <Obj.> menu, press:

l1   **[RETURN]**

l   = means list the members of this group
1   = group number or (gn)

```
┌────────────────────────────────────────────────────┐
│ Group # 1                                          │
│                                                    │
│     1 - |Serval|                                   │
│     2 - |Caracal lynx|                             │
│     3 - |Chaus cat|                                │
│     4 - |Golden cat|                               │
│     5 - |Cafer cat|                                │
│     6 - |Niger cat|                                │
│     7 - |* Test|                                   │
│                                                    │
│                                                    │
│                                                    │
│ |G ob  |                                           │
│                                                    │
└────────────────────────────────────────────────────┘
```

All these cats are African, climb trees, and weigh less than 80 kilos. From the <G ob> menu, you have access to the structure of the objects of the group. So, it is easy to verify that the cats have the right properties. Press:

x1   **[RETURN]**   **5**   **[RETURN]**   **[F5]**

The structure (features and attributes) is directly accessible by groups, which allows you to use smaller structures. It allows the creation of objects using rules by defining groups with common characteristics. (See <G fa> and <G ff> menus.)

RULES DETERMINATION - MONOGROUP COMPARISON

Return to the object menu by pressing a few [<-]s so we can perform a comparison. A comparison is always made between the objects of group 1 and those of group 2. If one of these 2 groups is empty, the comparison is made between the objects of the non-empty group. Let's see it. Type:

cp   [RETURN]

All the features now appear in reverse-video, which means that they do not have anything in common.

There are two comparison modes: AND and OR. In the OR comparison which we have already seen, the comparison works on the possible attributes of each group, that is to say, the possible attributes for at least one object in the group--possible attributes in one group.

The AND comparison mode works only with possible attributes for EACH object of the group--common attributes in one group.

To explain with an example, type:

and   [RETURN]

```
AND - COMPARISON -              |Abs. |   $ Rel.

   1 - Fur appearance
   2 - Fur length
   3 - Ears shape
   4 - Withers height
   5 - Weight
   6 - Body length
   7 - Tail relative length compared
         to the body length
   8 - |Canine length|
   9 - |Presence of a hyoid bone|
  10 - |Presence of retractable claws|
                                Page #1/ 2
|C fe |
```

INTERPRETING THE COMPARISON

The comparison mode is AND and there is only one group. The reversed video features have at least one attribute common to all objects of the group (all the cats in our group climb trees and all are African). Type:

10   [RETURN]

and you can see they all have retractable claws. Also, they have small canines, do not roar (presence of a hyoid bone), and hunt small prey.

We have a small base with a limited number of features and attributes. However, you can understand the indefinite number of possibilities offered by such a system in order to verify hypotheses and/or any kind of inferences that can be drawn from the data.

NOTE:

Why isn't the "Weight" feature, defined as common (less than 80 kilos) displayed in the features with common attributes? The answer is simple, the Weight feature has 3 attributes: less than 10 kilos, between 10 and 80 kilos, and more than 80 kilos. Our feature for the new group is under 80 kilos, which corresponds to TWO attributes. Cats belonging to this group have one or the other, so it is not a common attribute.

MULTIGROUP COMPARISON

We have just used the AND comparison. We already know about two comparison modes: AND and OR. There are also two types of differences: absolute and relative.

The following diagram explains the theory behind all the possible results of a comparison between two groups.

	O R	A N D
Absolute Difference displayed in reverse video	Feature having no true attri-butes in both groups (1)	Feature with no attributes common to all objects of both groups. (2)
Relative Difference indicated by $	Feature having at least 1 of its attributes possible in 1 possible in the other group. (3)	Feature having at least 1 of its attributes common to all group and not in the other group (4)

For example, create two groups containing all African cats. The first group should contain the tree climbing cats and the second group, the cats who remain on the ground. First, delete the previously created TEST object and initialize both groups. Follow these steps:

1 - <Obj.>   Deleting the TEST object

   -31 [RETURN] y [RETURN]

2 - <Obj.>   Initializing groups 1 and 2.

   eg [RETURN]

3 - <Obj.>   Creation of star objects

   +* African 1   [RETURN]
   +* African 2   [RETURN]
   [F2]

4 - <Obj.> Access to the frame for the African 1 object.

   x31   [RETURN]   [F1]

CREATION OF TWO GROUPS

5 - <O x F> Definition of attributes for
            Continent and Tree climbing

   13;=1 [RETURN]
   [F3] =2   [RETURN]
   [F5] [F5]
   =1 [F4] =1   [RETURN]
   [<-] [<-]

6 - <Obj.> Creation of both groups

   g1o31;g2o32   [RETURN]

7 - <Obj.> Deleting of star objects

   -31;y;-31;y   [RETURN]

8 - <Obj.> Comparison

   cp   [RETURN]

COMPARISON BETWEEN BOTH GROUPS - OR - FEATURES

```
OR - COMPARISON -              |Abs. |   $ Rel.

  1 -  $ Fur appearance
  2 - Fur length
  3 -  $ Ears shape
  4 -  $ Withers height
  5 - Weight
  7 -  $ Tail relative length compared to
       the body length
  8 - Canine length
  9 - Presence of a hyoid bone
 10 -  $ Presence of retractable claws
                              Page #1/ 2
|C fe |
```

The "Fur appearance" feature is preceded by a dollar sign, which on the chart on the previous page corresponds to a relative difference in OR mode - Third case.

GROUP COMPARISON - OR - ATTRIBUTES

There are attributes possible in both groups. Let's display the Attribute
Comparison menu - <C at>. Type:

1   [RETURN]

```
┌─────────────────────────────────────────────┐
│ Comparison OR              |g1|   $:g2       │
│                                              │
│ Fur  appearance                              │
│                                              │
│  1 -  | $ Spotless|                          │
│  2 -  | $ With spots|                        │
│  3 -  |Striped|                              │
│  4 -  Mottled                                │
│                                              │
│                                              │
│                                              │
│ |C at |                                      │
│                                              │
└─────────────────────────────────────────────┘
```

Cats from both groups can be with or without spots. That means that at least one
animal in each group has spots while another one in each group is spotless.
There are no felines with stripes in the second group, and no cats with mottled
fur in any group. Therefore, a relative difference between both groups as striped
is possible only in group 1.

We cannot study all cases, but let's look at some of them. Press:

[<-]   [F1]

The second page of menu <C fe> is displayed. The feature "Tree climbing" is in
reverse-video. So, we have an absolute difference in OR mode - Case 1. Enter:

13   [RETURN]

```
┌──────────────────────────────────────────────┐
│ Comparison OR                    |g1|   $:g2  │
│                                               │
│ Tree  climbing                                │
│                                               │
│  1  -  |Yes|                                  │
│  2  -  $ No                                   │
│                                               │
│                                               │
│                                               │
│                                               │
│                                               │
│                                               │
│  |C att|                                      │
│                                               │
└──────────────────────────────────────────────┘
```

All cats in group 1 climb trees and all cats in group 2 just look at them from the
ground, no common attribute exists, which corresponds to the definition of both
groups. Thus, there is an absolute difference between both groups.

Type:

[<-]   and   [RETURN]

to work with the AND comparison mode.

GROUP COMPARISON - AND

In the AND mode, objects of each group are first compared among themselves. XPER makes note of all possible attributes for all objects in the group. These common attributes are then compared between groups. Are there any in common?

The features causing an absolute differentiation between all the objects of one group and the other are displayed in reverse-video.

The "Ears shape" feature is in reverse-video. So we have an absence of common attributes in both groups, but there is a common attribute for one of the groups. To check it, press:

   3   [RETURN]

to access the Comparison Attributes menu - <C at>. And you can see that all objects of group 2 have rounded ears.

EXAMPLE SUMMARY

	O R	A N D
Absolute Difference Reversed video	Group 1 - Climb Group 2 - Do not climb trees No common attri- bute for this feature.	The ears shape is common to all cats in group 2 Not true for 1.
Relative Difference $	All animals in both groups may have spots or be spotless.	No such case in this example.

This concludes the tutorial on groups and also on the editor. We are now going to study the inquirer in the seventh lesson. To go there, and if you're still in the <C at> menu, press:

[<-] [<-] [<-] [<-] [<-] 2

LESSON 7

INQUIRER - OVERVIEW

The seventh lesson will continue exploring the inquirer and will expand on what you learned in the fourth lesson. The new points include:

- a larger file - "cats" with 30 objects.
- user "tricks" - such as: how to optimize an inquiry by eliminating non-discriminating features and attributes or by ordering the features to get the fastest way to an specified object, and how to go back levels during a determination.
- print-out of an inquiry.

Load the "cats" base now. When everything's ready, press:

2   [RETURN]

from the **<M In>** menu.

```
┌─────────────────────────────────────────────────┐
│ Qn= 1   Rf= 17   Ro=30              EAD   NDFD   │
│                                                  │
│   1 - Continent                                  │
│   2 - * Morphology                               │
│   3 - * Behavior                                 │
│                                                  │
│                                                  │
│                                                  │
│                                                  │
│                                                  │
│   |I rf |                                        │
│                                                  │
└─────────────────────────────────────────────────┘
```

We are not going to worry about the EAD and NDFD flags right now, so type:

f- ; a-   [RETURN]

Press **h   [RETURN]**   for HELP.

The following is displayed:

(fn)/ ro eo ef ! sa q(qn) a- a+ f- f+ af t+ t-

You know already some commands such as (fn)/ (answer to the feature number fn),
ro (remaining objects), eo (eliminated objects), ef (eliminated features), and sa
(start again). The remaining commands will be explained as we go. Press any
key to continue.

NON DISCRIMINATING FEATURES - ELIMININATION

Start the inquiry with a Behavior question. You can see that not all 17 features
are displayed because there are many child or son features (See Lesson 5). Press:

3 [RETURN]   to choose the Behavior question.

We know the cat behavior for our search, so type:

1 [RETURN]   to choose the Known attribute.

```
┌─────────────────────────────────────────────────────┐
│ Qn= 2   Rf= 16   Ro=30              EAD   NDFD        │
│                                                      │
│    1 - Continent                                     │
│    2 - * Morphology                                  │
│    3 - Hunting hours                                 │
│    4 - Prey size                                     │
│    5 - Tree climbing                                 │
│    6 - Main hunt method                              │
│                                                      │
│                                                      │
│                                                      │
│                                                      │
│ |I rf |                                              │
│                                                      │
└─────────────────────────────────────────────────────┘
```

We still have all our objects (Ro= 30), which is perfectly normal. We have
answered a Father/Star feature which does not directly interfere with the objects
but does affect the feature organization.

We have reached level 2 of the questioning (Qn= 2) and we have a feature missing
(Rf= 16).

We know that the animal we're looking for can climb trees. To indicate this information to XPER, type:

5   [RETURN]   1   [RETURN]

The question level is increased by one and the number of features is decreased by one. Five cats do not climb trees and are therefore eliminated from our search (Ro=25).

NON-DISCRIMINATING FEATURES AND EXCLUDED FEATURES

An answer to a certain question could make other features non-discriminating and exclude attributes.

A feature is said to be non-discriminating when it does not differentiate between the remaining objects. Therefore, answering a non-discriminating question does not aid a search.

An attribute is excluded when none of the remaining objects possess it. If this attribute is chosen during an inquiry, a "No corresponding objects" message is displayed.

Notice that you can go back to a previous question level by typing:

!   [RETURN]

This command sends the inquiry back one step, which is very useful when you decide to change the previous answer. In the same way, it is possible to go back to any level, simply by typing "q" and the question level (not question number). For example, to go to level 2, type:

q2 [RETURN]

We are already there. Now type:

f+;a+   [RETURN]

Two words are now displayed in the upper right-hand corner of the screen. EAD means Excluded Attributes Deletion and NDFD means Non-Discriminated Feature Deletion. Please read the REFERENCE part of this manual, pages R-27 and R-28, for more details on these two commands (and continue reading the following section).

```
┌─────────────────────────────────────────────────────┐
│                                                       │
│  Qn= 2   Rf= 16   Ro=30              EAD   NDFD       │
│                                                       │
│     1 -   Continent                                   │
│     2 -  * Morphology                                 │
│     3 -   Hunting hours                               │
│     4 -   Prey size                                   │
│     5 -   Tree climbing                               │
│     6 -   Main hunt method                            │
│                                                       │
│                                                       │
│                                                       │
│                                                       │
│   |I rf |                                             │
│                                                       │
│                                                       │
└─────────────────────────────────────────────────────┘
```

NON-DISCRIMINATING FEATURES AND EXCLUDED ATTRIBUTES

Let's tell XPER that our cat climbs trees.   Press:

5   [RETURN]

Notice when the "Tree climbing" attributes are displayed, the "Yes" attribute is in reverse-video. "Yes" was the answer given one level back, when the "!" command was issued. The answer must be given again, press:

1   [RETURN]

We have 25 objects and only 14 features left. Therefore one question (feature) has been eliminated without being used, because it was non-discriminating. To check which one and why, type:

ef   [RETURN]   for eliminated features.

```
3 Eliminated features

  1 -  |q1 * Behaviour|
  2 -  |q2 Tree climbing|
  3 -   q2 (Presence of retractable claws|




|I ef |
```

The first two features are in reverse-video, which means that they have been
eliminated; you have already answered those two questions. The last feature has a
preceding parenthesis which indicates that it is non-discriminating. The question
level when eliminated is also given: 3. To learn more about the reason for the
elimination of the "Presence of retractable claws" feature, type:

3   [RETURN]

ELIMINATION OF NON-DISCRIMINATING FEATURES

```
Presence of retractable claws / N.D. 2

  1 - |Yes|
  2 - No












|D ea |
```

The "Presence of retractable claws" feature has been eliminated because it is non-discriminating. For the remaining objects in our search, the "Yes" attribute is a common point. This means all felines climbing trees have retractable claws. It is a rule.

NOTE: The reverse of this rule does NOT hold true. "All felines with retractable claws can climb trees" is a false statement.

Let's continue the search, press:

[<-] [<-]

Suppose we have a guess as to the identity of the feline we are searching for. We can ask XPER to order the features so that the most discriminating ones are displayed first.

To do so, display all features by answering "Known" to the "Morphology" feature and by going to the Remaining Objects menu. From the <I fe> menu at question level 3, type:

2;1;ro   [RETURN]

RESEARCH OPTIMIZATION

The "Ro" command displays this screen:

```
25 Remaining Objects

  1 - Jaguar
  2 - Leopard
  3 - Ounce
  4 - Puma
  5 - Panther
  6 - Serval
  7 - Ocelet
  8 - Lynx
  9 - Caracal
 10 - Jaguarundi
                              Page #1/ 3
|I ro |
```

Suppose the feline we are looking for is a Jaguar. Press: **z1**   **[RETURN]**
to optimize the search criteria toward the determination of object 1, the jaguar.

```
Qn= 4   Rf= 13   Ro=25              EAD   NDFD

  1 - Prey size
  2 - Withers height
  3 - Weight
  4 - Presence of a hyoid bone
  5 - Canine length
  6 - Tail relative length compared to
      the body length
  7 - Continent
  8 - Hunting hours
  9 - Body length
 10 - Fur appearance
                              Page #1/ 2
|I rf |
```

We're still at the fourth question with 13 features and 25 objects. XPER has ordered the features and the "Prey size" is listed first. Optimization means that the answer to the first question will eliminate the largest number of objects. All questions are still available to be asked and answered, but now they are ordered to optimize our search for the jaquar.

Start with the first feature "Prey size", which should lead us to the Jaguar by the shortest path. Press: **1   [RETURN]**

The jaguar is a large animal and its prey is also large. So, press: **1   [RETURN]** XPER has found it! All the other cats have been eliminated from the search. The jaguar is the only large cat that climbs trees and attacks large prey.

Let's go back one level to find another way to determine the jaguar. Type:

! [RETURN]   ro   [RETURN]   z1 [RETURN]

We chose the first feature, "Prey size", in the previous search. Now try the second feature, "Withers height". Press: **2   [RETURN]**

The jaguar is a tall feline; its withers height is more than 70 cms (28 inches). Press: **3   [RETURN]**

```
 Qn= 4   Rf= 13   Ro=25                    EAD    NDFD

    1 - Prey size
    2 - Continent
    3 - Tail relative length compared to
        the body length
    4 - Hunting hours




 |I rf |
```

The screen shows 4 features and 2 objects remaining, which are:

ro   [RETURN]

the jaguar and the leopard.

The attribute "large prey" for the jaguar will help determine the answer. Type:

[<-]   1   [RETURN]   1   [RETURN]

DIFFERENCES BETWEEN OBJECTS

This particular inquiry shows us that the jaguar and the leopard are closely related to each other. To learn more about the difference(s) between the eliminated objects and the object which was determined through the search, type:

eo   [RETURN]

for the list of eliminated objects. Type:

di   [RETURN]

for the differences between the object found and the other objects in the knowledge base.

```
Number of differences

   1 - 1d q5 Leopard
   2 - 1d q2 Tiger
   3 - 1d q2 Lion
   4 - 1d q4 Panther
   5 - 1d q4 Jaguar
   6 - 2d q4 Chaus cat
   7 - 2d q4 Golden cat
   8 - 2d q4 Marguay cat
   9 - 2d q4 Andean cat
  10 - 2d q4 Ounce


|I nd |
```

There is only one difference (1d) between the jaguar and the leopard, and the leopard was eliminated from the search at the fifth question (q5). Of course, this information is only available for the features used during the inquiry and not all the features.

REASONS FOR ELIMINATION

To find out more reasons why the leopard was not chosen, type the corresponding list number, 1:

1   [RETURN]

And you get:

```
Not : Leopard    $

If prey size =

  1 -  |Big|
  2 -  $ Average
  3 -  Small




|I er  |
```

The leopard has been eliminated because it hunts average size prey (denoted by the dollar sign), while we were looking for a feline hunting large prey (displayed in reverse-video).

NOTE:

1 - If an object has more than one difference from the object found, the:

ne   [RETURN]

command will display the NExt difference(s).

2 - The "di" command is important because it rates the accuracy of a determination. Many differences between the object found and the other objects indicate a good result. If, on another hand, there is only one difference with another object, then you may have reason to doubt the correctness of the determination. By changing one parameter, or making one error, the result of the inquiry will not be the same.

TRACE MODE

The TRACE mode prints a summary of the determination process; a step-by-step listing of each inquiry. To do so, let's get back to the very beginning of the search. From the <I er> menu, press:

[<-] [<-] sa [RETURN]

The "EAD" and "NDFD" messages are still there. You can eliminate them by typing :

f-;a- [RETURN].

To enable the TRACE mode, press:

t+   [RETURN]

A printer must be connected to your system to use this command. The indicator "TRACE" is displayed in the upper right-hand corner of the screen. The program name "XPER" is outputted to the printer. While performing an inquiry, information will be sent to the printer, looking something like this:

**** XPER ****

- 1 / 1 - * Behavior : Known
30 Remaining objects
- 2 / 1 - * Morphology : Known
30 Remaining objects
- 3 / 1 - * Tree climbing : Yes
25 Remaining objects
- 4 / 1 - * Withers height : > 70 cms
2 Remaining objects
Jaguar
Leopard

- 5 / 1 - * Prey size : Big
Determination done
Jaguar

After each question is answered in the search, the following data is printed on the
first line: the question number, the order number of the chosen feature, the
feature name, and the chosen attribute. The second line contains the number of
remaining objects. When the number is less than 10, their names are also
printed. The result of the search is printed on the last line.

LESSON 8

REORGANIZER - OVERVIEW

The first seven lessons helped you create and use knowledge bases using the
EDITOR and the INQUIRER modules. Another useful module is the
REORGANIZER, which will be discussed in this lesson. From the XPER main
menu, press:

3

```
┌─────────────────────────────────────────────────┐
│  ┌───────────────────────────────────────────┐  │
│  │              XPER  V1.03                   │  │
│  │       (c) Micro Application 1984           │  │
│  └───────────────────────────────────────────┘  │
│  ┌───────────────────────────────────────────┐  │
│  │              - REORGANIZER -               │  │
│  │   1      : LOADING: Object linkage         │  │
│  │   2      : LOADING: Feature linkage        │  │
│  │   3      : Saving                          │  │
│  │   4      : Reorganizing                    │  │
│  │   ESC    - Main menu                       │  │
│  └───────────────────────────────────────────┘  │
│  |M Re                                            │
└─────────────────────────────────────────────────┘
```

Commands "1" and "2" merge two or more bases with the same features and
attributes in order to regroup their objects. If the bases have the same objects,
then their features and attributes will be regrouped.

Command "4" reorganizes a base by changing the order of its features, attributes,
and objects.

Command "3" saves the base in memory after you have finished your
reorganization or merging. The newly reorganized knowledge base will be lost if
you return to the main menu without first saving it.

These operations are useful when different people are working on the same
knowledge base.

REORGANIZER - LOADING

To reorganize a knowledge base, the file must be in memory. Because of the Reorganization module's structure and functions, the loading procedure for one or more bases is different from the procedures used in the other modules. This allows you to load more than one file at a time. However, let's start by loading only one base. Load the "kitties" base.

From the Reorganizer main menu <M Re>, type:

1 [RETURN]

```
- LOADING : object linkage -

No base




|Load.|
```

Let's get some help at this level, so type:

h [RETURN]

which displays the following:

r(bn)=(bt)   +(bt)   -(bn)   ld

(See REFERENCE section, page R-35, for the definitions of these commands.)

This syntax is different, but familiar. To indicate the base to be loaded, you just type "+" and the base name.

To load the "kitties" base (first press any key to erase the help screen) type:

+kitties   [RETURN]

```
- LOADING : object linkage -

1 - kitties







|Load.|
```

This screen indicates that the "kitties" base is ready for loading. If you want to merge two or more bases, enter the "+" command and the new base name. Or, if you are just working with one base, use the appropriate commands to modify or revise it ("+", "-" and "r ="). And when every name is correctly entered, type:

ld   [RETURN]

to effectively load the knowledge base(s) into memory. You will be returned to the Reorganizer menu **<M Re>** when the loading is done.

REORGANIZER - PRINCIPLES

From the Reorganizer main menu, enter **4** and **[RETURN]** to display the Reorganization screen.

```
┌─────────────────────────────────────────────────┐
│  ┌─────────────────────────────────────────────┐ │
│  │            - REORGANIZATION -               │ │
│  └─────────────────────────────────────────────┘ │
│                                                   │
│  ┌─────────────────────────────────────────────┐ │
│  │                                             │ │
│  │   1      : Title and Parameters             │ │
│  │   2      : Features                         │ │
│  │   3      : Objects                          │ │
│  │   ESC    : Previous menu                    │ │
│  │                                             │ │
│  └─────────────────────────────────────────────┘ │
│   |Reorg|                                         │
└─────────────────────────────────────────────────┘
```

You have seen this menu before. It was used during the editing and creation of a knowledge base.

The Title and Parameters option (1) displays just what it says. Check the number of objects, features, and attributes of the "kitties" base by entering **1** **[RETURN]**. The answers are 6, 5 and 13, respectively. Press [<-] to return to the menu shown above.

The second and third options are used differently in the Reorganizer module. In the editor module, these options were used to create, consult, and revise the objects, features, and attributes of a knowledge base.

REORGANIZATION BY OBJECTS

Let's modify the order of the objects in the "kitties" knowledge base. To get the list of objects, press:

3   [RETURN]

```
- OBJECTS -

1 - Lion
2 - Tiger
3 - Jaguar
4 - Cheetah
5 - Panther
6 - Lynx




|Obj. |
```

You can exchange two objects, or insert an object.

For example, exchange the TIGER (# 2) with the LYNX (# 6). Type:

x2=6   [RETURN]

to eXchange objects 2 and 6.

Another example. Insert the CHEETAH so it becomes the first feline of our base. Type:

i4=1   [RETURN]

which means insert object #4 at position 1.

The screen now looks like this:

```
- OBJECTS -

1 - Cheetah
2 - Lion
3 - Lynx
4 - Jaguar
5 - Panther
6 - Tiger




|Obj. |
```

Let's put the cats in alphabetical order. Simply insert the Jaguar in the second place with this command: I4=2   [RETURN].

The same commands can be used to exchange or insert features and attributes. When everything looks good, save the revised knowledge base in the usual way. However, give it a new name - "felines".

From the <Obj.> menu, type:

[<-] [<-] 3 [RETURN] felines [RETURN]

and the new knowledge base will be saved.

MERGING THE BASES

Let's merge the "kitties" and "felines" bases (both bases are identical, just in a different object order). You can group two bases in two ways: either link the bases with the same objects but different features--Feature linkage, or link the bases with the same features and attributes but different objects--Object linkage. We'll see an example of this last option. From the main reorganizer menu <M Re>, type:

1   [RETURN] to choose an object linkage.

And

y   [RETURN] to confirm the option.

The "Are you sure (y/n) ?" question is asked because the knowledge base in memory is destroyed when a new base is loaded.

Now type:

+kitties   **[RETURN]**
+felines   **[RETURN]**

```
- LOADING -

1 - kitties
2 - felines





|Load.|
```

To load both bases into memory, type:

ld   **[RETURN]**

The title of the base resulting from a merge is always the title of the base loaded first (kitties).

MERGING BASES

To check the success of these commands, display the Title and Parameter menu. From the <M Re> menu, press the following sequence of keys:

4   [RETURN]   1   [RETURN]

```
- TITLE PARAMETERS -

Parameters

  5     Features    Max. = (www)
 12     Objects     Max. = (xxx)
 13     Attributes  Max. = (yyy)

 Available memory  = (zzzz) bytes

 Title = Feline Species


 |TandP|
```

We started with two bases: each containing 5 features and 6 objects. The new base in memory now contains 5 features and 12 objects.

The Loading commands are helpful when more than one person is working on the same base. Each person works on a different base, with common features or objects, and then their efforts are regrouped into one main base and saved.

NOTE:

The REORGANIZER is the only module for which the knowledge base is not protected. You must save the newly created base before returning to the main menu.

LESSON 9

PRINTER - OVERVIEW

This final lesson explains a few of the PRINTER options.

Let's go back to the XPER main menu using a few [<-]s, a "y", and a [RETURN],
then type:

4   to load the Printer option.

The following Printer menu appears:

```
┌─────────────────────────────────────────────┐
│  ┌────────────────────────────────────────┐  │
│  │              XPER  V1.03                │  │
│  │     (c)  Micro  Application  1984       │  │
│  └────────────────────────────────────────┘  │
│  ┌────────────────────────────────────────┐  │
│  │              - PRINTER -                │  │
│  │  1      :  Loading                      │  │
│  │  2      :  Screen editing               │  │
│  │  3      :  Printer editing              │  │
│  │  4      :  Output device modification   │  │
│  │  5      :  Printer width modification   │  │
│  │  ESC    :  Main menu                    │  │
│  └────────────────────────────────────────┘  │
│     |M Pr |                                    │
└─────────────────────────────────────────────┘
```

Load the "cats" knowledge base with the first option (1).

Before using screen editing (2) and printer editing (3), let's first look at the two
modification options (4) and (5).

The fourth option is used to define or to modify the peripheral device. If you
have more than one printer, this option allows you to choose the printer for a
specific job.

The fifth option allows you to select the number of characters printer per line,
depending on your printer.

The possible values for both options also depend on the computer you're using.
So, check your computer manual for more details.

SCREEN EDITING

To use screen editing, press:

2   [RETURN]

```
┌─────────────────────────────────────────────────┐
│  ┌───────────────────────────────────────────┐  │
│  │                - PRINTING -               │  │
│  └───────────────────────────────────────────┘  │
│                                                  │
│  ┌───────────────────────────────────────────┐  │
│  │  1       : Feature list                   │  │
│  │  2       : Attribute list                 │  │
│  │  3       : Object list                    │  │
│  │  4       : Object description             │  │
│  │  5       : Frame                          │  │
│  │ ESC      : Previous menu                  │  │
│  └───────────────────────────────────────────┘  │
│     |Prin |                                      │
└─────────────────────────────────────────────────┘
```

All the available editing features are shown:

1 - displays a simplified list of features.

2 - lists all the attributes of a feature (press its number and [RETURN]), or lists all the attributes for all features (type **af [RETURN]**).

3 - displays a simplified list of objects.

4 - displays the complete description of one, some, or all objects. The selection is done by entering their numbers or the **ao** command for all objects.

5 - displays the complete structure of objects / features / attributes.

Take a look at option number 5, press:

5   [RETURN]

STRUCTURE

Structure of : Feline Species.

Ies	Att	1	2	3	4	5	6	7	......Objects
1	1	•••	–	–	–	–	–	•••	
	2	–	–	•••	•••	•••	•••	–	
	3	–	•••	–	–	–	–	–	
	4	–	–	–	–	–	–	–	
2	1	•••	•••	•••	•••	–	•••	•••	
	2	–	–	–	–	•••	–	–	
3	1	•••	•••	•••	•••	•••	•••	•••	
	2	–	–	–	–	–	–	–	
4	1	–	–	–	–	–	–	–	
	2	–	–	–	–	•••	–	•••	
	3	•••	•••	•••	•••		•••		

:

In this semi-graphic mode, the frame shows the object/feature/attribute relations. Stars "***" represent a possible attribute for a given feature and a given object. This frame allows you to check if some relations have not been defined for the objects.

Example : You can see that object #1 has attribute #1 possible for feature #1, and object #2 has attribute #3 possible for the same feature.

PRINTER EDITING

All the above information can be printed on a printer by using exactly the same commands. The only difference between displaying and printing the length of the printed line is that it can vary from printer to printer.

CONCLUSION

The Tutorial section is now finished. In order to simplify the lessons, not all commands have been shown. Please read the REFERENCE part of this manual to learn the remaining XPER features.

REFERENCE

SECTION

XPER - Knowledge Base Management System - Reference

OVERVIEW

A - PRESENTATION

XPER is a knowledge base management system that can define, create, modify, access, and print any kind of information. It is the first Computer Assisted Identification software available for microcomputers.

XPER contains four options from the Main menu:

1 - Editor

    The Editor creates, consults, and revises the knowledge bases. It can also calculate distances and perform multi-criteria searchs and comparisons.

2 - Inquirer

    The Inquirer identifies an object in the knowledge base from the description given by answers to questions or inquiries.

3 - Reorganizer

    The Reorganizer modifies the structure of all data in the knowledge base (features, attributes, objects) and merges two or more bases.

4 - Printer

    The Printer displays or prints the contents of a knowledge base.

    A KNOWLEDGE BASE is a list of objects described by qualitative features, each of which can have up to 14 attributes. The base is represented by a matrix.

    Each module of XPER is organized into a data structure called a "tree", which displays data or results, and waits for new data or a command from the user. A menu abbreviation appears in reverse-video in the lower left-hand corner of the screen, indicating the tree level (see appendix, page A-1, for a diagram).

B - DESCRIPTION OF COMMANDS AVAILABLE IN ANY MENU

All commands must be followed by [RETURN], except the [<-] key, the function keys, and the [CLR] key.

[<-]

Displays the previous menu.

?

Displays the last command used.

??

Displays the command preceding the last command.

If more than one command has been entered using the semicolon separator ";" (see below), then "??" displays the last two commands separated by a semicolon.

???

Displays the command three commands before.

As for "??", if more than one command has been entered using the ";" separator, "???" displays the last 3 commands separated by semicolons.

NOTE:
The "?", "??" and "???" commands are not memorized as executed commands.

;

Command separator.

You can enter more than one command at a time by separating each command with a semicolon instead of pressing the [RETURN] each time. The last ";" is optional.

If one of the commands followed by ";" is incorrect, the remaining commands are not executed. The "?" command will display the last command(s) used, and you can then correct the mistake.

COMMANDS ALWAYS AVAILABLE

[CLR]

   Erases the command line.

   Erases the command line before any execution. This command is not displayed, so it cannot be re-displayed by using "?", "??", or "???".

h

   Displays the HELP page.

   Displays a list of all commands available in the current menu, including their syntax.

   Between parentheses, help commands indicate the parameters of the command (such as numbers or texts). The parentheses serve only to indicate this and must not be typed in.

(an)	=	attribute number
(at)	=	attribute text
(bn)	=	base number
(bt)	=	base text
(fn)	=	feature number
(ft)	=	feature text
(gn)	=	group number
(on)	=	object number
(ot)	=	object text
(pn)	=	page number

   These commands and the screen page management commands (See Pages R-2 to R-4) are not recalled by the "h" command.

   After consulting the HELP page, any key can be pressed to get back to command input.

/

   Numeric data separator

   Indicates that more than one number is entered after a unique command, and they are separated by "/".

NOTE:

In some cases, XPER asks for confirmation of a command by displaying the "Are you sure (y/n) ?" message. The Y answer confirms the command; any other key rejects it.

SCREEN PAGE MANAGEMENT COMMANDS

1 - Changing page [F1]   [F2]   "p(pn)"

If a list of data, features, or objects is too large to be displayed on the screen, it will be displayed on more than one screen with the use of pages. XPER indicates the page number and the total number of pages in the lower right-hand corner of the screen.

The [F1] and [F2] keys move the screen from one page to the next or to the previous page: [F1] displays the next page and [F2] displays the previous page.

To go directly to a specific page, use the "p" command followed by the page number.

Example: p3 [RETURN]   for Page 3.

2 - Changing feature [F3] [F4]   "v(fn)"

When consulting the contents of features (example: their list of attributes), [F4] and [F3] displays the previous and next feature, respectively.

To go directly to a specific feature, use the "v" command followed by the feature number.

Example: v3 [RETURN]   for third Feature.

3 - Changing object [F5]   [F6]   "i(on)"

The commands [F6] and [F5] display the previous or next object, respectively.

To go directly to a specific object, use the "i" command followed the object number.

Example: i9 [RETURN]   for ninth Object.

4 - Changing group [F7]   [F8]   "l(gn)"

This command deals only with the editor, and can create three groups of objects: groups 0, 1, and 2. While consulting the list of objects of one group, [F8] and [F7] display the the previous and the next group, respectively.

The command "l", followed by the group number, displays the list of objects of the chosen group.

Example: l2 [RETURN]   for List of second Group.

EDITOR

I Editor menu - <M Ed>

The first menu of the Editor displays the options listed below. The selection is made by pressing the corresponding number.

1 - Loading

Loads a knowledge base already created and saved on diskette.

This command destroys any base already in memory. This is why XPER asks for confirmation of the option.

2 - Initializing - Creating

Initializes the program for the creation of a knowledge base. This command works the same as "loading"; it destroys the base in memory (if the choice is confirmed).

3 - Saving

Saves the knowledge base in memory onto diskette. This process is only possible when a knowledge base is in memory.

4 - Consulting - Revising

This option can only be used when a knowledge base resides in memory to modify, add, delete, and consult all data of the knowledge base.

[<-] : Main menu

Brings you back to the main menu in order to choose another option. The XPER program diskette must be in the disk drive when this option is requested.

I-1 Loading

The disk drive must be connected to your computer and must contain the diskette on which the base to be loaded is found.

You must type the name of the base. This name can be up to eight characters long and should not include any punctuation marks.

[<-]

Brings you back to the Main menu of the Editor in case of an error or if you do not want to load the base.

I-2 Initializing

This process erases any knowledge base in memory, reinitializes the memory and displays the Creating / Consulting / Revising menu.

[<-]

Brings you back to the main menu of the Editor.

I-3 Saving

The disk drive must be connected and turned on and contain a formatted diskette with enough room to store the knowledge base in memory.

Type the name of the base. This name can be up to 8 characters long and should not include any punctuation marks.

EDITOR

I-4 Consulting - Revising - <CorR>

This menu displays the different options. The selection is made by pressing the corresponding number.

1 : Title and Parameters.

Allows you to create or revise the title and to create or consult the main parameters of the knowledge base.

2 : Features.

Allows you to create, consult, or revise the base features with their attributes and the parenthood relations between features.

3 : Objects and Frame.

Allows you to create, revise, and consult the knowledge base objects and the associated structure (frame) which are the contents of the data matrix.

Also allows :

- Distance of Jacquard, which calculates the distance between two objects,

- group creation, to either input the base in a more efficient way, or to carry out comparisons and find out rules, and

- multi-criteria searchs on all objects or groups.

[<-]

Brings you back to the main menu of the Editor.

EDITOR

I-4.a Title and Parameters - <T &P>

Displays the parameters of the knowledge base, which are the actual and
maximum number of features, attributes, and objects. It also displays the
available memory, which is useful in controlling the creation of a
knowledge base.

A text character takes one byte of memory. Entering the structural relations
between objects, features, and attributes does not use much memory. Because
of the XPER command management, it is advisable to always leave at least
300 bytes unused at all times.

This operation also displays the title of the knowledge base, allowing you
to revise or create it if it does not already exist.

Available commands

=(title   text)
Creates the knowledge base title.

=

Displays the title so you can revise it.

[<-]
Returns you to the Consulting - Revising - Creating menu.

I-4.b   Features - <Fea.>

Displays the list of features. If the list is too large for the screen, the screen
management commands are available : [F1] [F2] "p(pn)".

Available commands :

r(fn)=(ft)
Revises feature number (fn) with the text (ft).

r(fn)=
Displays the actual text of the feature so it can be revised.

-(fn)

Deletes feature number (fn) after confirmation of the command. The numbers of the following features are automatically decremented.

+(ft)

Adds a new feature at the end of the list with text (ft). The features list can be reordered using the Reorganizer.

t(fn)=(ft)

Makes a copy of feature (fn) by creating its twin with the same attributes, the same contents in the frame, and the same parent feature (if any).

The son features are not associated with the twin. The twin is located at the end of the list with the text (ft). This command is used to increase the speed of creation of a base in the case of similar features having, for example, the same attributes (Yes, No, etc.).

cf(fn)

Connection - father (fn). See I-4.b 1.
A feature can depend on another feature, which is called a father feature. This command is used to consult, revise, or create the father relationship of feature (fn).

cs(fn)

Connection - son (fn). See I-4.b 2.
A feature can have features under its control, called son (or child) features. This command displays the list of son features of the feature (fn).

a(fn)

Attributes of feature (fn). See I-4.b 3.
Displays the list of attributes of feature (fn) and allows you to create or revise them.

ob

Displays the list of the objects without going through the Consulting / Revising menu.

ef

Eliminates all features. Allows you to redefine all the features of the base while keeping its objects.

[<-]

Back to the Consulting / Revising / Creating menu.

STAR FEATURE

Any feature displayed with a STAR (*) is not used to discriminate between objects in the inquirer. Whatever its contents, it won't appear during an identification unless it has at least one son feature.

A star feature is considered a non-discriminating feature by the inquirer.

The star allows you to either:

- create "commentary" features, which can be consulted and stored, but which won't interfere with an inquiry,

OR

- to ease the access to features during an inquiry by creating a complex hierarchy that will display only part of the features on the screen.

I-4.b 1   Father Connection <F fc>

If a feature does not have a father, a "No father feature" message is displayed followed by the list of features. You may then choose a father feature by pressing its number. A feature cannot be its own father and cannot have more than one father.

If the feature has a father feature, it will be displayed with its attributes. The exclusion attributes are displayed in reverse video. By using the exclusion attributes in the Inquirer, the son feature will be eliminated.

During an inquiry, a father feature is not displayed when the attribute chosen is the exclusion attribute. This hierarchy in the features (father-son relationships allow for sons that are also fathers) allows the creation of complex knowledge bases. The base is still easy to use because all the features won't be displayed at the same time during an inquiry.

Available commands :

-(an)/

Deletes the exclusion quality of attribute (an) or more attributes. To remove the exclusion quality of multiple attributes, separate their numbers with slashes (/).

-?

Deletes all exclusion attributes while keeping the father connections.

+(an)/

Adds one or more exclusion attributes (an). Has the same syntax as the "-(an)" command.

=(an)/

Replaces the actual exclusion attributes with those indicated after the "=" and separated by "/".

=0

Deletes all exclusion attributes like "-?", while keeping the father connection.

=?

Makes all attributes exclusion attributes. CAREFUL: If all attributes of a father feature are exclusion attributes then no matter what answer is given during an inquiry, the son feature is eliminated. On the other hand, if there is no exclusion attribute, the son feature will be displayed regardless of the answer to the father question.

df

Deletes the father feature of the feature f.

[F3]   [F4]
f(fn)

Changing feature - (See R-4).
Displays the father connection of feature "fn".

[<-]

Returns you to the list of features.

I-4.b 2   Son connection - <F sc>

If the feature has no son features, a "No son" message is displayed.

If there are sons to the feature, their list appears with the son features
displayed in reverse.

[F3]   [F4]
f(fn)

Changing features - (See R-4)

[<-]

Brings you back to the list of features.

I-4.b 3   Attributes of a feature - <F at>

Displays the list of attributes of a feature, their number being between 2 and
14, inclusive. Also allows their creation, correction, and deletion.

The attributes describe the different possible states of a feature for all the
objects in a knowledge base.

Available commands :

r(an)=(at)

Revises attribute (an) with new text (at). Same syntax used to revise the
features.

r(an)=

Displays the actual text of an attribute in order to modify it.

-(an)

Deletes attribute number (an). Beware--a feature must have at least 2
attributes (lower limit).

+(at)

Adds a new attribute with the text (at) at the end of the list. The maximum
number of attributes is 14 per feature.

t(an)=(at)

Makes a twin copy of the attribute (an) named (at) with the same contents in
the structure, which means the same answer for each object. But if (an) is an

exclusion attribute for some son features, the son features are not transmitted to its twin.

[F3]   [F4]
f(fn)
> Changing features - (See R-4).
> Allows you to display, revise, or create the attributes of other features.

[<-]
> Returns you to the list of features.

I-4.c Objects - <Obj.>

> Displays the list of objects. If the list is larger than the screen, the screen page management commands [F1], [F2], and "p(pn)" are available to change the screen page (See R-4).

> The group to which each object belongs is indicated by:

> | reverse video | for group 1 |
> |---|---|
> | dollar sign $ | for group 2 |
> | nothing | for group 0 |

> By default, all objects reside in group 0.

Available commands :

r(on)=(ot)
> Revises object (on) with new text (ot).

r(on)=
> Displays the actual text of object (on) so that it can be revised.

+(ot)
> Adds the object with text (ot) to the end of the list.

-(on)
> Deletes object number (on).

eo
> Eliminates all objects. Allows you to create a base with new objects, but keeps existing features and attributes.

t(on)=(ot)
>   Makes a twin copy of object (on) named (ot), with the same contents in the structure.

x(on) - See I-4.c 1
>   Displays the description of object (on) by displaying its structure.

d(on) - See I-4.c 2
>   Calculates the Distance of Jacquard between object (on) and all the others. It also displays a list of the closest objects in ascending order.

cp - See I-4.c 3
>   Compares groups 1 and 2. If one of the groups is empty, it compares the members of the non-empty group.

fe
>   Displays the list of features without going through the Consulting - Revising - Creating menu. <CorE>

eg
>   Erases the contents of groups 1 and 2 by transferring all objects to group 0.

l(gn) - See I-4.c 4
>   Lists the contents of group (gn) and allows you to consult, revise, or create the contents of the structure for all objects of the group.

g(gn)=(on)/
>   Replaces the contents of group (gn) with the list of objects following the "=" sign. Separate each object number with a slash.

g(gn)+(on)/
>   Adds one or more objects (on) to group (gn), with their numbers separated with a "/".

g(nga)>(ngb)
>   Adds all objects of group (nga) to group (ngb), transferring group (nga) to group (ngb).

g(gn)o(on)
>   Adds to group (gn) all objects with a description compatible with object (on).

>   This last command offers many possibilities. It allows you to verify the uniqueness of an object.

Multi-criteria searches can also be done, such as:

- Creation of a mask-object and search of all objects with the same definition as the mask-object by creating a group compatible with the mask.

- Creation of a twin-object and modification of its definition. For example, is there an object such as this one but having these attributes?

- Search of a relation between attributes: is the presence of this attribute always associated with this other attribute?

The test objects used during searches can be saved, but to keep them from interfering with an inquiry, we advise you to precede the test object with a star (*). In this way they will be automatically discarded during an inquiry.

I-4.c 1   Frame - Choice of features - <O xF>

Displays the list of all features. If it is larger than the screen, the screen page management commands [F1], [F2], and "p(pn)" are available.

If there is no feature, a "No Feature" message is displayed.

The frame input consists of the list of possible attributes for each feature's object.

Available commands :

(fn) - See I-4.c 1-a.
Chooses a feature so that its attributes will be displayed.

[<-]
Returns you to the list of objects.

I-4.c 1-a   Frame - Attributes - <O xA>

Lists all possible attributes for the chosen feature in reverse video.

If all attributes are in reverse video, it means:

- the frame has not been defined yet for the chosen object. All attributes are then declared as possible by default. This corresponds to the answer: "I don't know".

OR

- the object has all the attributes possible for this feature.

If no attribute is in reverse video, it means

- the list of attributes is incomplete and does not include the description of
the object. It is then necessary to go back to the Feature menu and add an
extra attribute.

OR

- the feature has no relation to the description of the chosen object.

I-4.c 1-a Frame - Attributes - <O xA>

Available commands :

-(an)/
Deletes the attributes (an) separated by slashes from the description of the
object.

+(an)/
Adds the attributes (an) separated by slashes to the description of an object.

=(an)/
Defines the description of the object by the attributes (an) separated by
slashes.

a-(an)/
Same command as -(an)/ but applies to all objects in the knowledge base.

a+(an)/
Same command as +(an)/ but applies to all objects in the knowledge base.

a=(an)/
Same command as =(an)/ but applies to all objects in the knowledge base.

=?
Makes all attributes possible in the description of the object.

=0
   Makes all attributes impossible.

[F3] [F4]
f(fn)
   Changes features for the same object.

[F5] [F6]
o(on)
   Changes objects for the same feature.

[<-]
   Returns you to the list of features.

I-4.c 2   Distances - <Dist>

   Calculates the Distance of Jacquard between a given object and all the
   others. Displays a number of objects with the closest distance. The value
   displayed in front of each object is the Distance of Jacquard multiplied by
   10,000.

   The Distance of Jacquard quantifies the similarity between an object and
   another object for the attributes and features in the base. If an attribute is
   not possible for either of the objects, it is not counted for the distance
   calculation. A common attribute decreases the distance and a non-common
   attribute increases it.

   Two objects with the same description have a distance of zero.

   Two objects with totally different descriptions, that is, with no common
   attributes, have a distance of 10,000.

   Two objects with a distance less than 2,000 are considered to have a strong
   resemblance.

Available commands

[F5] [F6]
o(on)
    Changes object. Calculates the Distance of Jacquard for another object.

[<-]
    Returns the list of objects to the screen.

I-4.c 3   Comparisions - <C fe> - List of Features

Displays the results of the comparison between groups 1 and 2 with a list of the features.

If a feature is in reverse-video, there is an absolute difference between each group for this feature. This means the groups do not have any attributes in common.

If a feature name is preceded by a dollar ($) sign, there is a relative difference between each group. This means the groups have some attributes in common while others are different.

If a feature is not displayed in reverse-video and not preceded by a dollar sign, the contents of each group for this feature are the same.

There are two modes of comparison: AND comparison and OR comparison. The mode is displayed in the upper right-hand corner of the screen.

OR COMPARISON

The attributes for each feature are compared with at least one object of the group, which means all the possible attributes for at least one object of the group are displayed.

An absolute difference means there are no matching attributes in either group and in both groups.

A relative difference means there is at least one attribute in one group which is absent in the other group and at least one attribute is common in both groups.

AND COMPARISON

The attributes common to all the objects in each group and for each feature are compared. This displays all the possible attributes for all objects in the group.

An absolute difference means there are no attributes common to both groups.

A relative difference means there is at least one attribute common to both groups.

If each group contains only one object, the AND and OR comparisons give the same results.

If one of the groups is empty, the comparison is done within the one group. This allows you to define rules.

Available commands:

l(gn)
Lists all objects of group (gn) and gives access to the structure of the objects in the group.

or
Displays the OR comparison.

and
Displays the AND comparison.

(fn)
See I-4. c 3-a.
Lists the attributes of a feature (fn) and compares the contents of both groups for this feature.

[<-]
Displays the Object menu.

I-4.c 3-a   Comparison - List of attributes - <C at>

Displays the list of attributes for the chosen feature. The attributes of group 1 are displayed in reverse-video. The attributes of group 2 are preceded by a dollar sign.

In OR comparison mode, an attribute is marked when a match is possible for at least one object of the group. In AND comparison mode, an attribute is marked when a match is possible for all objects of the group.

The study of the attributes per group allows you to discover the rules associated with the group.

Available commands:

l(gn)
Lists all objects of group (gn) and gives access to the frame representation for the objects of the group.

or
Displays the OR comparison.

and
Displays the AND comparison.

[F5] [F6]
Changes the feature within the same comparison.

[<-]
Displays the list of features menu.

I-4. c 4   Group - List of objects - <G ob>

Displays the list of objects in the chosen group and allows access to the structure of the group.

Available commands

x(on)
Displays the frame for object (on).

[F7] [F8]   or l(gn)
Changes the group.

rg
Deletes all the objects in the group and allows you to suppress all objects with common characteristics from a knowledge base.

[<-]
Returns you to the list of objects.

I-4. c 4-a   Frame per group - <G xF> - List of features
Lists all the features (see complete frame <O xf>).

Available commands:

(fn) - See I-4. c 4-a 1.
Displays feature (fn) in frame representation, within objects of the group.

I-4. c 4-a 1   Frame per group - <G xA> - List of attributes
(See Frame - Choice of attributes <O xA>)

The available commands are the same as for the complete frame with the only difference being that the "a" (for all) command applies only for all objects in the group. Use group creation (the automatic input of common information) to reduce the input time when creating a large knowledge base.

Also, if rules like "all objects having attribute A also have attribute B" are true, you can create a group with all the objects having the attribute A and then give all the objects attribute B with one command.

Available commands:

-(an)/
Deletes attributes (an), separated by "/", from the description of the object.

+(an)/
Adds attributes (an), separated by "/", to the description of the object.

=(an)/
Defines the description of the object with the attributes (an), separated by "/".

a-(an)/
Same command as "-(an)/", but for all the objects in the group.

a+(an)/
Same command as "+(an)/", but for all the objects in the group.

a=(an)/
> Same command as "=(an)/", but for all the objects in the group.

=?
> All attributes are possible in the description of the object.

=0
> Makes all attributes impossible.

[F3]   [F4]
f(fn)
> Changes the feature for the same object.

[F5]   [F6]
o(on)
> Changes the object for the same feature.

[<-]
> Returns you to the list of features.

INQUIRER

II Inquirer Menu - <M In>

Displays the following options:

1 : Loading

2 : Inquiring

A knowledge base must be in memory to use these commands. To make inquiries, the base must have at least one object not preceded by a "*", and one feature not preceded by a "*" (and without a father feature).

Inquiry consists of a step-by-step description of an unknown subject. It is a search within the knowledge base to find a corresponding object.

[<-] : Main menu
Returns the main menu to the screen so you choose another module of XPER. The XPER program diskette must be in the disk drive when this option is requested.

II-1 Loading

The disk drive must be connected to your computer. Insert the diskette containing the knowledge base to be loaded into the disk drive.

Type the name of the base. This name can be up to 8 characters long and should not include any punctuation marks.

[<-]
Displays the Main menu of the Inquirer on the screen in case of an error or if the user does not want to load the base.

II-2 Inquiring - List of features - <I rf>

Displays the list of active features, i.e. those which can be inquired about.

A son feature appears only if its father is no longer active and if an exclusion attribute has not been answered for that father feature.

A feature preceded with "*" (called a star feature) is not displayed, unless it has a son features. Otherwise the star feature is absent from the inquiry.

Three parameters are displayed during an inquiry in the upper left-hand side of the screen:

Qn

   Question level number.

Rf

   Number of remaining features (all active features and their son features).

Ro

   Number of remaining objects that are still compatible with the description already given of the subject.

Available   commands:

(fn)/ - See II-2. a.

   Type the corresponding number of the feature (fn) that is going to be used to describe the object you are searching for. When more than one feature is entered, each number must be separated using the "/".

ro - See II-2. b.

   Displays the list of remaining objects or the final result of an inquiry.

eo - See II-2. c.

   Lists the objects eliminated from the search.

   You can also find out why the object was eliminated and see the list of differences between the eliminated objects and the object already described.

ef - See II-2. d.

   Lists the eliminated features. There are three reasons leading to their elimination:

   - the feature has already been inquired about.

   - there are no more discriminating features for the remaining objects (only in the NDFD mode).

   - an exclusion attribute has been answered in its father feature.

   This command also displays the answer to a feature already used.

!

Gets you back to the previous question level in the inquiry.

sa

Starts a new inquiry ("start again").

q(qn)

Gets you back to question level (qn).

a-

Disables the automatic Excluded-Attributes-Deletion (EAD) mode.

a+

Enables the Excluded-Attributes-Deletion mode and displays the EAD indicator in the upper right-hand corner of the screen. This mode automatically deletes all attributes which are not possible for any remaining objects. Therefore you cannot reach a "No corresponding objects" situation in the EAD mode.

f-

Disables the automatic Non-Discriminating Features Deletion NDFD mode.

f+

Enables the Non-Discriminating Features Deletion mode and displays the NDFD sign in the upper right-hand corner of the screen.

The "f+" deletes all features that do not discriminate between the remaining objects.

af

Displays all active features.

This command is useful when you want to describe an object in a totally different way in order to test the validity of an inquiry. This command must be repeated as many times as there are hierarchical levels in the feature organization in order to answer all the questions.

t+

Enables the TRACE mode and displays the TRACE sign in the upper right-hand corner of the screen.

This command prints the following information after each question: the feature and its answer and the number of remaining objects. If this number is smaller than 10, the remaining objects are also printed. A printer must be connected to your computer to use this mode.

t-

Disables the TRACE or printing mode.

[<-]

Brings you back to the Inquirer main menu after confirmation.

II-2.a Inquiry - List of attributes - <I at>

Displays the list of attributes of the chosen feature.

Available commands :

(an)/

You can choose the attribute (an) in order to answer it corresponding to the object you are searching for. In case of doubt, answer the question with "yes" or describe the feature as being present in the object you are looking for. In this case, the inquiry is slower but there is less chance of error.

[<-]

Returns you to the list of features <I rf>.

If the answer to a displayed feature is unknown, it is possible to get back to the list of features in order to choose another one. This corresponds to the answer "I don't know". The unanswered feature is not eliminated.

After choosing the attributes, the objects not corresponding to the new description are eliminated and XPER returns the list of features to the screen. In case a solution is found, the list of the remaining objects are displayed. Three possible situations exist:

- the inquiry has been succesful and one object remains.

- it is impossible to discriminate between the remaining displayed objects.

- a "No corresponding objects" message is displayed. The description given of the object you are searching for does not match any object in the knowledge base.

When a feature has already been answered and is asked again, the attributes answered the first time are displayed in reverse video.

II-2.b   Remaining objects - <I ro>

Displays :

- the list of the remaining objects compatible with the current description.

OR

- the result of the inquiry (See Inquiry - list of attributes).

Available commands :

ef
Displays the eliminated features (See II-2 - List of features).

eo
Displays the eliminated objects (See II-2 - List of features).

!

Returns you to the previous question.

rc
Starts a new inquiry.

q(qn)
Returns you to question level (qn).

z(on)
Orders the active features more efficiently so you can reach the result in less time. The most discriminating features are displayed first.

Use this command when you have a guess as to the identity of the object you are searching for. It will find the shortest (fastest) path to the solution.

II-2.c   Eliminated Objects - <I eo>

Displays the list of eliminated objects and the question number (or level) where the object was eliminated.

Available commands :

(on) - See II-2. c 1.
　　Displays the reason object (on) was eliminated and all the differences
　　between the object and the description of the object you are looking for.

di - See II-2.c 2
　　Calculates and displays the number of differences between the eliminated
　　objects and the description of the subject.

　　Displays a limited number of objects.

[<-]
　　Returns you to the last menu used (either remaining objects or active
　　features).

II-2.c 1　Elimination reason - <I er>

　　Displays the reason for eliminating the chosen object, i.e. the feature that
　　discarded the object and the list of attributes. The answers you gave during
　　the inquiry are displayed in reverse-video. The attributes given to the
　　discarded objects are preceded by a dollar ($) sign. This is how XPER
　　justifies its actions.

Available commands :

ne
　　Displays the next feature(s).

[F5] [F6]　OR　o(on)
　　Displays the next or previous object, or object (on).

[<-]
　　Displays the list of eliminated objects.

II-2.c 2 Number of differences - <I dn>

　　Displays a limited number of eliminated objects.　Each object name is
　　preceded with its number of differences and the number of the question that
　　eliminated it.

The number of differences can represent the number of errors made during the inquiry which resulted in this object being found, instead of the object you were searching for. Please check the description of the features for the objects when there is only one difference with the object found.

Available commands :

(on)
Displays the Elimination Reason menu for object (on).

[<-]
Returns you to the Eliminated object Menu.

II-2.d Eliminated Features - <I ef>

Displays the list of eliminated features, each preceded by the question number where it was eliminated.

The features already answered are displayed in reverse-video.

The features eliminated because they are not discriminating are preceded by a parenthesis "(" (only in NDFD mode).

The features that have been eliminated because an exclusion attribute has been answered to the father feature are preceded by a square bracket "[".

Available commands :

(fn) - See II-2.d 1
Displays the attributes of feature (fn).

[<-]
Returns you to the last menu (either active feature or eliminated objects).

II-2.d 1 Eliminated attributes - <I ea>

Displays the list of attributes for the eliminated feature.

The feature name is followed by an abbreviation of the elimination type and the number of the question level where the feature was eliminated. (See Inquiry - List of features).

Abbreviations:

USED   used feature.

N.D.   non-discriminating feature.

DEL.   feature deleted by its father feature.

The attributes chosen during the inquiry are displayed for each used feature.

The common attributes for each remaining object are displayed in reverse-video for all non-discriminating features.

No attribute is displayed in reverse-video when the feature has been deleted by its father feature.

Available commands :

[F3]   [F4]
f(fn)
     Displays the next or previous feature, or feature (fn).

[<-]
     Returns the list of eliminated features to the screen.

III - Reorganizer Menu - <M Re>

Displays these options:

1 : Loading / Object Linkage

Loads one or more knowledge bases containing different objects, described using the same features, in order to merge them together.

XPER asks for confirmation of this command because the base already in memory will be lost.

2 : Loading / Feature Linkage

Loads one or more knowledge bases containing different features, described using the same objects, in order to merge them together. The title of the newly merged base is the same as the first knowledge base that was loaded.

You must also confirm this command.

3 : Saving

Saves the newly created base in memory.

4 : Reorganization

The knowledge base you want to reorganize must be in memory. You can then order features, attributes, and objects.

[<-]

Displays the XPER main menu. The disk drive must be connected and contain the XPER diskette.

The knowledge base is erased from memory when you use the [<-] command. The knowledge base MUST first be saved using the "Saving" option 3 before returning to the Main menu.

III-1 Loading / Objects - <Load>

Enter the names of one or more bases to be loaded. A "No base" message is displayed before a base has been loaded. Each base name can be up to 8 characters long and must not contain any punctuation marks.

Up to 10 knowledge bases can be loaded at the same time.

The loading occurs only when the "ld" command is entered and not when the base names are entered.

The objects are added when the bases are loaded. Each knowledge base must have the same features and attributes.

Available commands:

r(bn)=(bt)
   Revises knowledge base name (bn) with the new text (bt).

r(bn)=
   Displays the knowledge base name (bn) in order to modify it.

+(bt)
   Adds knowledge base (bt) to the end of the list.

-(bn)
   Deletes knowledge base number (bn).

ld

   Loads the different knowledge bases, merges them, and then displays the Reorganizer main menu.

[<-]
   Returns the Reorganizer main menu to the screen.

III-2 Loading / Features - <Load>

   Same procedure as for Loading / Objects - See III-1.

   Features are added while loading. Each knowledge base must have the same objects in order to merge their features.

III-3 Saving

   The disk drive must be connected to your computer and turned on. The diskette must be formatted and have enough room to store the knowledge base in memory. Enter the name you want to save the base under.

   <u>BEWARE!!</u>

   The knowledge base is not protected in memory while returning from the REORGANIZER to the main menu. Make sure to save a reorganized knowledge base before returning to the main menu.

III-4 Reorganizer - <Reor>

Displays the following options:

1 : Title and Parameters - See III-4.a.
Displays the parameters of the knowledge base and allows you to modify the title.

2 : Features - See III-4.b
Displays the list of features and allows you to modify their order. Also displays the attributes of each feature and allows you to arrange them in order.

3 : Objects - See III-4.c
Displays the list of objects and allows you to modify their order.

[<-]
Returns the Reorganizer main menu <M Re> to the screen.

III-4.a   Titles and Parameters - <T &P>

Displays the parameters of the knowledge base which are: the number of features, attributes, and objects, the maximum number for each, and the available memory. This command is useful when merging knowledge bases.

One character of text occupies one byte of memory. Because of XPER's memory management, the memory available varies during the use of a knowledge base. Therefore, it is advisable to keep about 300 bytes of free memory.

This option also displays the title of the knowledge base so you can change it if necessary.

Available commands:

=(title text)
Creates the knowledge base name.

=
Displays the title of the knowledge base. The title of the newly merged base is the title of the first knowledge base loaded.

[<-]
Displays the Reorganization menu <Reor>.

III-4.b Features - <Fea>

Lists the features so their order can be modified.

Available commands :

x(fn1)=(fn2)
Exchanges feature number (fn1) with feature number (fn2).

i(fn1)=(fn2)
Inserts feature (fn1) at the location of feature (fn2) and shifts the following features down, including (fn2).

a(fn) - See III-4.b 1
Displays the attributes of feature (fn) so their order can be modified.

ob
Displays the list of objects.

[<-]
Back to the Reorganization menu <Reor>

III-4.b 1 Attributes - <F at>

Displays the attributes of the chosen feature so their order can be changed.

Available commands :

x(an1)=(an2)
Exchanges attribute number (an1) with attribute number (an2).

i(an1)=(an2)
Inserts attribute (an1) in the location of attribute (an2) and shifts the following attributes down, including (an2).

[F3] [F4]
f(fn)
Displays the previous or next feature or feature (fn).

[<-]
Displays the list of features.

III-4.c Objects - <Obj.>

Displays the list of objects so that their order can be modified.

Available commands :

x(on1)=(on2)
Exchanges object number (on1) with object number (on2).

i(on1)=(on2)
Inserts object (on1) in the location of object (on2) and shifts the following objects down, including (on2).

fe
Displays the list of features.

[<-]
Displays the reorganizing menu - <Reor>.

IV Printer Menu - <M Pr>

Displays these options:

1 : Loading (See IV-1)

2 : Screen Editing
Displays a copy of what can be printed on paper. A knowledge base must first be loaded in memory. (See IV-2)

3 : Printer editing
Prints the contents of a knowledge base. A knowledge base must be in memory and a printer must be connected. (See IV-3)

4 : Output device modification
Modifies the output peripheral on which the knowledge base will be edited. (See IV-4)

5 : Printer width modification
Allows you to choose the number of characters per printed line. (See IV-5)

[<-]
Returns the main menu to the screen. The XPER program diskette must be in the disk drive when this option is requested.

IV-1 Loading

The disk drive must be connected and contain the diskette with the base to be loaded. Enter the name of the base and press [RETURN].

[<-]
Displays the Main menu of the Printer.

IV-2 Screen Editing - <Prin>

Edits all these options on the screen:

1 : List of features. See IV-2.a

2 : List of attributes.
Lists the features so you can choose which attributes will be displayed.

3 : List of objects. See IV-2.b

4 : Object Description.
Displays the list of objects so you can choose which description you want displayed.

5 : Frame.
Displays the whole knowledge base in its frame representation.

[<-]
Displays the Printer main menu.

No special commands.

During a screen display, the [RETURN] key slows the listing and [SPACE] key stops the display until pressed again.

IV-2.a Features - <P fe>

Displays the list of features so you can choose the attributes to be displayed/printed.

Available commands :

(fn)
   Chooses feature (fn) so that its attribute will be displayed/ printed.

af
   Displays/prints all attributes for all features.

[<-]
   Displays the Printing menu - <Prin>.

IV-2.b Objects - <P ob>

   Lists the objects so you can choose which description will be
   displayed/printed.

Available commands :

(on)
   Chooses object (on) so that its description will be displayed/ printed.

ao
   Displays/prints all descriptions for all objects.

[<-]
   Displays the Printing menu - <Prin>.

IV-3 Printer editing - <Prin>

Prints these options:

1 : List of features.   (See IV-2.a)

2 : List of attributes.
Lists the features in order to choose which list of attributes will be printed.

3 : List of objects.   (See IV-2.b)

4 : Description of objects.
Displays the list of objects in order to choose which description will be
printed.

5 : Frame.
Prints the knowledge base in its frame representation.

[<-]
Displays the Printer menu.

No special commands.

IV-4 Output device modification

You can specify which output device you wish to use.

Available command :

(n od)
Number of output device.

IV-5 Printer width modification

You can specify the number of characters per printed line. This parameter
has no effect on the screen display.

Available command :

(width)
Number of characters per printed line.

APPENDICES

XPER ORGANIZATION

OVERVIEW

Diagrams describing the tree structure and the linking of all functions of the system are listed here. Also included is an index to the REFERENCE and TUTORIAL sections of this manual for each menu option.

NOTE:

The menu/function options indicated with a "*" do not have a screen representation in the TUTORIAL.

The menus are indicated between square brackets <____>. The other modules are functions which do not have their own menu but are part of the system.

XPER GENERAL ORGANIZATION

```
                         ┌──────┐
                         │ XPER │
                         └──────┘
          ┌─────────────┬────┴────────┬─────────────┐
      ┌──────┐      ┌──────┐      ┌──────┐      ┌──────┐
      │ M Ed │      │ M In │      │ M Pr │      │ M Re │
      └──────┘      └──────┘      └──────┘      └──────┘
```
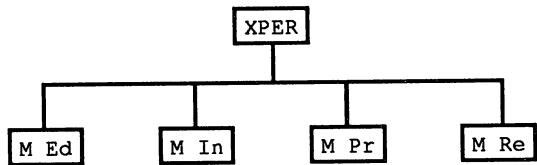
MENU	FUNCTION	REFERENCE	TUTORIAL
<M Ed>	Editor	R-5	Lessons 2,3,4,5,6
<M In>	Inquirer	R-25	Lessons 4,7
<M Pr>	Printer	R-40	Lessons 9
<M Re>	Reorganizer	R-34	Lessons 8

EDITOR GENERAL ORGANIZATION

```
                              ┌──────┐
                              │ M Ed │
                              └──────┘
        ┌───────────┬────────────┴──────────┬──────────┐
   ┌─────────┐  ┌─────────┐          ┌────────┐    ┌──────┐
   │ Load.   │  │ Save.   │          │ CorE   │    │ Init │
   └─────────┘  └─────────┘          └────────┘    └──────┘
                        ┌───────────────┼──────────────┐
                   ┌────────┐      ┌────────┐      ┌──────┐
                   │ Fea.   │──────│ Obj.   │      │ T &P │
                   └────────┘      └────────┘      └──────┘
              ┌───────┬────┴───┐   ┌────┴───┬──────┬─────────┐
          ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐
          │ F fc │ │ F sc │ │ F at │ │ O xF │ │ Dist │ │ C fe │─│ G ob │
          └──────┘ └──────┘ └──────┘ └──────┘ └──────┘ └──────┘ └──────┘
                                        │            │       │
                                    ┌──────┐     ┌──────┐ ┌──────┐
                                    │ O fa │     │ C at │ │ G ff │
                                    └──────┘     └──────┘ └──────┘
                                                             │
                                                         ┌──────┐
                                                         │ G fa │
                                                         └──────┘
```
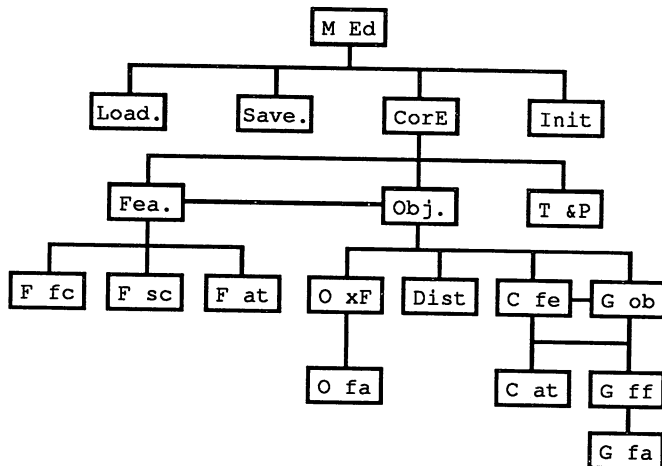
MENU	FUNCTION	REFERENCE	TUTORIAL	
\<C at\>	Comparison/Attributes	R-22	T-50	
\<C fe\>	Comparison/Features	R-20	T-49	
\<CorE\>	Consul/Revising	R-7	T-10	
\<Dist\>	Distances	R-19	T-46	
\<F at\>	Fea. - Attribute	R-13	T-16	
\<F fc\>	Fea. - Father connect.	R-11	T-43	
\<F sc\>	Fea. - Son connection	R-12	T-42	
\<Fea.\>	Features	R-9	T-13	
\<G ob\>	Groups - Objects	R-23	T-52	
\<G xA\>	Group - Frame - Att.	R-23	T-52	*
\<G xF\>	Group - Frame - FEa.	R-23	T-52	*
Init	Initial./Creation	R-6	T-10	
Load	Loading	R-6	T-30	
\<M Ed\>	Menu - Editor	R-5	T-9	
\<O xA\>	Object - Frame - Att.	R-17	T-24	
\<O xF\>	Object - Frame - Fea.	R-17	T-23	
\<Obj.\>	Objects	R-14	T-21	
Save	Saving	R-6	T-20	
\<T &P\>	Title - Parameter	R-8	T-11	

INQUIRER GENERAL ORGANIZATION

```
                    ┌──────┐
                    │ M In │
                    └──────┘
            ┌──────────┴──────────┐
        ┌───────┐             ┌──────┐
        │ Load. │             │ I rf │
        └───────┘             └──────┘
      ┌──────┬──────────┬──────────┐
  ┌──────┐┌──────┐  ┌──────┐  ┌──────┐
  │ I eo ├┤ I ro ├──┤ I ef │  │ I at │
  └──────┘└──────┘  └──────┘  └──────┘
      │                 │
  ┌──────┐┌──────┐  ┌──────┐
  │ I er ├┤ I dn │  │ I ea │
  └──────┘└──────┘  └──────┘
```
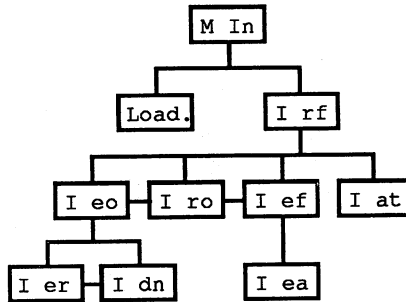
MENU	FUNCTION	REFERENCE	TUTORIAL
<I at>	List Attributes	R-29	T-32
<I dn>	Difference number	R-32	T-67
<I ea>	Exclusion attributes	R-32	T-64
<I ef>	Eliminated features	R-32	T-63
<I eo>	Eliminated objects	R-31	T-36
<I er>	Eliminated reason	R-31	T-36
<I rf>	Remaining features	R-26	T-31
<I ro>	Remaining objects	R-30	T-35
Load	Loading	R-25	T-30
<M In>	Menu - Inquirer	R-25	T-29

REORGANIZER GENERAL ORGANIZATION

```
                    ┌──────┐
                    │ M Re │
                    └──┬───┘
         ┌─────────────┼─────────────┐
     ┌───┴──┐      ┌───┴──┐      ┌────┴──┐
     │ Load │      │ Reor │      │ Save. │
     └──────┘      └───┬──┘      └───────┘
            ┌──────────┼──────────┐
        ┌───┴──┐   ┌───┴─┐    ┌───┴──┐
        │ T &P │   │ Fea.├────┤ Obj. │
        └──────┘   └───┬─┘    └──────┘
                   ┌───┴──┐
                   │ F at │
                   └──────┘
```
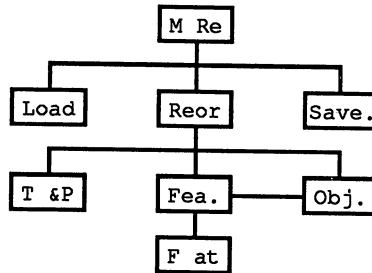
MENU	FUNCTION	REFERENCE	TUTORIAL	
<F at>	Attributes	R-38	T-75	★
<Fea.>	Features	R-38	T-75	★
<Load>	Loading	R-35	T-71	
<M Re>	Menu Reorganizer	R-34	T-70	
<Obj.>	Objects	R-39	T-74	
<Reor>	Reorganization	R-36	T-73	
Save	Saving	R-36	T-75	★
<T &P>	Title & Paramaters	R-37	T-77	

PRINTER GENERAL ORGANIZATION

```
                 ┌──────┐
                 │ M Pr │
                 └──┬───┘
          ┌─────────┴─────────┐
      ┌───┴───┐           ┌───┴──┐
      │ Load. │           │ Prin │
      └───────┘           └───┬──┘
       ┌──────┬─────────┬─────┼──────┬────────┐
   ┌───┴──┐┌──┴───┐ ┌───┴──┐ ┌┴─────┐ ┌──┴───┐
   │ P fe ││ P at │ │ P ob │ │ P od │ │ P fr │
   └──────┘└──────┘ └──────┘ └──────┘ └──────┘
```
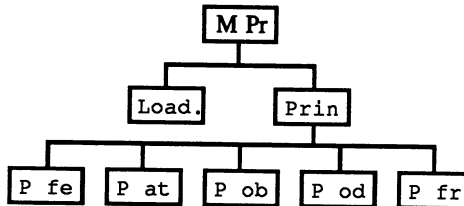
MENU	FUNCTION	REFERENCE	TUTORIAL	
Load	Loading	R-40	T-78	★
<M Pr>	Menu - Printer	R-40	T-78	
P at	Print attributes	R-43	T-79	★
<P fe>	Print features	R-42	T-79	★
P fr	Print frame	R-43	T-80	
<P ob>	Print objects	R-42	T-79	★
P od	Print object descr.	R-43	T-79	★
<Prin>	Printing	R-41	T-79	

COMMAND SUMMARY

COMMAND	FUNCTION	MENU	REF.
:!	:Back to previous question	:<I ro><I rf>	:24 27:
:( )	:Displays prev./next page	:	: 4 :
:< >	:Displays prev./next feature	:	: 4 :
:[ ]	:Displays prev./next object	:	: 4 :
:@ *	:Displays prev./next group	:	: 4 :
:(an)/	:Choice attribute number	:<I at>	:26 :
:(fn)	:Access attributes / feature	:<I ef>	:29 :
:(fn)	:Choice feature number	:<G xF><C fe>	:15 19:
:	:	:<P fe><O xF>	:21 37:
:(fn)/	:Choice feature inquirer	:<I rf>	:23 :
:(on)	:Object # for printing	:<P fe>	:37 :
:(on)	:Elimination reason-object	:<I eo>	:27 :
:(on)	:Back to menu <I er>	:<I dn>	:28 :
:+(an)/	:Adds exclusion attributes	:<F fc>	:10 :
:+(an)/	:Adds attributes for object	:<O xA><G xA>	:16 22:
:+(at)	:Adds attribute text (name)	:<F at>	:12 :
:+(bt)	:Adds knowledge base text	:<Load>	:31 :
:+(ft)	:Adds feature text (name)	:<Fea.>	: 8 :
:+(ot)	:Adds object text (name)	:<Obj.>	:13 :
:-(an)	:Deletes attribute number	:<F at>	:12 :
:-(an)/	:Deletes exclusion attr. #	:<F fc>	:10 :
:-(an)/	:Deletes attributes 1 obj.	:<G xA><O xA>	:16 22:
:-(bn)	:Deletes knowledge base num.	:<Load>	:32 :
:-(fn)	:Deletes feature number	:<Fea.>	: 8 :
:-(on)	:Deletes object number	:<Obj.>	:13 :
:-?	:Deletes all exclu. attr.	:<F fc>	:10 :
:;	:Command separator	:	: 2 :
:=	:Display k. base title	:<T &P>	: 8 33:
:=(an)/	:Creates exclusion attribute	:<F fc>	:10 :
:=(an)/	:Describes object attribute	:<G xA><O xA>	:16 22:
:=(title)	:Creates k. base name	:<T &P>	: 8 33:
:=0	:Deletes all exclu. attr.	:<F fc>	:10 :
:=0	:All attributes impossible	:<G xA><O xA>	:16 22:
:=?	:All attributes exclusion	:<F fc>	:10 :
:=?	:All attributes possible	:<G xA><O xA>	:16 22:
:? ?? ???	:Displays last commands	:	: 2 :
:[ESC]	:Back to previous menu	:	: 2 :
:a+	:Enables EAD mode	:<I rf>	:24 :
:a+(an)/	:Adds attributes all objects	:<G xA><O xA>	:16 22:
:a-	:Disables EAD mode	:<I rf>	:24 :

COMMAND	FUNCTION	MENU	REF.
:a-(an)/	:Deletes attrib. all objects	:<G xA><O xA>	:16 22:
:a=(an)/	:Describes attr. all objects	:<G xA><O xA>	:16 22:
:a(fn)	:Displays feature attributes	:<Fea.>& reor	:10 34:
:af	:All features	:<I rf><P fe>	:25 37:
:and	:Displays AND comparison	:<C at><C fe>	:19 19:
:ao	:Prints all objects	:<P fe>	:37 :
:cf(fn)	:Connects father feature	:<Fea.>	: 8 :
:cp	:Compares groups 1 and 2	:<Obj.>	:13 :
:cs(fn)	:Connects son feature	:<Fea.>	: 8 :
:d(on)	:Distance to object number	:<Obj.>	:13 :
:df	:Deletes feature fatherhood	:<F fc>	:12 :
:di	:Difference number	:<I eo>	:27 :
:ef	:Eliminates all features	:<Fea.>	:10 :
:ef	:Displays elimin. features	:<I rf><I ro>	:25 27:
:eg	:Erases groups 1 and 2	:<Obj.>	:13 :
:eo	:Displays eliminated objects	:<I rf><I ro>	:24 27:
:eo	:Eliminates all objects	:<Obj.>	:13 :
:f+	:Enables NDFD mode	:<I rf>	:25 :
:f-	:Disables NDFD mode	:<I rf>	:25 :
:f(fn)	:Changes feature pages	:	: 4 :
:fe	:Gets to feature menu	:<Obj.>& reor	:13 35:
:g(gn)+(on)/	:Adds objects (on) to group	:<Obj.>	:13 :
:g(gn)=(on)/	:Creates group with objects	:<Obj.>	:13 :
:g(gn)o(on)	:Adds object-like to group	:<Obj.>	:14 :
:g(ng1)>(ng2)	:Adds group 1 to group 2	:<Obj.>	:13 :
:h	:Displays HELP page	:	: 3 :
:i(an1)=(an2)	:Inserts attribute	:<F at> Reor.	:34 :
:i(fn1)=(fn2)	:Inserts feature	:<Fea.> Reor.	:34 :
:i(on1)=(on2)	:Inserts object	:<Obj.> Reor.	:35 :
:l(gn)	:Lists group	:	: 4 :
:ld	:Loads knowledge bases	:<Load>	:31 :
:ne	:Next	:<I eo>	:27 :
:o(on)	:Changes object page	:	: 4 :
:ob	:Gets to object menu	:<Fea.>& reor	:10 34:
:or	:Displays OR comparison	:<C at><C fe>	:19 19:
:p(pn)	:Changes screen-page	:	: 4 :
:q(qn)	:Back to question number	:<I ro><I rf>	:24 27:
:r(an)=	:Displays attribute text	:<F at>	:12 :
:r(an)=(at)	:Revises attribute text	:<F at>	:12 :
:r(bn)=	:Displays k. base name	:<Load>	:31 :
:r(bn)=(bt)	:Revises knowledge base text	:<Load>	:31 :
:r(fn)=	:Displays feature text	:<Fea.>	: 8 :

COMMAND	FUNCTION	MENU	REF.
:r(fn)=(ft)	:Revises feature text	:<Fea.>	: 8 :
:r(on)=	:Displays object text	:<Obj.>	:13 :
:r(on)=(ot)	:Revises object text	:<Obj.>	:13 :
:rg	:Deletes all objects/group	:<G ob>	:20 :
:ro	:Displays remaining objects	:<I rf>	:23 :
:sa	:Starts again inquiry	:<I ro><I rf>	:33 27:
:t+	:Enables TRACE mode	:<I rf>	:25 :
:t-	:Disables TRACE mode	:<I rf>	:25 :
:t(an)=(at)	:Creates twin attribute	:<F at>	:12 :
:t(fn)=(ft)	:Creates twin feature	:<Fea.>	: 8 :
:t(on)=(ot)	:Creates twin object	:<Obj.>	:13 :
:x(an1)=(an2)	:Exchanges attribute numbers	:<F at> Reor.	:34 :
:x(fn1)=(fn2)	:Exchanges feature numbers	:<Fea.> Reor.	:34 :
:x(on)	:Frame for object number	:<G ob><Obj.>	:13 20:
:x(on1)=(on2)	:Exchanges object numbers	:<Obj.> Reor.	:35 :
:z(on)	:Order feature for object #	:<I ro>	:27 :

INDEX

XPER KNOWLEDGE BASE SOFTWARE

Knowledge Base Software

XPER is the first *"expert system"* for the C-128 and C-64. While ordinary data base systems are good for reproducing facts, **XPER** can derive knowledge from a mountain of facts and help you make expert decisions.

With **XPER** you first build the information into your knowledge base using simple entry procedures. Later, using its efficient searching techniques, **XPER** can easily guide you through the most complex decision making criteria.

XPER is currently used to assist in tree identification, animal classification, poison control and automobile diagnosis.

Includes full reporting and data maintenance capabilities.

For Commodore 128/64 and 1541/1571 disk drive. Printer optional.