

## DEVELOPING MATERIALS FOR COMPUTER SCIENCE

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### OBJECTIVE:

The main objective of this paper is to describe the process involved in the design of materials for our Computer Science Course at the Universidade Federal de Pernambuco on the basis of our ESP experience, and of our students' achievement in reading according to their needs and interests.

### BACKGROUND:

Our experience in teaching ESP for Computer Science started in 1977, but rigorously speaking we did not teach ESP from 1977 to 1979. What actually took place was students' exposure to short texts, while the main pedagogical concern was the teaching of grammar. In 1979 the National ESP project had started and we attended the first national seminar held at PUC-SP. By that time we were eager to find someone else who could possibly be interested in the same kind of activity we were. Although we profited a great deal from the two-week intensive seminar, to our disappointment the participants had completely different objectives from ours. The groups were divided and we had in charge of the production of materials to be used in the Engineering courses at the Universidades Federais. From that time on we continued teaching Computer Science along with other ESP courses centered on Engineering, Architecture, Education, Economics and Business Administration. The experience of applying reading strategies to different sorts of materials at the same time to several ESP courses every other semester, enabled us to perceive that while the students in the different areas of study were more

concerned about general aspects of the texts, the computer science students were much more interested in and motivated by detailed and specific information, and they felt like analysing every aspect of the subject matter presented in the texts. They also tried to learn the computer terminology found in the texts very carefully so as to improve the specific vocabulary which would meet their needs.

The "Departamento de Informática" in complying with students' requests has changed the curriculum of the course and added 120 hours to our ESP course which will last 2 semesters instead of only 45 hours in one semester. Since the new curriculum will start in the first semester of 1984, the course content presented in this paper will be replaced by the new one.

ON OUR ESP STUDENTS IN COMPUTER SCIENCE FROM 1977 to 1983:

1. Number of students in class per semester:
  - 1.1. - 40 students from Computer Science. It is a compulsory course.
  - 1.2. - 10 to 15 students from different areas of study that need some background in English to read textbooks or manuals to operate computer machines. This implies students from the areas of Civil, Electronic, Mechanical, Cartographical Engineering; Chemistry ; Mathematics; Statistics. They attend our ESP course as an optional one.
  - 1.3. - Auditors enrolled in the post-graduate program in Computer Science.
2. Students' behaviour:
  - They are highly motivated during the whole course. They also ask for extra ESP textbooks to practice at home
3. - Students' background in English:
  - 50% of the class has had some previous knowledge of the English language through private English language courses and 50% has nothing but a high school English type of background.

## DEFINING PROBLEMS AND NEEDS FOR PREPARING MATERIALS:

We felt that the solution to our problem in writing new materials could not be arrived at single-handedly. We started working with a large number of questions. To find answers to our questions we considered the following factors:

1. Our own teaching experience and professional background.
2. Attendance at some courses in the area of study, such as Introduction to Computer Science, Computer Language Programmes (FORTRAN, BASIC, etc).
3. Administration of a questionnaire to students
4. Interviews with subject teachers.
5. The students' classroom environment.

## QUESTIONNAIRE TO STUDENTS:

The questionnaire was divided into two parts:

1. General information
2. Questions centered on the following aspects:
  - 2.1. What was their previous experience of learning English like?
  - 2.2. What was their attitude to English?
  - 2.3. How were they motivated?
  - 2.4. If they studied English, what language and reading skills did they need?
  - 2.5. What did they want?
  - 2.6. What notion did they have of learning in a university setting?

## INTERVIEWS WITH SUBJECT TEACHERS:

Subject teachers are those in the field of computer science. Practically, a short interview was processed based on these questions:

1. How did they (as teachers of science) perceive students' problems and needs in using English textbooks?
2. To what extent did they require their students to read English?
3. What kind of skills and strategies would their students need in order to fulfill learning tasks which required reading at the beginning of the "Curso de Informática"?

### SOME FINDINGS:

Students informed us in questionnaires that they considered reading in English important to their studies, but difficult. Their motivation was high. They suggested that a great percentage of the content of their reading should be related to the subject they were studying. On the other hand, the subject teachers tend to think that students had both linguistic and conceptual problems in reading.

Based on the results of the five elements previously established to define the problems and learners' needs, our next step now is describing the course design and presenting the course content.

### THE ESP COURSE:

#### Aspects considered:

1. The course is compulsory.
2. Schedule: 3 hours per week covering 45 hours in a semester for 3 credits.
3. Aims of the ESP course:
  - A. Helping students to understand the ways in which writers of academic texts use English to relate ideas, and to use this knowledge to perceive, predict and infer such relationships.
  - B. Helping students to use linguistic knowledge in the application of selected skills and strategies to reading for a purpose.
  - C. Helping students to acquire, master and use some special technical terms.

### COURSE DESIGN:

The students have to develop their linguistic sophistication as they apply their knowledge and reading skills to a variety of reading activities. Based on this criteria, we seriously considered the selection of texts and contents thereof.

## TEXTS:

Texts are authentic and chosen from university textbooks and specialized magazines taken from the Computer Science library.

## CRITERIA FOR TEXT SELECTION:

1. Texts reflect the students' expressed interests and concerns, their subjects and matters that affect them in the "Curso de Informática".
2. Texts relevant and accessible to the students in all disciplines of Computer Science.
3. Text appeal to students.

Grading was performed on the basis of the conceptual proximity of the content to the students' prior knowledge and experience.

## CONTENTS:

To satisfy again the requirements of the students' knowledge and experience, the course content was prepared following the same sequence of topics of the Introduction to Computer Science Course, which is given simultaneously with the ESP course. This finding facilitates the reading comprehension of the text.

The content was divided into four units:

### UNIT I - INTRODUCTION

Text 1 - Reading as a process

Text 2 - How to read a text in English

Text 3 - Computer Science - An Introduction

Text 4 - The Computer and the Human Brain - Similarities and Differences.

The first two texts introduce the students to the reading strategies and focus them on the reading process involved on texts. The last two texts introduce the scientific and historical aspects of the computer area of study.

## UNIT II - THE COMPUTER ORGANIZATION

This unit consists of 6 texts:

Text 5 - What is a Computer?

Text 6 - A Computer System

Text 7 - Basic Elements in a Computer Data Processing System

Text 8 - Input/Output Devices

Text 9 - Control of I/O Devices by the Operating System.

Additional Text: A Survey of the Literature of Cluster Analysis  
(How Cluster Analysis is used in the Computer field of study).

## UNIT III - ALGORITHMS DESIGN AND FLOWCHARTS

Text 10 - Algorithms (introduction)

Text 11 - Types of Algorithms

Text 12 - Flowcharts

Text 13 - More about Flowcharts.

## UNIT IV - TYPES OF COMPUTERS

Text 14 - Analogue Computers

Text 15 - Digital Computers I

Text 16 - Digital Computers II

Text 17 - The Binary System I

Text 18 - The Binary System II

Additional Texts used in this unit:

- Microcomputers

- Computer Advertisement.

### EXTRA ACTIVITIES:

1. Visiting the University Computational Center by arrangement with the ESP and Introduction to Computer Science teachers.
2. A report of the visit
3. Translation of one text chosen by the students according to their needs.
4. An extra activity is also included before text 17, which covers some exercises and special vocabulary used to solve addition, subtraction, multiplication and division problems in English.

A SAMPLE OF THE CONTENT:

Three texts are include in this sample from Unit III. Each unit of the content has a sequence and the texts are interrelated with each other in some aspect.

The text chosen are:

- Text 5 - What is a Computer?
- Text 6 - A Computer System
- Text 7 - Basic Elements in a Computer Data Processing System.

GENERAL AIMS OF UNIT II:

Text were selected in accordance with the aims established for this unit:

1. To introduce students to the terminological language of Computer Science.
2. To help students use the vocabulary and specialised terminology through practice activities within a contextual frame of reference.
3. To help students use language clues to discover the order of information in a text.
4. To enable students to pick out relevant information through close reading of the text in separated sections.
5. To give students practice in using key words and expressions to understand the overall meaning of a text.
6. To get students to study the connection between texts and diagrams and how diagrams can be a help in interpreting text.

WHAT IS A COMPUTER ?

1           A computer is an electronic computational  
device or machine having internal storage, a stored  
program of instructions, and the capability for  
modification of the set of instructions during the  
5 execution of the program. In other words, its system  
reads, records and processes data according to a series  
of instructions. Data are pieces or items of  
information that have been properly prepared so that  
the machine can work with them. Processing means  
10 handling or manipulating the material that has been  
presented to the machine in such ways as performing  
calculations, classifying information, or making  
comparisons. A computer is made of millions of  
electronic devices that can store the data or switch  
15 them through complex circuits with different functions.  
The basic task of a computer consists of counting and  
calculating at incredible speed. It performs four  
basic operations:

1. input
- 20           2. storage
3. processing
4. output



The input, the processing, and the output are determined by a human agent. This person is called  
25 the PROGRAMMER. His job is to determine what information is needed and what operations the computer must perform in order to solve a problem. He determines how the information is to be processed in order to obtain the desired result.

30 To show how the system works, let us think of a student's assessment marks. His marks resulting from exercises and tests would be the INPUT; the teacher's register, in which information about the student is kept, would be the STORAGE; the teacher  
35 himself would be the CENTRAL PROCESSING UNIT (C.P.U.) because he calculates the student's final marks; the student's final marks would be the OUTPUT because they show the student's performance during the school year.

The tasks can be viewed as PROGRAMS. A  
40 program is a step-by-step description of the task to be performed. The computer must be told, in detail, where to find information, how to arrange it, which calculations to do, how to come to a final conclusion, and what to do with it. Data processing then, is simply  
45 the manipulating and using of facts.

1. Special Terms

Os termos abaixo serão encontrados no texto. Estude-os:

- DATA - dados
- TO PROGRAM - programar
- DEVICE - dispositivo
- PROGRAMMER - programador
- INPUT - entrada
- PROGRAMMING - programação
- OUTPUT - saída
- PROGRAMMED - (part.passado)  
programado
- TO PERFORM - executar,
- STORED - (part.passado) ar-  
fazer mazenado
- PROCESSING - processa\_
- TO STORE - armazenar  
mento
- PROGRAM - programa
- STORAGE - memória

2. Leia o texto com atenção e sublinhe as palavras acima mencionadas:

3. Após a leitura, procure dar em português o equivalente das seguintes expressões:

- DATA PROCESSING : \_\_\_\_\_
- CENTRAL PROCESSING UNIT (CPU) : \_\_\_\_\_
- INPUT AND OUTPUT DEVICES (I/O DEVICES) : \_\_\_\_\_
- DATA PROCESSING SYSTEM : \_\_\_\_\_

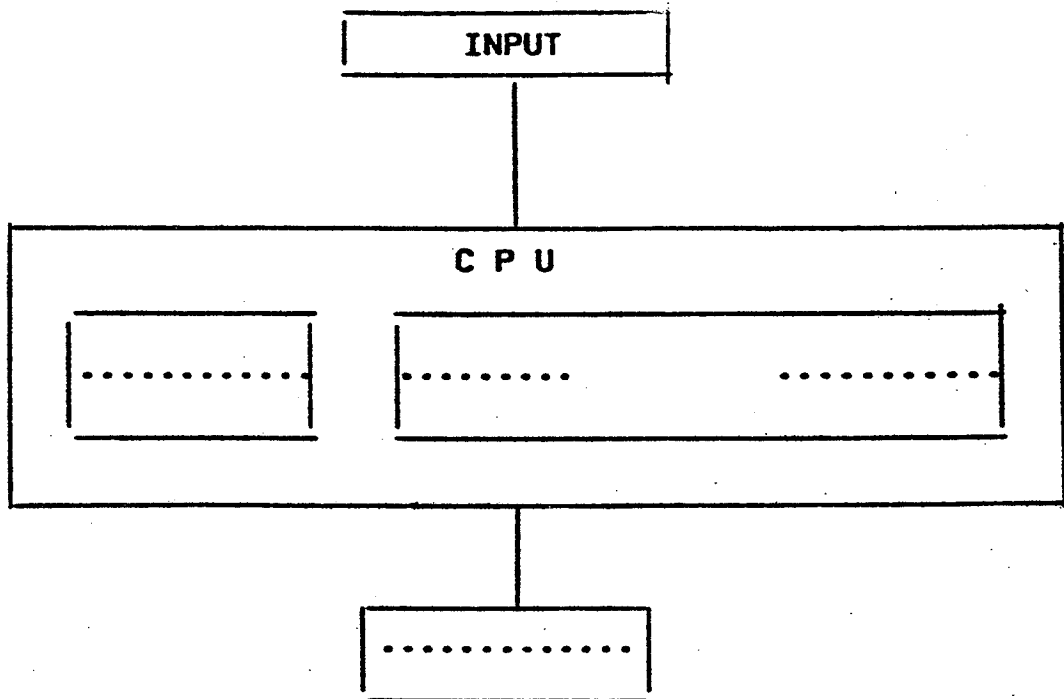
4. Match the words on the left with the statements on the right.

- |                 |     |   |
|-----------------|-----|---|
| 1. DATA         | ___ | unidade de um computador constituindo dos circuitos que controlam a interpretação e execução das instruções.                                    |
| 2. INPUT DEVICE | ___ | pessoa que projeta, escreve e testa programas.  |
| 3. PROGRAM      | ___ | resultado ou informação transmitida para um dispositivo de saída.   |
| 4. PROCESS      | ___ | elementos básicos que são fornecidos, produzidos ou processados pelo computador.  |
| 5. INPUT        | ___ | sinônimo de memória, dispositivo no qual os dados podem entrar, serem recuperados.  |
| 6. CPU          | ___ | conjunto de instruções em determinada seqüência, destinado a resolver um problema específico e apresentado ao computador em uma dada linguagem. |
| 7. STORAGE      | ___ | seqüência sistemática de operações para produzir um resultado específico.   |
| 8. OUTPUT       | ___ | dispositivo usado para trazer dados a serem processados para dentro da unidade central de processamento de dados.                               |
| 9. PROGRAMMER   | ___ | meio externo para a memória interna do computador.  |

5. Observe a definição sobre CPU:

The CPU is the main part of the system because it contains the central memory, the logic and arithmetic units and the control unit.

6. Como você preencheria o diagrama abaixo tendo como base esta definição ?

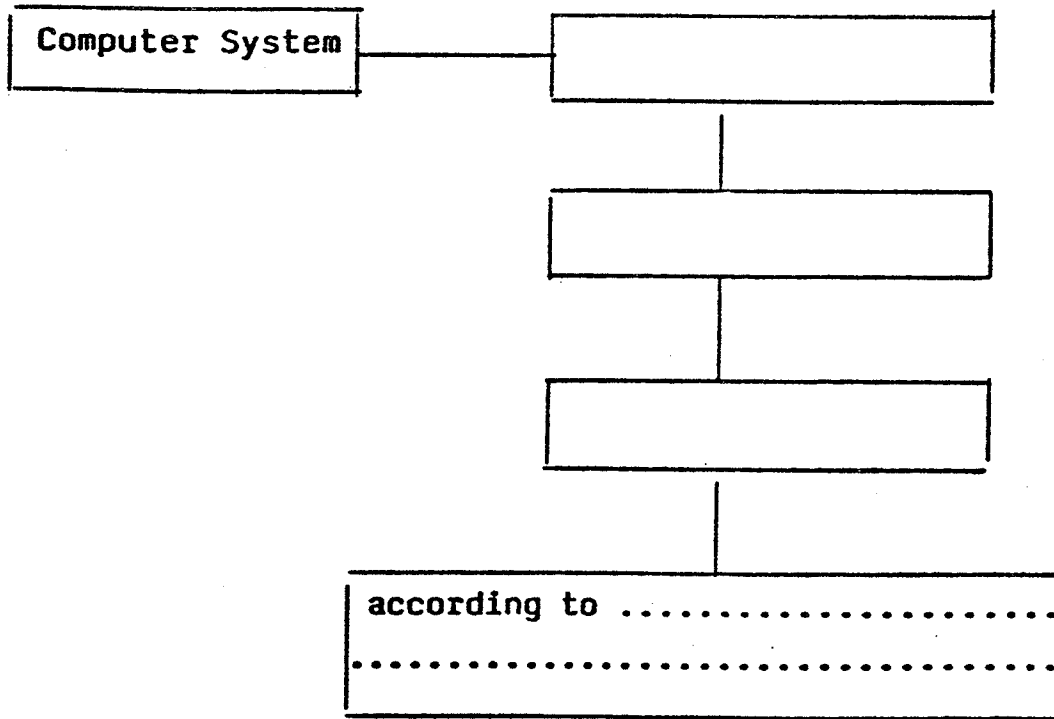


7. Complete the passage inserting the words PROGRAM, TO PROGRAM, PROGRAMMER, PROGRAMMED and PROGRAMMING

\_\_\_\_\_ is a step-by-step plan consisting of a sequence of instructions to the computer that is used to solve a specific problem. The person who prepares the step-by-step plan is a \_\_\_\_\_. The verb form \_\_\_\_\_ data also occurs frequently, and so do the noun \_\_\_\_\_ and the adjective \_\_\_\_\_ that are derived from the verb.

8. Leia mais uma vez o texto para sua melhor compreensão e em seguida responda a pergunta abaixo preenchendo o gráfico.

What does the computer system do ?



9. Leia o terceiro parágrafo e associe em seguida as operações aos exemplos correspondentes:

- |               |     |               |
|---------------|-----|---------------|
| 1. storage    | ( ) | the teacher   |
| 2. processing | ( ) | marks         |
| 3. output     | ( ) | the registers |
| 4. input      | ( ) | final marks.  |

10. Are these statements TRUE (T) or FALSE (F) according to the text?

- A. Computers process large amount of data slowly. ( )
- B. The task of a computer consists not only on counting but in calculating as well. ( )
- C. The task can be viewed as input. ( )
- D. The computer performs five basic operations. ( )

11. Now justify the FALSE answers:

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12. What do these words refer to ?

- a. ITS system reads (line 4)
- a. system
  - b. computer
  - c. internal storage
  - d. set of instructions
- b. ... the machine can work with THEM. (line 6)
- a. pieces
  - b. items of information
  - c. data
  - d. machine
- c. ... switch THEM through complex circuits (line 10)
- a. electronic devices
  - b. functions
  - c. data
- d. ... how to arrange IT (line 31)
- a. information
  - b. calculation
  - c. final conclusion.

13. Read the text again and complete the following sentences.

1. A computer is an electronic .....
2. The basic task of a computer consists of .....  
..... and ..... in a great .....  
.....
3. Data are ..... of information.
4. ....manipulates the material

- presented to the ..... in such ways as
- A. ....
  - B. ....
  - C. ....

14. Read the last paragraph and answer this question:

- What do we have to tell a computer?
- A. We have to tell a computer to find information.
- B. ....
- C. ....
- D. ....
- E. ....

TEXT N<sup>o</sup> 6

A COMPUTER SYSTEM

The term COMPUTER is generally applied to a collection of devices that together are technically known as a computer system.

A computer system consists of a number of inter-connected systems. The basic units of a computer system are INPUT UNIT, such as the card reader; OUTPUT UNIT, such as a printer; and a unit for processing information, which we call the CENTRAL PROCESSING UNIT, or CPU for short.

An input unit or device converts information into electronic pulses and passes the program and the data into the CPU. The heart of the computer is the CPU and it performs the necessary calculations and controls the input and output units. The Central Processing Unit is divided into 3 parts. The MEMORY UNIT stores the data and the

program. The CONTROL UNIT selects data and instructions from the memory unit, interprets them and controls the calculations. The ARITHMETIC UNIT adds, subtracts and compares data.

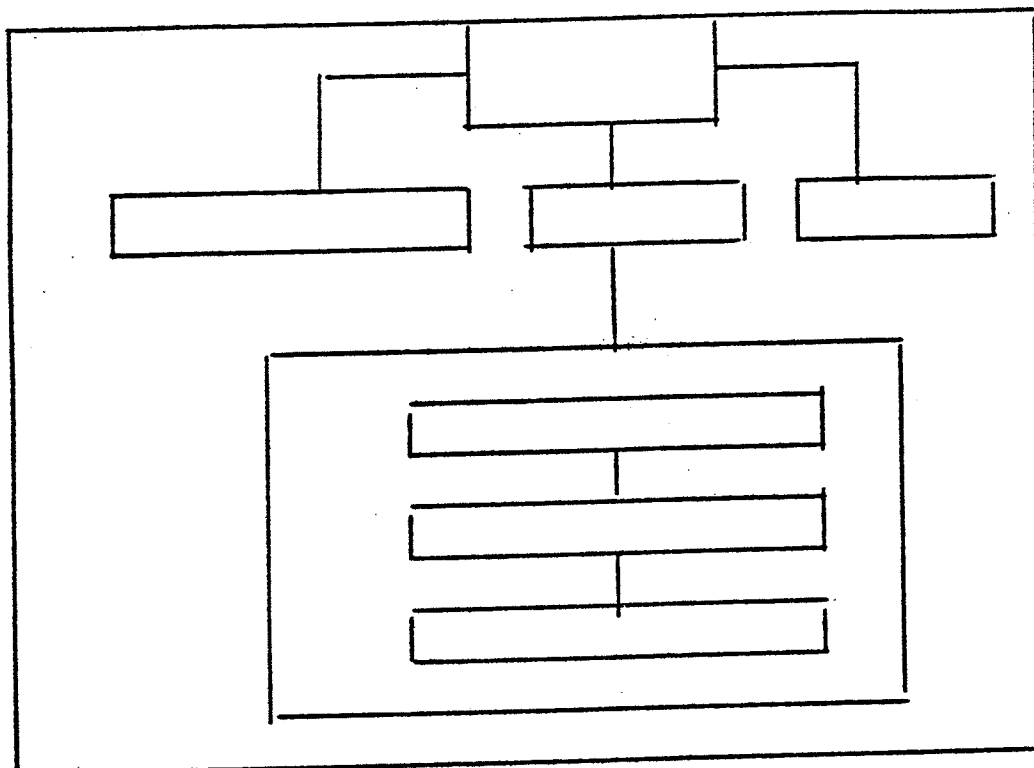
The OUTPUT UNIT or device converts electronic pulses back into information and presents the information to the user.

TEXT O Nº 6

### A COMPUTER SYSTEM

#### ROTEIRO PARA LEITURA DO TEXTO E EXERCÍCIOS

1. Read the text about computer system and complete the diagram.





2. Use information from the text to complet the next diagram:

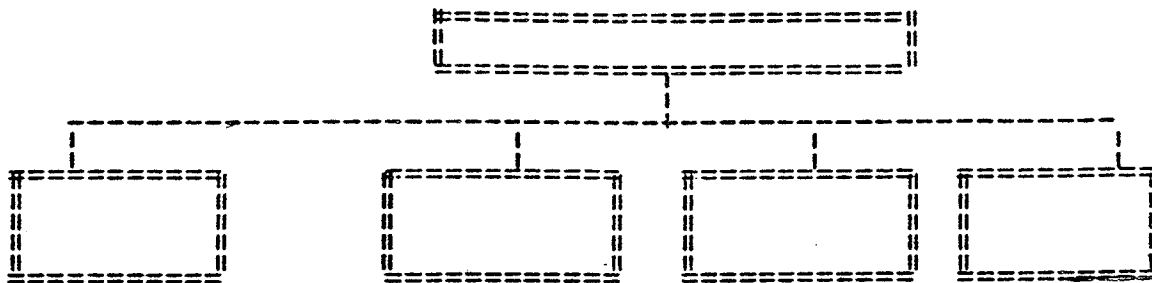
SUBSYSTEM/UNIT	F U N C T I O N
Input Device	1. converts 2.
	1. 2.
Memory Unit	Stores
	1. selects 2.
Arithmetic unit	
	1. 2.

3. Read the following text about the CONTROL UNIT

Then answer the question below completing the diagram.

The CONTROL UNIT conducts and arranges the operations required by instructions. It controls the order in which instructions are obeyed. It also controls the peripherals and performs the read-and-write instructions issued by a program.

QUESTION: What does a control unit do ?



4. Complete the following sentences inserting these expressions in the boxes on the left.

CPU

ARITHMETIC UNIT

CONTROL UNIT

MEMORY UNIT

1.  - The ..... is able to perform arithmetical and simple logical processes.
2.  - ..... does the arithmetic operations comparisons, etc. to process data.
3.  - ..... is a type of file of ready access. This unit holds a vast amount of data and instructions for processing.
4.  - The ..... has been designed by the manufacturer to control and carry out instructions to that particular computer.
5.  .....holds the instructions to be executed and the data to be used
6.  ..... directs the arithmetic unit and keeps the entire system operating as directed by the instructions.



## BASIC ELEMENTS IN A COMPUTER DATA PROCESSING SYSTEM

There are five basic elements in a computer data processing system. These are the hardware, the software, the programs, the procedures, and the personnel.

The Hardware for computer data processing involves equipment which can perform the following functions; data preparation; input to the computer; computation; control; primary storage; secondary storage; and output from the computer.

The Software consists of programs and routines whose purpose is to facilitate the use of the computer by the user installations. Software extends the capabilities of the computer and is therefore as critical to effective use of a computer as the hardware.

A Program consists of a set of instructions for performing a data processing task. A complete data processing job usually requires a number of programs. It is necessary for the user to write most of the programs needed to meet his own processing requirements.

The operations of a data processing system requires PROCEDURES for use in obtaining and preparing data, for operating the computer, and for distributing the output from computer processing. These procedures include control steps such as actions to be taken in the event there are errors in the data or there is a malfunctioning of the equipment. (From "Data Processing Terminology Course" book. C.C.A.A.)

BASIC ELEMENTS IN A COMPUTER DATA  
PROCESSING SYSTEM ROTEIRO PARA LEITURA  
E EXERCÍCIOS

1. Read the text.
2. If the statement is TRUE mark A. If the statement is FALSE mark B.
  01. (     ) An equipment to prepare data is an element of hardware
  02. (     ) The user needs to write all the programs needed to meet his requirements.
  03. (     ) A control step is an action to be taken in the event there are errors in the equipment.
  04. (     ) Sets of instructions for performing data processing tasks are one basic element of a computer.
  05. (     ) Software is the main element of a computer data processing system because it extends the capability of hardware.
  06. (     ) To obtain and prepare data; to operate the computer; and to distribute the output from computer processing are 4 functions performed by hardware.
  07. (     ) To facilitate the use of the computer by the user installation routines and procedures are used.
  08. (     ) Hardware is used to prepare and store data.
  09. (     ) It is always necessary a number or programs for a complete data processing job.



### CONCLUDING REMARKS:

To ensure maximum flexibility and provide valid criteria for the measurement of success we give students a clear statement of the aims of each unit and the objectives of each text. We are also concerned with the students' ability to understand and use features of discourse coherence in order to create, predict, confirm discourse, but our foremost concern is the knowledge of features of textual cohesion which enable the students to build and retrieve the information structure of the text.

### CONCLUSION:

This paper is a description of an attempt at developing materials for a Computer Science Course. Indeed, it was just a point of departure for gaining useful insights into the design of a future project as a whole. In fact, we have succeeded in some aspects and failed in others, but we believe that the course design for our materials is basically appropriate to the level of competence of the students for whom the materials were written.