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N01/650/S(2)A

COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Thursday 15 November 2001 (morning)

1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.

1. Some programming languages define arrays as starting at position zero rather than position one. Consider the following array `MONTHS`:

Position	MONTHS
[0]	January
[1]	February
[2]	March
:	:
[11]	December

The following algorithm is meant to take a month as a parameter and convert it from its text description to the correct month number; for example, if the parameter is the string `"February"` the function should return the integer value 2. (You may assume that any string passed to `MONTHNUMBER` is a valid entry in the array `MONTHS`.)

```
function MONTHNUMBER(val SMONTH string)
   result integer
   /*SMONTH is a pass-by-value parameter*/

   declare P integer

   P <-- 0
   while SMONTH # MONTHS[P] and P<11 do
      P <-- P + 1
   enddo

   return P
endfunction MONTHNUMBER
```

(a) Copy and complete the trace table below for the call `MONTHNUMBER("March")`.

SMONTH	P	MONTHS[P]	SMONTH # MONTHS[P]
"March"	0	"January"	true
:	:	:	:

[4 marks]

(b) Explain how the algorithm should be changed to give the correct return. *[2 marks]*

(This question continues on the following page)

(Question 1 continued)

(c) A new array, DAYS, is set up as follows:

Position	DAYS
[1]	31
[2]	28
[3]	31
:	:
[12]	31

The number of days in January is stored in position 1, the number of days in February is stored in position 2 and so on.

Construct the algorithm for the function TOTAL which has parameters of a month and a day in that month. It will return the number of days since the start of the year. For example, **output** TOTAL("March",10), would display 69.

(If the month is **not** valid **or** the day is **greater than** the corresponding value in the DAYS array, the return value should be -1. Examples of invalid parameters are ("Jobble",10) and ("February",30). You may use the function MONTHNUMBER assuming it has been corrected as answered in part (b).)

[12 marks]

(d) Using either a Bubble Sort or a Selection Sort, construct an algorithm which will sort the array MONTHS into alphabetical order. *[12 marks]*

This question requires the use of the Case Study.

2. (a) State **one** advantage and **one** disadvantage of the data input at collection sites, such as barometer and thermometer readings, being automated. *[2 marks]*

(b) Describe **two** error-checking methods that could be used when data is transmitted from the local data collection site to the National Weather Service (NWS) headquarters. *[4 marks]*

(c) Describe METAR format and explain how it is converted by the local television stations into a weather forecast. *[3 marks]*

(d) Compare the use of 6250 bpi tapes with robotics high-density storage system in the storage and retrieval of archived data. *[6 marks]*

(e) State **two** uses of archived data and discuss their effect on society. *[6 marks]*

(f) Identify **two** factors that could cause a super computer to give a false weather forecast and suggest how the risk of this happening could be reduced. *[4 marks]*

3. A local television weather station (similar to those described in the case study) has added some weather recording instruments to increase the accuracy of its weather forecasts. These inputs are added to the rest of the input data from the private data vendors for the station's computer to process. The output from the system will be used directly by the station's television weather presenters.

(a) (i) Define the term *single-task process*. *[1 mark]*

(ii) Identify a *single-task process* in the above situation. *[1 mark]*

(b) Describe **two** possible output formats (and the devices required) for the presenters to use. *[4 marks]*

(c) Draw the systems flowchart for the situation described. *[6 marks]*

The employees of the local television station also use the computer system for several administrative tasks such as word processing and desktop publishing.

(d) Describe how *multi-tasking* may be used within the system, with reference to a specific example. *[3 marks]*