INTERNATIONAL BACCALAUREATE
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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)

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(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]*

Turn over

This question requires the use of the Case Study.

2. (a) Explain **two** factors which make it difficult to construct computer weather models that can predict more than a few days ahead. *[4 marks]*

(b) Explain **two** differences between short-range and long-range forecasting other than time scale. *[4 marks]*

(c) Outline **one** advantage and **one** disadvantage of changing the secondary storage medium used to archive weather data. *[4 marks]*

(d) State **one** situation in the Case Study where a standard protocol would be used. *[1 mark]*

(e) Describe how a computer model would be tested for a wide range of weather conditions. *[4 marks]*

(f) Outline **four** characteristics of a super computer which make it suitable to run a national weather model. *[8 marks]*

(g) State **one** on-line process and **one** batch process used in the processing of weather data. *[2 marks]*

(h) State **one** reason why coded weather data is not encrypted. *[1 mark]*

(i) Identify a situation where distributed data processing occurs. *[2 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]*