INTERNATIONAL BACCALAUREATE
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COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Thursday 3 May 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. Data is stored in a one-dimensional integer array of order 5 called NUMBERS. The application that uses the data requires values between 1 and 1000 to be stored. An example is:

NUMBERS

27	216	15	2	56
[1]	[2]	[3]	[4]	[5]

The following algorithm processes the array:

```
procedure FIND(val NUMBERS integer array [1..5]
               ref INDEX integer array [1..5])
   declare POS, VALUE integer

   VALUE <-- 5000
   for POS <-- 1 upto 5 do
     if NUMBERS[POS] < VALUE then
        VALUE <-- NUMBERS[POS]
        INDEX[1] <-- POS
     endif
   endfor
endprocedure FIND
```

The purpose of the algorithm is to place the array subscript of the smallest value into INDEX[1].

(a) Outline the difference between declaring the parameter of NUMBERS as a *pass-by-value* parameter and INDEX as *pass-by-reference/variable* parameter. *[2 marks]*

(b) Copy and complete the following trace table for the call FIND(NUMBERS,INDEX):

POS	NUMBERS[POS] < VALUE	VALUE	INDEX[1]
		5000	
1	true	27	1
2	:	:	:

[6 marks]

(c) Construct the algorithm that shows the changes required to FIND so that INDEX is completed with the remaining entries to store the subscripts of the values in NUMBERS in ascending order. This would mean that the final entries in INDEX are:

INDEX

4	3	1	5	2
[1]	[2]	[3]	[4]	[5]

[6 marks]

(This question continues on the following page)

(Question 1 continued)

    (d)   Construct the algorithm (that uses INDEX from part c) to transfer the contents of NUMBERS into another integer array of order 5 called SORTED, in sorted (ascending) order.   *[4 marks]*

Another part of the program uses a one-dimensional sorted integer array of order 600 called ORDERED. Part of the array is shown below:

ORDERED	2	2	2	6	6	7	. . .	780	780
	[1]	[2]	[3]	[4]	[5]	[6]		[599]	[600]

    (e)   Construct the algorithm to display each separate number of the array, and the number of times that it is stored. For example the start of the output for ORDERED above would be:
2 is stored 3 times
6 is stored 2 times
and so on.   *[12 marks]*

This question requires the use of the Case Study.

2. (a) State **one** possible input sensor used in the Case Study. *[1 mark]*

(b) Outline **one** example of how more powerful computers improve weather forecasting. *[2 marks]*

(c) State what archive data is and describe **one** purpose of keeping such data. *[3 marks]*

(d) (i) State **one** situation in the Case Study where data is sent over a WAN. *[1 mark]*

(ii) Outline why data integrity is important in the sending of this data. *[2 marks]*

(e) Identify and explain **two** reasons why the archived data is expected to be transferred to a new storage medium in the future. *[6 marks]*

(f) (i) Identify **one** situation in the Case Study where a computer prediction was trusted more than a human expert. *[1 mark]*

(ii) Discuss **one** implication of trusting computers more than people. *[3 marks]*

(g) Outline **two** suitable forms of output presentation of the weather data from the computer system for the local television stations to use. *[6 marks]*

3.   An engineer has built a robot buggy which moves around on its own. The buggy is used to carry heavy car components from one part of a factory to another part. It is controlled by a processor which takes battery level and sensor readings as input. The outputs include signals to control motor speeds which operate the wheels. A program is stored in ROM which processes data so that the buggy never bumps into anything and moves to a power socket to recharge its battery when low.

(a)   State **one** purpose of RAM in this system.   *[1 mark]*

(b)   (i)   Describe **one** specific input device that could be used.   *[2 marks]*

(ii)   Describe **one** further possible output device that could be used (other than a motor).   *[2 marks]*

(c)   Discuss **one** implication of a system failure in the buggy.   *[3 marks]*

(d)   Explain the consequence of reorganising the layout of the factory so that some routes that the buggy used to take are now blocked.   *[3 marks]*

The management of the factory are considering making the entire factory computer-controlled with no manual workers at all.

(e)   Discuss **one** advantage and **one** disadvantage for the management if this happened.   *[4 marks]*