

THE BRITISH COMPUTER SOCIETY
THE BCS PROFESSIONAL EXAMINATION
Certificate

SOFTWARE DEVELOPMENT

19th April 2005, 2.30 p.m.-4.30 p.m.
Time: TWO hours

SECTION A

Answer TWO questions out of FOUR. All questions carry equal marks.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. The file 'stock' contains details of books currently held in stock by a retailing bookshop:

<ISBN>	<Author>	<title>	<stock level>	<price>
10-digit integer	20 characters	40 characters	4-digit integer	real number
0 7493 97543	Bernieres, L.	Capt. Corelli's mandolin	25	7.99

Another file 'supply' contains details of books held in a warehouse:

<supplier name>	<ISBN>	<available>	<stock level>	<price>
20 characters	10-digit integer	1 char, T/F	4-digit integer	real number
Vintage Fiction	0 7493 97543	T	650	6.55

- a) Specify suitable data structures to hold details for both of these files. Hence write a suitable file description of 'stock' and 'supply'. **(6 marks)**
- b) The <Author> and <title> fields both use many characters and for a typical file with 1000 books would result in waste of storage space, as much of the available space would not be used. Suggest how this storage space could be minimised without losing processing capability. **(4 marks)**
- c) Write an initial algorithm to read the 'stock' file once and for each entry search the 'supply' file to match the ISBN of a book. If the book is found in the 'supply' file and the price lower than on the shop 'stock' file, print the full details of the book. Count how many records are on the 'stock' file, how many matches are found and print the results at the end.

An initial algorithm and at least one stage of development must be shown. **(20 marks)**

2. line number Program best-of-three
 main variables a, b, c : INTEGER
 1 Procedure select (t1,t2,t3)
 BEGIN
 2 If t2 > t1 THEN swap (t2, t1)
 3 If t3 > t2 THEN swap (t3, t2)
 4 If t2 > t1 THEN swap (t2, t1)
 END
 5 INPUT (a, b, c)
 6 select (a, b, c)
 7 WRITE (a, b, c)
 END

- a) Dry run the algorithm with input values 1 3 2 at the top level. Use the line numbers in your answer. **(12 marks)**
- b) Certain languages (e.g. Pascal) do not incorporate a system procedure 'swap'. Write appropriate code for this procedure and state where it would be placed in the supplied code, with reasons. **(7 marks)**
- c) What property must the variables used for procedure parameters (t1, t2, t3) have for the desired result to be achieved? **(4 marks)**
- d) In some languages the variables (a, b, c, t1, t2, t3) can be strings of characters. Where could this be applied? What constraints are needed to make this work properly? **(7 marks)**

3. a) Write a procedure, in Pseudocode, or Structured English or a programming language with which you are familiar, that implements **insertion** in an array of data ordered in an ascending manner as follows:

The procedure should accept an integer parameter EL that is the data to be inserted.

The procedure should scan an array (name = LIST, size = 100).

The first element in the list contains the number of data elements it contains. That is, LIST[1] = number of elements in LIST.

All existing data in LIST is held together, that is all data is stored adjacent, ascending.

On finding where to insert the new data, you will need to make a space and move the existing data to create an empty space.

If LIST is full, that is, there is no space to insert the new value, an error message should be given. If successful, no return message need be given. **(20 marks)**

- b) Dry-run your pseudocode from a) above with the following data:

EL = 23

LIST =

4	10	15	22	24				98	99	100
1	2	3	4	5	6					

(10 marks)

4. a) Algorithmic design in Structured Programming uses three principles. Describe EACH of these principles. **(12 marks)**
- b) Give an example of each principle applied to **CODE**. **(9 marks)**
- c) Give an example of each principle applied to **DATA**. **(9 marks)**

SECTION B

Answer FIVE questions out of eight. All questions carry equal marks.

5. Briefly describe the type of testing you would use for:
- a) Unit tests (6 marks)
 - b) Integration testing (6 marks)

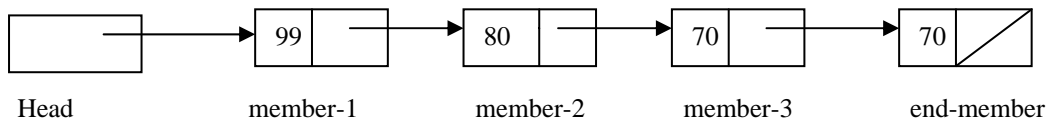
Give reasons for your answers.

6. An inter-island ferry has a passenger-carrying capacity of C people. In general W people are waiting for the ferry. If $W > C$ then those left behind are P percent of those waiting and L percent of the ferry's capacity.
- a) Derive separate expressions for P and L in terms of the variables (C, W). Simplify these expressions as far as possible. (6 marks)
 - b) Write a program
 - i) to accept a value for C
 - ii) to accept lower and upper limits for W
 - iii) to accept a value for W and
 - iv) then print a table with the headings below

People waiting (W)	Number of people left behind	% of people waiting left behind (P)	% of ferry's (L) capacity left behind

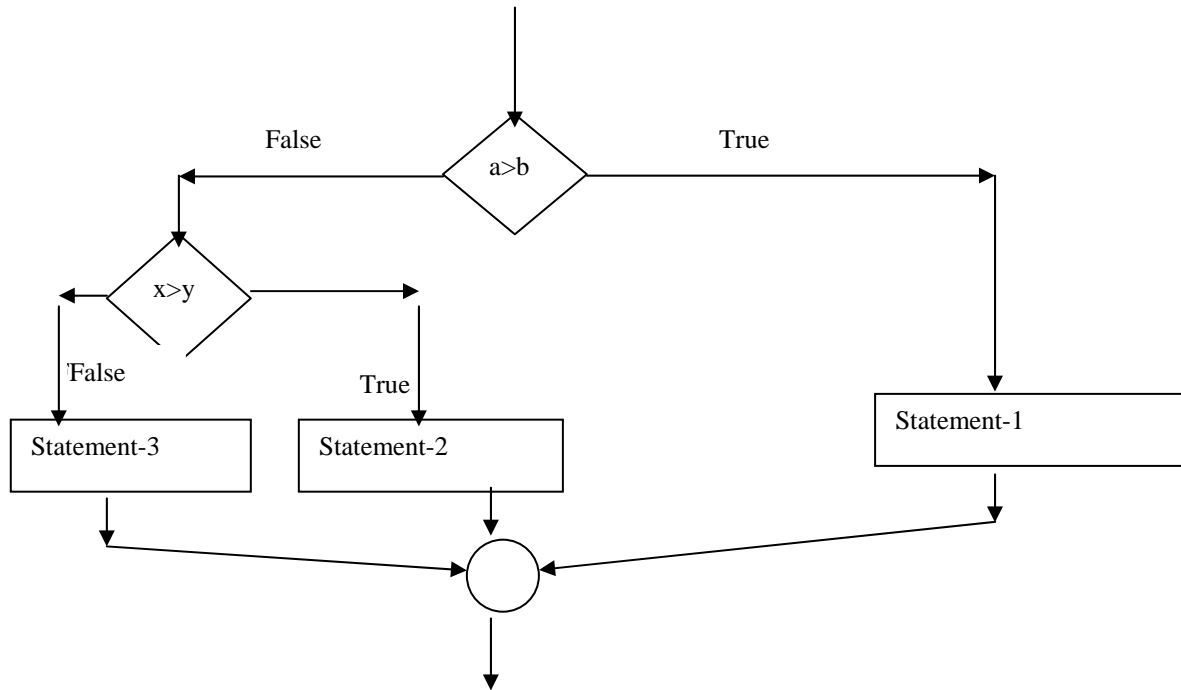
(6 marks)

7. The diagram below represents a linked list with a single pointer field.



- a) Write a declaration for one member of this list in a suitable language. State which language you are using. (3 marks)
- b) Copy the diagram and show the necessary pointer movements to exchange member-2 with member-3. (5 marks)
- c) Write code for these pointer movements in the same language you used in part a). (4 marks)

8.



a) Represent the flowchart (above) in pseudocode. (4 marks)

b) Represent the pseudocode below by a flowchart.

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IF test-1 THEN      IF test-2      THEN statement-1
                    ELSE statement-2
ELSE statement-3
  
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(4 marks)

c) Specify appropriate test data for b) so that each of the three statements is output. State which output should be produced for each set of test data. (4 marks)

9. a) Describe one purpose of an index-access file? Give reasons for your answer. (6 marks)

b) When in operation, is it better to keep the index in main memory, or on disk? Give reasons for your answer. (6 marks)

10. Show a GUI design for a system that is used to monitor 4 different locations using four remote cameras. Include in your design GUI elements of a drop-down list and a set of radio buttons, and give them appropriate functions to perform. Explain your design fully. (12 marks)

11. Describe the functions of the following software elements. State whether each is 'system software' or 'application software'.

a) A Compiler (4 marks)

b) A Scheduler (4 marks)

c) A Word Processor (4 marks)

12. Briefly describe the type of documentation you would assemble for the maintenance of a desktop database application. Give reasons for your answer. (12 marks)