

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION Certificate

SOFTWARE DEVELOPMENT

12th October 2004, 2.30 p.m.-4.30 p.m.
Time: TWO hours

SECTION A

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

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

1. The file 'studs' contains details of students enrolled on their courses in alphabetic order of names. It has the following items in each student record:

<identifier>	<student name>	<course code>	<fees paid>
8-digit integer	30 characters	4 characters	1 character (restricted to Y/N)
45362722	HALFORD, Chris	BSc1	Y

Another file 'marks' holds the identifier followed by six integer marks, these being the percentages obtained in six subjects:

<identifier code>	<mark-1>	<mark-2>	...	<mark-6>		
8-digit integer	six two-digit integers					
45362722	55	67	44	45	59	38

There are more student records on 'studs' than on 'marks' as some students did not take the examinations. Validation has already been carried out so that every course code corresponds to one on the 'studs' file.

Both files are stored in increasing identifier order.

- a) Under what possible circumstance could the 'marks' file description prove inadequate? **(2 marks)**
- b) Define suitable data structures to contain the student name and one student record. Hence write a suitable description for the files 'studs' and 'marks'. **(8 marks)**
- c) Write an initial algorithm to read the entire 'marks' file sequentially, read the 'studs' file and match the identifier on both files. If the identifier on 'studs' file is less than on 'marks' file, ignore it and read the next one. When a match is obtained a check is made to see if the student has paid his/her fees. If not, the message 'UNPAID FEES' is to be output. Otherwise the arithmetic mean of the six marks is evaluated then printed as output along with the student's name and course identifier. If this mean is greater than 39.9 %, and none of the individual marks is less than 30% the word 'PASS' is output otherwise 'NOT YET PASSED' is output.

You should not deal with error conditions in any of the data items.

(20 marks)

Turn over]

2. A progressing relationship between integer numbers is given below:

left side	right side
$1*9 + 2$	$= 11$
$12*9 + 3$	$= 111$
$123*9 + 4$	$= 1111$
$1234*9 + 5$	$= 11111$

a) Write the next two lines of this relationship. (2 marks)

The algorithm below demonstrates this relationship by separately calculating the left side and right side of this relationship:

line no.	instruction
1	READ lim
2	n = 0 pl = 0 pr = 1
3	WHILE n < lim DO
4	n = n + 1
5	le = pl*10 + n
6	ln = le*9 + n + 1
7	rn = pr*10 + 1
8	WRITE "left side" ln "right side" rn
9	pl = le
10	pr = rn
11	ENDWHILE

b) Dry-run the algorithm with 'lim' input as 4. (14 marks)

c) Devise more meaningful names for the memory locations (identifiers) used in the algorithm and place it in a program with appropriate declarations and more meaningful output. (14 marks)

3. a) Write a procedure, in Pseudocode, or Structured English, or a programming language with which you are familiar, that implements **sorting** as follows:

The function should **sort** integer data in an array named MATERIAL, of size LENGTH, such that the elements of MATERIAL are arranged in ascending order. Both MATERIAL and LENGTH are defined as globals to the function. (15 marks)

b) Dry-run your pseudo-code from a) above with the following data:
LENGTH = 6 MATERIAL =

2
10
4
8
6
12

(15 marks)

4. a) Describe a program generator tool (such as a software development environment, or software development kit, or CASE program generator) with which you are familiar. Be sure to explain the facilities and functions that it has, and the purpose of the software that it produces. **(15 marks)**
- b) What do you think are the benefits of using such program generator tools? How do they change the quality of product, the speed of software development, and the satisfaction of the end-user? Give reasons for your answer. **(15 marks)**

SECTION B

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

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

5. A serial file 'datafile' has a sequence of records R_1, R_2, \dots, R_N .
- a) Draw diagrams showing how the records are laid out in the file, including any file pointers,
- i) after the file has been opened but before any records are read from the file **(4 marks)**
- ii) after the last record of the file has been read. **(4 marks)**
- b) Write a program fragment which opens the file, counts how many records are in it, then closes it. State which language you use. **(4 marks)**
6. a) Write a procedure 'convtime' which takes as an input parameter a decimal time in hours (e.g. 5.8765) and which returns the corresponding time as hours (integer), minutes (integer) and seconds (nearest integer). Thus input time 5.8765 IS 5 hours 52 minutes 35 seconds. **(6 marks)**
- b) Incorporate this into a program fragment which uses 'convtime'. The program fragment provides appropriate parameters to the procedure 'convtime' as input and the program fragment then prints out the returned answer. It must also incorporate a 'repeat' facility so that the conversion can be repeated a set number of times during one program run. **(6 marks)**
7. The equation relating the time in minutes (x) from the hour ' H ' where $1 \leq H \leq 11$ to when the hands overlap on the clock face is given by $30H + x/2 = 6x$
- a) Arrange this equation into a form suitable for calculating x for a given value of H . **(3 marks)**
- b) Write code to return a series of these times (for H from 1 to 11) when the hands overlap as a captioned table thus:
- | | | | |
|-------------|------------------------|---------|------------------|
| time(hours) | minutes(as calculated) | seconds | (9 marks) |
|-------------|------------------------|---------|------------------|
8. a) i) Show diagrammatically a linked list with one pointer. **(2 marks)**
- ii) Specify ONE area where this data structure is particularly useful. **(2 marks)**
- iii) Why should sorting NOT be attempted with this structure? **(2 marks)**
- b) i) Likewise show diagrammatically an array with one subscript. **(2 marks)**
- ii) What particular operation is expedited by this data structure? Show why it is particularly suitable for sorting operations. **(2 marks)**
- iii) Under what circumstances is an array unsuitable for use? **(2 marks)**

Turn over]

9. a) Describe the operation of a queue data structure. Include a description with suitable diagrams of how a queue data structure is constructed and used. **(6 marks)**
- b) Describe how ONE piece of system software uses a queue data structure as part of its functioning. **(6 marks)**
10. a) Contrast and compare the methods of testing known as 'Black Box' and 'White Box'. Include the stages of development lifecycle when each method of testing is used. **(6 marks)**
- b) State TWO situations when ONLY Black Box testing is employed. Give your reasons. **(6 marks)**
11. Describe THREE GUI features that you expect to find in the design of an interactive website for an e-commerce company that sells PCs and parts for PCs. Give your reasons. **(12 marks)**
12. Briefly describe the operation of file organisations that support the following:
- a) Dealing with telephone enquiries from customers about account details **(6 marks)**
- b) Producing a print-out of all customers' invoices to be posted to them **(6 marks)**

Use suitable diagrams to illustrate your answer.