

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION Certificate

SOFTWARE DEVELOPMENT

18th October 2002, 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 courses in alphabetical order of student names. Each student record has the following items:

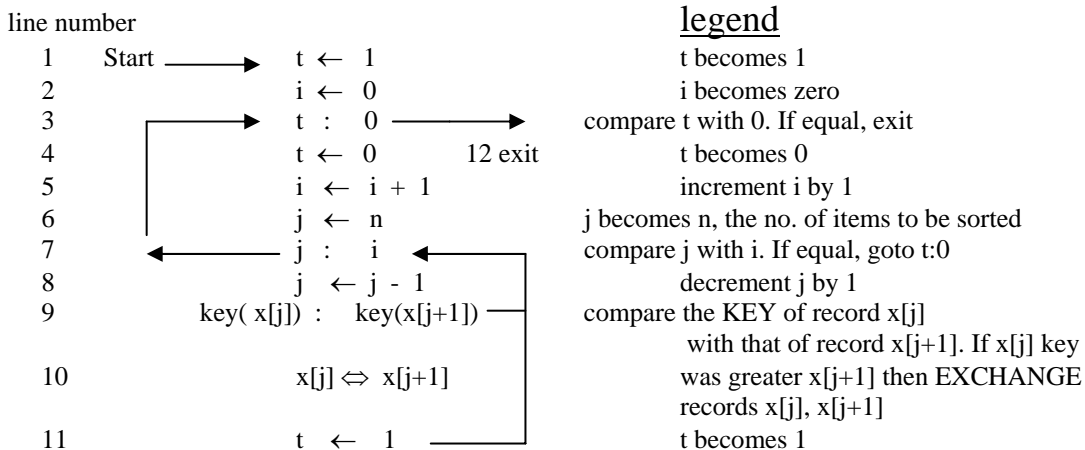
| <identifier> | <student name> | <course code> | <options chosen> |
|-----------------|-----------------|---------------|--------------------|
| 8-digit integer | 30 characters | 4 characters | 20 characters |
| 92878112 | BABBAGE Charles | PNC1 | PRO1 HR1 MATH COMP |

Another file, 'descr', contains full descriptions of the courses and the corresponding course codes:

| <course code> | <course description> |
|---------------|-------------------------------|
| 4 characters | 30 characters |
| PNC1 | National Dip/Computing year 1 |

- a) Specify a suitable data structure to contain the <student name> and a suitable data structure to contain one student record. Hence write a suitable description for the files 'stud's and 'descr'. (8 marks)
- b) Write an initial algorithm to
- read the entire 'studs' file
 - store each different unique course code encountered in the 2-dimensional array 'cscodes'
 - count how many unique course codes are found
 - how many students are on each course and
 - the total number of student records on the file.
- (14 marks)
- c) Write code to sort the array 'cscodes' into descending order of course code. (You do NOT need to deal with error conditions in any of the data items). (8 marks)

2. The Iveson Algorithm for a sorting method is given below:



legend

t becomes 1
i becomes zero
compare t with 0. If equal, exit
t becomes 0
increment i by 1
j becomes n, the no. of items to be sorted
compare j with i. If equal, goto t:0
decrement j by 1
compare the KEY of record x[j]
with that of record x[j+1]. If x[j] key
was greater x[j+1] then EXCHANGE
records x[j], x[j+1]
t becomes 1

- a) Translate this algorithm literally into a procedural programming language. (Thus the transfers of control implied by → must be translated into 'GO TO label' statements.) State which language you are using. (10 marks)
- b) Write a detailed criticism of the style of programming implied by the algorithm. (6 marks)
- c) Modify the algorithm and translate it into a modern, structured PROCEDURE *ivsort(...)* with meaningful variable names and without using labels. The PROCEDURE *ivsort(...)* requires appropriate parameters; that is, everything *ivsort* uses must be passed as parameters. (14 marks)

- 3. a) Describe the three common constructs of programming languages - sequence, selection and iteration. (10 marks)
- b) In a programming language of your choice, show how code structures are built using these constructs. (10 marks)
- c) Show how these constructs can be used to build up data structures. (10 marks)

- 4. a) Describe a software development method with which you are familiar and identify the type of programming language for which it is most suited. Give reasons for your choice of language type. (15 marks)
- b) For the method you have described in part a), discuss the **cost** of getting the development **wrong** at each stage of the method. How does the method contribute to, or reduce, this cost at each stage? (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) What TWO conditions must be met for a recursive solution to a problem to be found? **(6 marks)**
b) How do recursive solutions operate in practice? **(3 marks)**
c) When is a recursive solution likely to be unworkable in practice? **(3 marks)**
6. If A is an approximation to the cube root of a real number N then A + C is a better approximation, where C is given by the formula
- $$C = [N/A^2 - A] / 3$$
- The initial value of (A) is A/3.
- a) Develop a process for repeatedly evaluating the cube root of an input number until successive values differ by less than an input limit E.
- b) Incorporate it into a user-defined function 'Cubrt(...)' with appropriately-chosen parameters. State your chosen language. **(12 marks)**
7. a) Define a linked list data structure to contain a name (20 characters), an integer telephone number and one pointer to the next list member. **(2 marks)**
- b) Two such linked lists have been set up (list1 and list2) each having their members in increasing telephone number order. Develop an algorithm to merge the lists, creating one new list which retains the members in increasing telephone number order. State your target language. **(10 marks)**
8. A publisher offers an author a fixed contract price A, to publish a novel by the author. The publisher expects to recoup this outlay from book sales. The publisher will retain a royalty R (typically being between 10% and 30%), being a percentage of the bookshop sale price P. The book selling price is typically between £3 and £15.
- Write an interactive program which prints a table showing how many books have to be sold between these limits for the range of selling prices for the publisher to recover his investment. The necessary data (A) is requested interactively before printing the table. **(12 marks)**
9. a) Describe the operation of a stack. **(6 marks)**
b) Describe an IT application that needs to use a stack. Show how the application uses the stack. **(6 marks)**
10. What types of documentation should you give to a client on completion and hand over of a software project? Give reasons for the type of documentation specified. **(12 marks)**

[Turn over

11. A graphical user-interface (GUI) is designed to meet the needs of the person using it. Describe THREE features that you expect to find in the GUI of an interactive website for a travel company. Give your reasons. **(12 marks)**

12. Describe the advantages and disadvantages of the following file organisations:

- a)* sequential only **(4 marks)**
- b)* index only **(4 marks)**
- c)* index-sequential hybrid **(4 marks)**