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THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION Certificate

SOFTWARE DEVELOPMENT

11th April 2000 - 10:00a.m. - 12:00p.m.

Time: TWO hours

SECTION A

Answer TWO questions out of FOUR from this section. All questions carry equal marks.

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

- | | | |
|----|---------------------------|----------------------------------|
| 1. | 1: temp ← 0 | 8: octnum ← 0 |
| | 2: decnum ← INPUT | 9: REPEAT |
| | 3: REPEAT | 10: digit ← temp MOD 10 |
| | 4: rem ← decnum MOD 8 | 11: octnum ← 10 * octnum + digit |
| | 5: temp ← 10 * temp + rem | 12: temp ← temp DIV 10 |
| | 6: decnum ← decnum DIV 8 | 13: UNTIL temp = 0 |
| | 7: UNTIL decnum = 0 | 14: octnum → OUTPUT |

The above algorithm is intended to convert an input positive decimal integer (decnum) to its octal equivalent (octnum) and then output it where

MOD returns the remainder obtained by dividing its two operands and
DIV returns the quotient of the two operands rounded in the direction of zero.

- a) Perform a dry run using '123' as input. Use the given line numbers in your answer. **(5 marks)**
- b) The algorithm fails when the input is any multiple of 8. Illustrate what happens in this case with another dry run. Modify the algorithm to correct this error. **(8 marks)**
- c) Convert the revised algorithm to a suitable high-level language (e.g. Pascal, C, Fortran, Basic). Include in your code:
- i) comments to make its purpose easily intelligible
 - ii) appropriate prompts and output statements. **(17 marks)**
2. A sequential file contains sorted records of chemical element data. Each record has the following format:
- Element name (15 characters)
Element symbol (2 characters)
Relative atomic mass (real number)
Atomic number (integer)
Type (metal or non-metal)
- The records are in ascending atomic number order, and there is an entry for every value between 1 and 110.
- Define the data structure and develop an algorithm to count how many metals and non-metals occur within an atomic number range input to the algorithm. Validate that the second atomic number is greater than the first and that both are within the smallest and largest atomic values in the file. **(30 marks)**

3. As the administrative manager of a small business you have been offered a suite of PC-based programs. Full source code listings are to be provided. The programs carry out the following tasks:
- Payroll and tax payments
Stores update and inventory
Material throughput and profitability.
- a) On what would you base a judgement about the purchase of the software? Discuss the relative importance of the various factors. **(15 marks)**
- b) Design a test plan for the implementation of each task, mentioning where black box and white box testing is appropriate. **(15 marks)**
4. Describe the tools that might be available in a modern PC environment with which to develop application software. How do you think these tools may develop over the next five years? **(30 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. Give, with reasons, one example where the use of a linked list is preferable to the use of a one-dimensional array and one example where the use of a one-dimensional array is preferable to the use of a linked list. **(12 marks)**
6. Explain the difference between a compiled program and an interpreted program. List the advantages and disadvantages of a compiled program compared to an interpreted program. **(12 marks)**
7. Write brief notes on each of the following:
- a) CASE tools **(6 marks)**
- b) Object-oriented programming **(6 marks)**
8. Show clearly the pointer movements when a pair of adjacent items in the middle of a linear linked list are to be swapped. What difference is there if one of the items is at the head of the list? What difference is there if one of the items is at the end of the list? **(12 marks)**
9. 'The user interface required for an infrequent and inexperienced PC user is different to that required for a regular and professional user.' Indicate, with reasons, whether you believe the preceding statement to be true. **(12 marks)**
10. Write brief notes on each of the following:
- a) data abstraction **(4 marks)**
- b) independent compilation **(4 marks)**
- c) software version control **(4 marks)**

11. Briefly describe one diagrammatic tool to help design software. What are the strengths and weaknesses of the tool described? **(12 marks)**

12. Compare and contrast the following pairs:

a) stacks and queues

(6 marks)

b) cohesion and coupling

(6 marks)