THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION
Advanced Diploma

SYSTEMS DESIGN METHODS

27th April 2000 - 10:00a.m. - 1:00p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours.

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

1. *i)* Several design methods make use of data flow diagrams. Name the four main symbols that are used to construct a data flow diagram and provide an illustration and brief description of the meaning of each of the symbols. **(6 marks)**

    ii) Consider the following simple warehouse system:

    > A warehouse stocks batteries of various different types. A simple computer system is used to maintain a record of the current stock level of each type of battery. Batteries are delivered to the warehouse, and shipped from the warehouse in batches. The stockman is responsible for entering delivery and shipment information into the computer system as batches arrive or are shipped. From time to time the warehouse manager needs to find out the current stock level associated with a particular type of battery. The manager does this by querying the computer system.

    > *a)* Produce a context diagram (also known as a fundamental system model, context model or level 0 data flow diagram) to provide a high level overview of the battery warehouse system. **(5 marks)**

    > *b)* Produce the corresponding level 1 data flow diagram for this system. Make sure that your diagram is consistent with the context diagram given above. **(8 marks)**

    iii) Briefly discuss the scope and limitations of using data flow diagrams alone for system modelling, and indicate how other diagram notations can be used to provide graphical system models from different perspectives. **(6 marks)**

2. Software design is an essential process of software engineering and can be performed with an appropriate design method. A typical design process covers four aspects: data, architecture, interface and procedural design.

    i) Describe the objectives of each aspect of the design and the activities conducted to achieve them. **(14 marks)**

    ii) State the techniques you would choose (e.g. structured or object-oriented techniques) for each aspect of design, and justify your choice. **(11 marks)**

3. *i)* With the aid of illustrations describe the classic Waterfall model of a software process. Provide a brief but clear definition of the meaning of each process stage included in the model. **(7 marks)**

    ii) Give details of the support that is provided by a particular software development method for each of the distinct Waterfall lifecycle stages. Base your answer on one method with which you are familiar. **(6 marks)**

    iii) Briefly discuss the problems associated with the Waterfall model's idealistic view of a software process. Use examples from your own experience to support your answer. **(7 marks)**

    iv) Explain possible ways in which the traditional Waterfall model could be improved to make it reflect a more realistic and less idealistic software process. **(5 marks)**

4. Many legacy systems are critical to the operation of the organisation that uses them. Software re-engineering must be performed on these systems to ensure that they continue to satisfy the organisation's requirements.

i)   Compare the notions of "forward software engineering" and "software re-engineering", and discuss the need for software re-engineering. **(14 marks)**

ii)   One of the tasks in software re-engineering is to convert data from various sources in different data structures into a managed environment. This is sometimes called data conversion or data re-engineering. Identify and explain **TWO** problems that may be encountered in data conversion. **(11 marks)**

5. *i)*   Explain what is meant by the term *metric* when used in the context of a software development process and indicate three outcomes from a software development process that can be used to derive process metrics.
(5 marks)

ii)   Software process metrics can provide significant benefits in terms of software process maturity; however, if metrics are misused they can cause more problems than they solve. Indicate potential problems that metrics misuse could cause and suggest a list of guidelines that a manager should adhere to when instituting a process metrics programme. **(8 marks)**

iii)   Software maintainability is one of the most important quality metrics. There are a number of technical and non-technical factors affecting maintainability. Identify **THREE** such factors and suggest how maintainability can be improved with respect to these factors. **(12 marks)**