## Answer ALL of Part I and TWO questions from Part II

*You are advised to spend not more than 1 hour on Part I.*

## Part I

1. You have been given the following preliminary specification for a proposed software system:

   "An automated gas billing system is needed. Gas meters will be connected via modems to the data processing centre, allowing meter readings to be done remotely. Readings will be taken once per week, to monitor demand and collect billing information. Bills will be sent to customers either monthly or quarterly depending on how frequently the customer wants to pay.

   The software system should take control of reading the meters, collating the information received, storing it in a database, and periodically extracting data for billing and for generating reports on gas consumption. Modem faults, resulting in failure to collect data, should be reported immediately.

   The system should also include a command driven interface to allow operators to monitor progress and issue commands directly."

   a) Use the data flow method to build a quick design model of the proposed system. Provide a context diagram, level 1 DFD and structure chart to show the overall structure of the system.

   [15 marks]

   b) Repeat the analysis using object-oriented methods. Describe the main scenarios and provide a class diagram. For each class identified provide a class template listing the operations supported by the class.

   [15 marks]

   c) Compare the two design approaches. Which do you believe to be more appropriate for dealing with this problem and why?

   [10 marks]

   d) If the detailed design of the system went ahead following your chosen approach, what options are available for the organisation of the development team, and which would be most appropriate?

   [10 marks]

   [Total 50 marks]

## Part II

*(Answer two of the following questions.)*

2. Compare and contrast structured, object-oriented and formal methods with respect to correctness, verification and validation.

[Total 25 marks]

3. a) What kinds of development are the major software life cycle models appropriate for?

[15 marks]

b) What are the features of good software design? In what way can design patterns improve the design of systems?

[10 marks]

[Total 25 marks]

4. a) Why is software difficult to design? How can management organisation and the systematic application of methods increase the chance that a development project will succeed?

[15 marks]

b) What are the consequences of the need for legal contracts in software development?

[10 marks]

[Total 25 marks]

END OF PAPER