

OLLSCOIL NA hÉIREANN, GAILLIMH  
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER II EXAMINATIONS 1998/99

Third Examination in B.Sc. in Information Technology

SOFTWARE ENGINEERING II

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Time allowed: THREE hours

Answer **Question 1** and any **three** other questions of your choice  
All questions carry equal marks

- Q. 1.** The following text describes a banking network, which includes both human cashiers and automatic teller machines (ATMs). This network is to be shared by a consortium of banks. You have been asked to develop the software to support its computerisation.

*Each bank in the consortium will provide its own computer to maintain its own accounts and process transactions against them. Every bank will also be responsible for issuing cash cards to their customers, authorising access to accounts over the ATM network. Each card contains a bank code and a card number, determining the accounts that the card can access. As multiple copies of the card may exist, the possibility of simultaneous use of the same card from different machines must be considered. A customer can consist of one or more persons or corporations. Cashier stations are owned by individual banks and communicate directly with their own bank's computers. These stations print receipts for the transactions processed by the cashiers. They also communicate with the bank computer to validate and process the transactions. Human cashiers enter account and transaction data. Accounts may be of various types, at least chequing or savings. A customer may hold more than one account. Automatic teller machines communicate with a central computer, which clears transactions with the appropriate banks. An ATM accepts a cash card, interacts with the user to gather transaction information, communicates with the central system to carry out the transaction, dispenses cash, and prints receipts. The system requires appropriate recordkeeping and security provisions. The system must handle concurrent accesses to the same account correctly. The cost of the shared system will be apportioned to the banks according to the number of customers with cash cards.*

*The banks will provide their own software for their own computers; you are to design the software for the ATMs and the network.*

(i) Identify all **classes** in the above description. Prepare a data dictionary entry for each class (name, description, scope, and restrictions on its membership or use). [ 5]

(ii) Prepare a class diagram, showing all associations (including inheritance), attributes and operations, from the above text. [20]

Q. 2. (i) What is an interaction diagram? What techniques does UML offer for diagramming class interaction, and how do these techniques differ? Which technique would you recommend for the ATM network described in Q.1 above, and why? [ 5]

(ii) Using the problem description from Q.1 of a bank consortium ATM network, prepare a use case diagram for this system. Expand one use case into its full description, and prepare a scenario for both a normal interaction and an exception or unusual interaction. [ 8]

(iii) Using the models produced in (ii) above, and Q.1(ii) (i.e. use case and class models respectively), prepare a sequence diagram for the use case described. [12]

Q.3. Based on the data analysis of the Garage Service Management System described in the following narrative:

### ***Garage Service Management System***

*The Service Management System is used to keep track of all car services performed by the garage, including details of labour and parts used so that correct invoices may be generated. Details stored include: customer name, address, home and work telephone numbers and credit status; car reg. no, make, model and warranty status. For each service, a work order number is created, and the garage keeps data on the date-of-service, a short description of work done, the number of labour hours needed, the part numbers and part descriptions used. These data allow the garage to invoice the customer with a correct amount, which includes part details and costs and labour costs. Invoices are also dated, and contain a short description of the service work performed.*

(i) Construct and refine an E-R model of the data [12]

*contd. /*

(ii) Then normalise the resulting relations to 3NF and translate the normalised relations into Logical Record Structures (LRS) showing the links.

[13]

- Q. 4. Write a note on **three** of the following subjects. Your answer should include a description, covering the origins, merits, demerits etc. where applicable, and should be illustrated with real examples in each case:

CASE

UML

Requirements Gathering

PSP

Data Dictionary

Essential System Model

- Q. 5. (i) Compare and contrast a structured approach to systems development (analysis, design and implementation) with an object oriented approach, using the bank consortium ATM network described in Q.1 as a practical example to illustrate your comparison.

[15]

(ii) An object has state, behaviour and identity. Explain each of these concepts and how they are handled by the UML.

[ 6]

(iii) Explain the difference between the concepts of inheritance and aggregation as used in UML relationship modeling; use an example of each to illustrate your response.

[ 4]

- Q. 6. The goal of requirements engineering can be described as establishing and specifying precisely what software must do without describing how to do it.

Discuss the role of the process, techniques and tools of software engineering in respect of the above statement and their role in addressing the difficulties associated with deciding "what" to say.

Make use of any articles you may have read on this subject in your answer.

[20]

Describe the outputs of the requirements phase and how these help inform the system design process.

[ 5]