Tentamen Software Engineering (400071)
26 June 2003

This exam is centered on the case study "on-line supermarket" (OLS). All questions refer to the OLS case study.
A big food chain wants to sell goods on the Internet. Shopping must be accessible on the Web, via standard browsers (e.g. Mozilla or Internet Explorer). The potential customer must be able to browse the catalogue to "see" the description of goods and eventually make an order.
Each item is described by:

- A high-resolution picture
- The brand (i.e. the legal name of the manufacturer)
- A short description
- The indication of the size of the package
- Its characteristics (e.g. usage information and/or list of ingredients)
- Current discount (if available)
- Indication if the item is in stock or not available (in the latter case, the item cannot be ordered)

Items are organized in a goods' classification tree: the customer can either browse the classification to find the items of a certain type, or use the "search" facility by typing in some keywords.
The customer can add any item to his/her shopping basket, and specify the desired number of items. The shopping basket can always be visualized. When ready to order, the customer can close the basket and proceed with the purchase.
Payment is possible via either credit card, or cash upon receipt of the ordered goods. If credit card payment is chosen, an additional discount is applied; the necessary customer information is gathered. If cash payment is preferred, only the customer address is needed. In both cases, a secure connection must be ensured, to support customer privacy and security of credit card information.
An additional service is the customer mailing list: if a customer is interested in receiving advertisements about goods, or if he/she wants to be noticed when an unavailable item is back in stock, he/she can subscribe by inserting the e-mail address.
If after a period of evaluation the Internet market turns out to be profitable, the food chain plans to expand to the wireless domain, by extending application access to wireless mobile phones. This implies the modification of user access, to support the GSM connection, to make the GUI suitable for the screen of mobile terminals, and to maintain current quality of service (e.g. smooth end-user interaction).
A facility supporting customers in tracking the status of their orders (e.g. submitted, in progress, delivered) could be an added value. In this case, a tracking number must be associated with the order.

Note: this problem description can be ambiguous and incomplete. In answering the questions, you are free to complete it (if needed) and to briefly motivate your assumptions.

Question 1: Life cycle models

a) Provide the definition of the following software life cycle models:
   - Waterfall
   - Prototyping
   - RAD

b) Provide for each model, two advantages and two disadvantages.
c) Show how these models fit into the spiral model.

d) Which software life cycle model would you suggest for the OLS case study? Motivate your answer.

Question 2: Requirements engineering

a) Provide the list of functional requirements of the OLS case study, and organize them in a MoSCoW list. Briefly motivate your choices. Also, formalize the "Must have" requirements by means of a Use Case diagram.
b) Provide the list of non-functional requirements of the OLS case study. Motivate briefly each of them.
c) Analyze the OLS case study and provide the class diagram: make use of specialization/generalization (is-a), aggregation (part-of) and/or usage associations. This diagram should provide the conceptual model with emphasis on concepts and existing relationships among them. Class attributes and methods are not required in this diagram. Describe shortly the classes and their associations. If different from UML, explain the notation you used, and motivate your choice.
d) To provide a complete requirements specification for the OLS case study, explain which models should be part of the specification, and (for each model) the diagrams describing them. Motivate your answer.

Question 3: Software architecture

a) What are architectural/design patterns? Why are they used in software engineering?
b) Design the global software architecture of the system for the OLS case study, and show which architectural/design patterns you use. Motivate your choices.
c) Explain the relationship between the OLS software architecture and the non-functional requirements stated in the answer for question 2.b).

Question 4: Software design

a) What is software design?
b) Provide two important criteria used in software design, and explain them.
c) Explain one design method.

Question 5: Testing

a) Provide the definition of V&V. Choose a test technique to be applied to the design of the OLS case study, and identify the items to be tested.

Scoring

With this exam, you can gain 90 points at most. Your final mark is calculated as follows:

Final mark = (#points + 10) / 10

The weight of each question is as follows:

1a: 3 b: 3 c: 3 d: 6
2a: 5 b: 5 c: 15 d: 10
3a: 5 b: 10 c: 5
4a: 2 b: 4 c: 4
5a: 10

Exam language

If possible, you are kindly requested to write your answers in English. In any case, be sure that your handwriting is clear and understandable.