Roll No. Name:

Class Test-I

Information System Design (IT60105)
Autumn Semester – 2005

25 August 2005

Marks: 40 **Time: 50 minutes**

Answer all questions

1. State whether the following statements are False (×) or True (√)

(One mark each)

1.1 System development effort varies exponentially with the size (LOC) of the project.

1.2 Exploratory programming style is costly for developing system that requires technological breakthrough, and also it is hard to maintain.

1.3 The main objective of carrying out reviews is phase containment errors.

1.4 Iterative waterfall model is not at all suitable for R & D projects.

1.5 Evolutionary model is not a better choice for developing very large systems.

1.6 Software organizations achieve efficient manpower utilization by adopting project-based team structures.

1.7 Gantt charts for a system development can be used to allocate resources to activities.

1.8 COCOMO II estimation model is an empirical estimation technique.

1.9 SRS and SPMP documents are touted as legal documents.

1.10 COTS (Component Off The Shelf) is used in RAD (Rapid Application Development) process model.

2. Select the most appropriate choice out of multiple options. Put a √ mark on the correct choice(s).

(One mark each)

2.1 Putnam model estimates

(a) Effort as a function of project duration

(b) Number of engineers at any particular time during the duration of the project

(c) Total number of staff require for a project

(d) Size of the project

2.2 In a software project COCOMO model is used to determine

(a) Effort and duration based on the size of software

(b) Effort and size based on the cost of the software

(c) Size and cost based on the effort of the software

(d) Size, effort and duration based on the cost of the software

Roll No. Name:

Class Test-II

Information System Design (IT60105)
Autumn Semester – 2005

10 November 2005

Marks: 50 **Time: 60 minutes**

Answer all questions

1. A very large university, say, Indiana University (IU), has a large number of students enrollment and it has several campuses distributed over the country. The IU runs a number of courses in all campuses. The IU follows a common examination system for all enrolled students and for a course offered by several departments in it. The *Academic Section* of the IU facing a number of problems in the smooth functioning of the examinations in every academic session, like timetable preparation, question paper preparation and maintaining its confidentiality, conducting examinations, evaluating the answer scripts within a stipulated time, compiling the results, announcement of results to different campuses and preparing grade sheets for individual students etc. To tackle these situations, the IU *Academic Section* wants to adopt atomization in the examination procedure.

   Suppose, a project to develop a software system entitles IUES that satisfies the current needs of the IU *Academic Section* is offered to you. The design group follows the unified design process using UML and being a team member of the design group you are asked to do the following.

   (Clearly mention any reasonable assumption you make.)

   a. Draw the use case diagram of IUES. Clearly identify all actors and use case relations, if any. 10
   b. Identify three important classes those are required to be included in the design of IUES. You must mention important attributes and methods within each. 10
   c. Select any one use case that you have mentioned in 1(a) and draw an activity diagram of it. 10
   d. Select any one use case from the use case diagram in the answer of 1(a) or an activity in the activity diagram in the answer of 1(b) and draw a sequence diagram of it. 10

2. You have to test an information system, which has developed under your supervision and as a final phase of the development you have to test it adequately. How you can plan the testing? (You may just mention the taxonomy of information system testing strategies and underlined those strategies, which are to be followed critically.) 10

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Roll No. Name:

2.3 Objects which can not be put under configuration management activities is

(a) Tools used to build the system

(b) Test cases

(c) PERT chart

(d) Design documents

2.4 The system design life cycle model which has no influence of waterfall model is

(a) Prototype model

(b) Evolutionary model

(c) Spiral model

(d) Rapid application development

2.5 Maximum effort that is required in the phase of a typical system development is

(a) Requirement analysis and specification

(b) Design

(c) Coding and Testing

(d) Maintenance

3. **Answer should be brief and to the points. <u>Write answer on the box provide</u>.**
Clearly mention any reasonable assumptions you make.

(Two marks each)

3.1 Point out two limitations of COCOM estimation model.

1. 2.

3.2 How the two limitations as mentioned in Q 3.1 has overcame in COCOMO II model?

Roll No. Name:

3.3 Mention two main significances of using Spiral model.

1.

2.

3.4 Which project team organization is preferable? Why?

Project team:

Reason(s):

3.5 Give two examples of non-functional requirements in a project deal with Internet.

1.

2.

4. The system analysis group working on a system design project estimated the schedule of activities as given below.

Activity	**Notation**	**Must Follow**	**Expected Time (Days)**
Draw DFD	A	None	9
Draw Decision Tree	B	A	12
Revise tree	C	B	3
Write up report	D	C,H	7
Organize Data Dictionary	E	A	11
Do output prototype	F	None	8
Revise Design	G	F	14
Design database	H	E, G	5

With reference to the above data, answer the following questions.
(Five marks each)

Roll No. Name:

4.1 Draw PERT diagram based on the above mentioned data.

4.2 Complete the following table. The symbols bear usual meanings.

Activity	**MT**	**ES**	**LS**	**EF**	**LF**	**ST**
Draw DFD						
Draw Decision Tree						
Revise tree						
Write up report						
Organize Data Dictionary						
Do output prototype						
Revise Design						
Design database						

4.3 Calculate the project completion (best) time.

Indian Institute of Technology Kharagpur
School of Information Technology

IT 60105 : Information System Design
Mid-Semester Examination
Autumn Semester 2005

Full marks: 60 **Time: 02 hours**

Attempt all questions

Answers should be brief and to-the-point. Answer with example is recommended.

1. Explain how both the *Waterfall model* and *Prototyping model* of the software process can be accommodated in the spiral model? 2+2

2. Why *Evolutionary model* considered by many to be the best approach to software development in a modern context? 3

3. Describe *three* different types of *non-functional requirements* that may be placed on a system. Give examples of each of these types of requirements. 3+3

   Mention *three* risks at three different phases of the software process. Give the possible mitigation and management policies for the risk you have mentioned. 3+3

4. Draw a *context model* and a *Level 1 model* for a patient information system in a hospital. You may make any reasonable assumptions about the other hospital systems, which are available, but your models must include a patient admission system and image storage system for X-rays. 2+3

5. Based on your experience with a bank ATM, draw a *data-flow diagram* modeling the data processing involved when a customer withdraw cash from the machine. 5

6. The table below sets out a number of activities, duration and dependencies. Draw the *activity diagram* and a *bar chart* showing the project schedule. 4+4

Task	Duration (days)	Dependencies
T1	10	
T2	15	T1
T3	10	T1, T2
T4	20	
T5	10	
T6	15	
T7	20	T3
T8	35	T7
T9	15	T6
T10	5	T5, T9
T11	10	T9
T12	20	T10
T13	35	T3, T4
T14	10	T8, T9
T15	20	T12, T14
T16	10	T15

7. Explain why neither *fully centralized* nor *fully democratic* project team organization is preferable? 4

8. Discuss the pros and cons of letting people rotate among projects from different application domain as opposed to letting them true experts in one particular application domain. 3

9. Explain the following type of coupling and cohesion.
   (a) Data coupling
   (b) Common coupling
   (c) Functional cohesion
   (d) Coincidental cohesion 4×1.5

10. From the description of the following problem draw an *ERD* and find the *tables* from that. For each table indicate the primary attribute only.
    - Each department has exactly one supervisor.
    - A supervisor is in charge of one and only department.
    - Each department has 0 or more projects.
    - Each department is assigned at least one employee.
    - Each employee works for at least one department.
    - Each project has at least one employee working on it.
    - An employee is assigned to 0 or more projects. 2×2.5

11. *Sahara Car Rental* manages several outlets for car rental. They have five sizes of cars that they list as A to E.

    A: Subcompact
    B: Compact
    C: Midsize
    D: Fullsize
    E: Luxury

    Counter booking or booking through telephone is available for cars A, B, and C. Booking through Web is available for all cars. Advance payment can be made with cash (for counter booking only) or credit card (for counter booking and web booking only). If a customer reserves a subcompact (A) and finds on arriving that they don't have one, that customer gets a free upgrade to the next-sized car, in this case a compact (B). Customers also get a free upgrade from their reserved car size if their company has an account with Sahara. There is a discount for membership in any of the frequent flyer clubs run by Sahara Airlines, too. A special discount is provided for car D and E if the customer has any insurance policy. Sahara encourages the customer for booking through Web and advance payment through credit card by allowing another discount. Sahara Car Rental desires to computerize the billing process for them so that the customer can get their car quickly and still be billed correctly. Draw a *decision table* that represents the *conditions*, *condition alternatives*, *actions* and *action rules*. 5

Note: Before giving an answer to a question, read the question many times until you understand the question. Then decide the points to be included in your answer and structure of the answer.

Indian Institute of Technology Kharagpur
School of Information Technology

IT 60105 : Information System Design
End-Semester Examination
Autumn Semester, Session 2005-2006

Full marks: 100 **Time: 03 hours**

Important Instructions
Attempt **ALL** questions.
Answers to all parts of a question should be placed together.
Answers should be brief and to-the-point. Unnecessary lengthy answer will be penalized.
Answers with examples are recommended.

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1. (a) Out of the following documents which document(s) is/are treated as legal document? Justify your answer.
   i) SRS (System Requirement Specification)
   ii) SPMP (Software Project Management & Planning)
   iii) SDD (System Design Document) 1+1

   (b) What is the objective of feasibility study during software development? Who are responsible for carrying out this study? 1+1

   (c) Point out the ambiguities or omissions in the following statement of requirements for a *ticket issuing system*.

   An automated ticket issuing system sells rail tickets. Users select their destinations and input a credit card and a PIN. The rail ticket is issued and their credit card account charged with its costs. When the user presses the start button, a menu display of potential destinations is activated along with a message to the user to select a destination. Once a destination has been selected users are requested to input their credit card. Its validity is checked and the user is requested to input a PIN. When the credit transaction is validated, the ticket is issued. 4

   (d) Three things identify an information system: technology, people and organization setting. If the *OfficeXP* pioneered by Microsoft Corporation Inc. is an information system then identify the above three things in it. 3

   (e) List six important things those have to be exercised during the project planning phase. 3

   (f) Which system design life cycle model best suits the project based on object-oriented design approach? Why? 1+1

   (g) Draw the PNR (Putnam-Nordan-Rayleigh) curve. What information can be obtained from it? 1+1

   (h) Give four reasons why COCOMO 81 is not sufficient to estimate the project with the current software engineering. 2

Please Turn Over

2. (a) While designing an information system, what are the main things that is focused during the following.
   i) High level design
   ii) Detail design 2+1

   (b) What are the main criteria you may fix to judge the goodness of a design? Assume that the design is based on the SA/SD approach. 2

   (c) Why high-fanin and low-fanout are always preferable in function-oriented design? 2

   (d) For what type of systems you should consider the function-oriented design approach? 1

   (e) Mention the possible things to be delivered or documented during the structured analysis (SA) and structured design phase. 2

   (f) How do you determine the number of columns (rules) a *decision table* should have? Support your answer with an example. 1+2

   (g) Give two main differences between the DFD (data flow diagram) and the flow chart. 2

   (h) In usual banking system, following are the pertinent information.

   There are two types of accounts: savings account and current account. One or more customers can hold an account. In case of a joint account, customer(s) either single or jointly is/are allowed to operate an account. A customer may have one or more accounts. A savings account should have minimum balance of Rs. 1000 and which further limits maximum amount in a transaction. On the other hand, a transaction in a current account is limited up to the availability of the balance. Maximum number of transactions permissible in savings account is three whereas there is no such upper limit in case of current bank account.

   As a task of system designer you have to decide suitable information base so that the above mentioned information can be processed. Give your idea. 5

3. (a) A language is specified by two constructs: *a set of alphabets* and *a grammar*. In that sense, is UML (Unified Modeling Language) strictly a language? 2

   (b) Mention the four major usefulness of UML in software engineering practices. 2

   (c) With suitable examples, explain the following concepts in UML.
   i) Association and multiplicity
   ii) Association versus aggregation
   iii) Specialization relation and hence inheritance and polymorphism 3×2

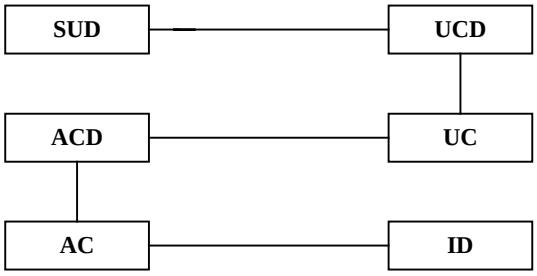
   (d) How two objects defined by a class can be differentiated from each other? 2

   (e) What do you mean by an *active object* and a *passive object*. Give an example in each case. 2+2

(f) In object-oriented design approach everything is in terms of objects. How a large (or complex) object can be decomposed? 2

(g) Give four *advantages of choosing* object-oriented design approach over the function-oriented design approach. 2

4. (a) Following is a partial UML diagram to represent some concepts in UML modeling.



Annotations:
SUD: System under design
UCD: Use case diagram
UC: Use case
ACD: Activity diagram
AC: Activity
ID: Interaction diagram

Fig. 1

Answer the following questions with reference to the above diagram.

i) What information roughly can be obtained from it? 1.5

ii) Identify each relation in the above diagram as association, aggregation or composition (redraw the revised diagram with your recommended relations) 1.5

iii) Apply the multiplicity which are appropriate in each relation (redraw the revised diagram with the multiplicity you suggest) 1.5

(b) Explain how the following three things can be incorporated into a sequence diagram.

i) Conditional interaction between two objects 1.5
ii) Recursive messaging 1.5
iii) Iterative message passing 1.5

(In each case you are advised to draw the relevant figure and explain your answer).

(c) Do you need to develop all the views of a system using all the UML modeling diagrams supported by UML? Justify your answer. 1+2

(d) Consider the collaboration as defined below in a bank ATM.

A customer wants to draw money from his bank account. He enters his card into an ATM (automated teller machine). The ATM machine prompts "*Enter PIN*". The customer enters his PIN. The ATM (internally) retrieves the bank account number from the card. The ATM encrypts the PIN and the account number and sends it over to the bank. The bank verifies the encrypted *Account* and *PIN* number. If the *PIN* number is correct, the ATM displays "*Enter amount*", draws money from the bank account and pays out the amount.

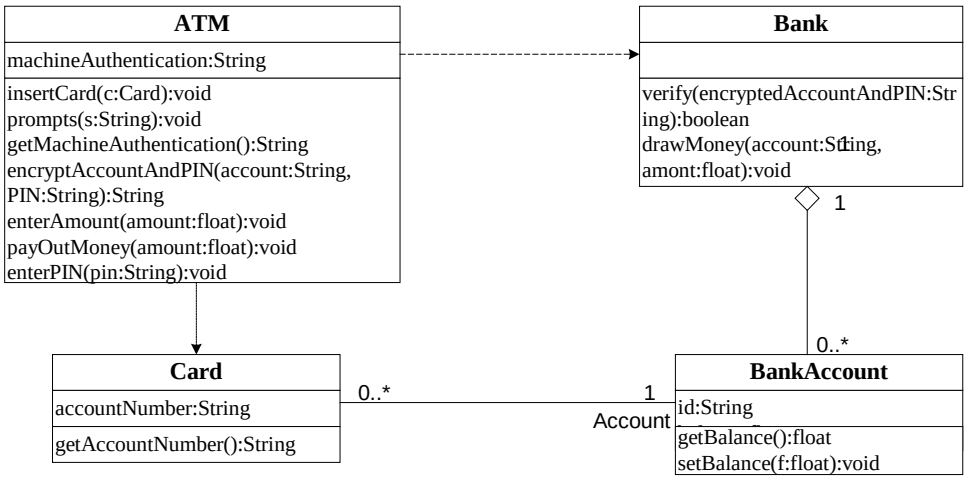


Fig. 2

i) Create a sequence diagram for the above collaboration. Use the classes and method as shown in the Fig. 2.

ii) Create a collaboration diagram of the same. 5+3

5. (a) Define validation and verification in quality assurance (QA) activity. What is the difference between the two? 2+2

(b) In which phase(s) of system design life cycle the *verification* takes place?

(c) *Black-box* testing and *White-box* testing are two different strategies of unit testing. Is only White-box testing not adequate to cover all faults? Justify your answer. 1+2

(d) Suppose, a test suite has been designed. How you can test its adequacy? 3

(e) Following is a routine in C programming language for searching an integer value from a stored sequence of integer values in an array of size 100, using the *Binary Search* method.

```
1.  int BinarySearch(int low, int high; int key)
2.  {
3.     if (low > high)
4.          return (-1);

5.      mid = (low+high)/2;

6.      if (key == A[mid]
7.            return (mid);
8.      if (key > A[mid]) {
9.           high = mid +1;
10.          BinarySearch(low, high, key);
11.    }
12.    if (key < A[mid]) {
13.       low = mid - 1;
14.       BinarySearch(low, high, key);
15.    }
16. }
```

(Ignore the typographic mistake(s), if any).

Answer the following questions.

i) Obtain the test cases to test all branches in the BinraySearch() routine. 3

ii) Draw the control-flow graph (CFG) of the BinarySearch() unit. 2

iii) Obtain all the basis paths in the CFG you have drawn and hence find the test cases that test all the basis paths. 2+3

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