2011-12
SECOND SEMESTER M.TECH EXAMINATION
(COMPUTER SCIENCE AND ENGINEERING)
SOFTWARE ENGINEERING-II
(CO-603)

Maximum Marks: 60
Duration: 3 Hours

"Students governed by the old ordinance will be examined out of 75 marks and their obtained marks shall be proportionately raised".

Attempt all questions
Symbols have their usual meanings
Assume appropriate data if missing

1.(a) List the four ‘P’s of software project management. Why is the order important? When team members combine the product and the process, what are the product functions that apply to each of the work activities performed? (6)

1.(b) List and briefly explain the metrics for the design model. How are these metrics different from those used within the analysis model? (6)

2.(a) Compute the function point value for a project with the following information domain characteristics:
Number of user inputs: 32
Number of user outputs: 60
Number of user inquiries: 24
Number of files: 8
Number of external interfaces: 2
Assume that all complexity adjustment values are average and each $F_i$ is rated as "absolutely essential" (highest rating) (6)

2.(b) Differentiate between public and private metrics and explain their respective roles. (6)

OR

2'(a) Discuss metrics used to assess software quality. Are these metrics based on LOCs? What do these metrics indicate? (6)

2'(b) Can the number of errors uncovered be used in itself as a metric for assessing the DRE? If not, then what additional measures

contd...
would have to be made in order convey the error removal efficiency of a software team.

3(a) During the course of development of a project, a risk identified is that 79% of the components will be obsolete by the time the product is released. The probability of risk is very high at 92%. Estimate the Risk Exposure (RE) if the total number of components being used is 80 and each component has 150 LOCs; with each LOC incurring an expenditure of $15.

3(b) Explain Risk Mitigation, Monitoring and Management (RMMM). Does it include Risk avoidance?

OR

3’(b) What is Risk Projection? List the four steps performed under Risk Projection. Is it an alternative to Risk Identification? If not, why?

4.(a) Draw the activity diagram for eliciting requirements. What does this diagram depict? Can it show the behavioural characteristics of the system under-development?

OR

4’.(a) Draw the use-case diagram for a home-security function. What is an “actor” and is it necessary for an “actor” to be depicted within a use-case diagram?

4.(b) Statistical SQA is applied to a complex project that was undertaken by a large software organization. After analysis, design, coding, testing, and release, the following data are gathered:

\[ E_i = \text{the total number of errors uncovered during the } i^{th} \text{ step in the software engineering process} = 139 \]

\[ S_i = \text{the number of serious errors} = 23 \]

\[ M_i = \text{the number of moderate errors} = 51 \]

\[ T_i = \text{the number of trivial errors} = 65 \]

\[ PS = \text{size of the product (LOC)} = 150,000 \]

Calculate the Phase Index at every step of the software

cont'd ... 3
development process if the weight factors are $w_s = 10$, $w_m = 3$, $w_t = 1$ during the analysis phase and each $w$ increase by a factor of 2 for every subsequent step.

5(a) Discuss the unified approach to object-oriented design. How is it different from a conventional design approach?

5(b) Define Black Box, State Box and Clear Box under Cleanroom method for software development. Draw a diagram showing the refinement approach adopted using box structure specification OR

5'(b) Define “re-engineering” when applied to software development. Draw a diagram explaining this paradigm. What activity is undertaken during “inventory analysis”? 
2011 – 2012
M.TECH. WINTER (II SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
OBJECT ORIENTED ANALYSIS AND DESIGN
(CO-604)
Max Marks : 60
Duration : Three Hours

Note: (i) “Students governed by the old ordinance will be examined out of 75 marks and their obtained marks shall be proportionately raised.”
(ii) Answer all questions.

1. (a) Construct class model from following informates. A railway network has several stations. Two stations are connected using railway track of some length. Railway track between a pair of station can be one of three kind – Broadgauge, meter gauge and Narrowgauge.
(b) How are active, passive and transient objects represented in sequence diagram? Explain using single example depicting the three kind of objects.
(c) Describe the order of execution of entry and exit activities while transitioning into or out of a nested state.

2. (a) Differentiate between operation and method. Give a realistic example to highlight the difference between operation and method.
(b) Construct state diagram for an audio/video player which stores audio/video files,
Audio/video player has following buttons-
ON/OFF : Switch ON/switch OFF player
MOVIE : Plays only video file
SONG : Plays only audio file
VOLUP : Increases volume
VOLDOWN : Decreases volume
NEXT : Plays next file
(c) Use case represents a piece of functionality. Therefore in use case generalization, a functionality is generalized to another functionality. What is the meaning of functionality being generalized to another functionality?

3. (a) List the steps that you would follow to construct application interaction model.
(b) Which of the following practice you will follow during modeling-
i) Using generalization to capture values of an enumerated attribute.
ii) folding attributes of an association into class.
iii) using association between company class & employee class instead of aggregation.
iv) Preferring super-classes to be abstract.

(c) Consider following use cases for library system. Prepare use case diagram and show appropriate relationship between use cases. You can add abstract parent in case of generalization-
i) Login     (ii) Book Return
iii) Calculate fine   (iv) Book issue to student
v) Book issue to faculty
vi) Check against limit of book that can be issued.

4. (a) What do bag and sequence represent? Give example of each.     04
(b) Differentiate between closed architecture and open architecture of layered system.     04
(c) How are sending and receiving of signal represented in activity model?     04

OR

4’. (a) How is concurrency within an object represented in its state diagrams. Give a realistic example.     04
(b) Describe the guidelines to discard unnecessary and incorrect association during domain analyses.     04
(c) What is visibility in class model? What are its possible values? Describe UML notation for representing visibility.     04

5. (a) Give example of followings-
i) Propagation of operations in class model
ii) Association class
(b) List the steps that you would follow to construct domain class model.     04
(c) Give sequence diagram for withdrawing money from ATM machine.     04

OR

5’. (a) What is a package? How is it represented?     04
(b) How are constraints represented in class model.     04
(c) Differentiate between domain analysis and application analysis.     04
“Students governed by the old ordinance will be examined out of 75 marks and their obtained marks shall be proportionately raised”.

1. Assume a suitable data, if not given.
2. Acronyms have their usual meanings.

Q1 (a) What are the characteristics of wireless links? With the help of suitable diagrams, discuss hidden terminal problem and fading.

(b) (i) Consider Code-Division Multiple Access (CDMA) for a single sender who is assigned an M-bit code \((1, -1, 1, -1, 1, 1, -1, -1)\), where \(M=8\). Assume that there are two data bits \(d_0 = -1, d_1 = 1\) to be sent in time slots 0 and time slot 1, respectively. Sketch the channel output at the sender side as well as at the receiver side.

(ii) Now consider that there are two sender-receiver pairs: (S1, R1) and (S2, R2). The first pair is allocated a code \((1, 1, 1, -1, 1, -1, -1, -1)\), and the second pair is allocated a code \((1, -1, 1, 1, 1, -1, 1, 1)\). Sketch the channel outputs at the sender side and at the receiver side. Write all intermediate steps and expressions used.

OR

1’ (a) What are the impacts of wireless nature of links and the mobility, on higher layer protocols, for example, TCP and UDP? Describe the approaches to deal with the problems arising due to TCP’s congestion control response in a wireless setting.

(b) What is meant by a handoff in GSM? With the help of suitable diagrams, describe the steps involved when a base station does decide to handoff a mobile user. What happens when the mobile moves to a base station (BS) that is associated with a different MSC than the old BS, and what happens when this inter-MSC handoff occurs more than once?

Q2 (a) Describe 802.11 MAC protocol. Why collision detection is not implemented in case of 802.11? How can one avoid collisions in the presence of hidden terminals in case of 802.11? Explain with the help of suitable diagrams.
(b) Suppose there are two ISPs providing Wi-Fi access in a particular café, with each ISP operating its own AP and having its own IP address block.

(i) Further suppose that by accident, each ISP has configured its AP to operate over channel 11. Will the 802.11 protocol completely breakdown in this situation? Discuss what happens when two stations, each associated with a different ISP, attempt to transmit at the same time.

(ii) Now suppose that one AP operates over channel 1 and other over channel 11.

Q3 (a) What are the elements of mobile network architecture? With the help of suitable diagrams, describe in detail the indirect and direct routing to a mobile node.

(b) Consider an indirect routing from a correspondent to a mobile user. Suppose that the correspondent is also mobile. Sketch the network layer infrastructure that would be needed to route the datagram from the correspondent to the mobile user, and from the mobile user to the now mobile correspondent. Use indirect routing.

OR

3’ (a) Describe agent discovery, registration with the home agent, and indirect routing of datagrams in case of Mobile IP.

(b) Consider two mobile nodes in a foreign network having a foreign agent. Is it possible for the two mobile nodes to use the same care-of-address in Mobile IP? Explain your answer.

(c) In Mobile IP, what effect will mobility have on end-to-end delays of datagrams between the source and destination?

Q4 (a) How jitter can be removed at the receiver for audio? Describe two playout strategies: fixed playout delay, and adaptive playout delay.

(b) Consider the adaptive playout delay scheme to estimate the network delays. Let \( d_i \) be an estimate of the average network delay upon reception of the \( i \)th packet, which is governed by the following expression.

\[
d_i = (1-u)d_{i-1} + u(r_i - t_i)
\]

where, \( t_i \) is the timestamp of the \( i \)th packet (i.e. the time the packet was generated by the sender), \( r_i \) is the time packet \( i \) is received by the receiver, and \( p_i \) is the time the packet is played at the receiver. Suppose that \( u = 0.1 \). Let \( r_i - t_i \) be the most recent sample delay, let \( r_i - t_i \), be the next most recent sample delay, and so on.
(i) For a given audio application, suppose four packets have arrived at the receiver with sample delays $r_4 - t_4$, $r_3 - t_3$, $r_2 - t_2$, and $r_1 - t_1$. Express the estimate of the delay $d$ in terms of the four samples.

(ii) Generalize your formula for the $n$ sample delays. 6

OR

4' (a) With the help of an appropriate diagram, describe setting up a call to a known IP address in case of Session Initiation Protocol (SIP). With the help of a suitable example, describe how name translation is carried out for a voice-over-IP session using SIP. 6

(b) Consider two forward error correction (FEC) schemes for Internet phone. The first scheme sends a redundant encoded chunk after every $n$ chunks. The second scheme sends a lower resolution audio stream as the redundant information. Suppose the first scheme generates a redundant chunk for every four original chunks. Suppose the second scheme uses a low-bit rate encoding whose transmission rate is 25% of the transmission rate of the nominal stream.

(i) How much additional bandwidth does each scheme require? How much playback delay does each scheme add?

(ii) How do the two schemes perform if the first packet is lost in every group of five packets? Which scheme will have better audio quality?

(iii) How do the two schemes perform if the first packet is lost in every group of two packets? Which scheme will have better audio quality? 6

Q5 (a) What do you understand by policing? What are the parameters used for policing? Discuss how one can combine leaky bucket with weighted fair queuing for provable maximum delay in a queue. 6

(b) Describe the key features of Intserv architecture. What are the difficulties associated with the Intserv model? How these difficulties are addressed in case of Diffserv model. 6
1. (a) What is Artificial Intelligence? What are the typical AI problems? Define an agent? What is rational Agent? Describe different agent environments.  
(b) Describe any four Agent architectures using suitable schematic diagram.

2. (a) What is the difference between uninformed search and informed search strategies?  
(b) Explain A* search using an example. Prove that A* is optimal if \( h(n) \) is an admissible heuristic.  

OR

2'. (a) Explain Resolution Inference rule in First Order Logic

(b) Why are representations so important in Artificial Intelligence? What risks are inherent using wrong representations? Explain the relationship between graphs, semantic nets, semantics trees, search space and search trees.

3. (a) Convert the following statements to expressions (formula) in first order logic
   1. John likes all kinds of food.
   2. Apples are food.
   3. Chicken is food.
   4. Anything anyone eats and isn’t killed by is food.
   5. Bill eats peanut and is still alive.

(b) Convert the formula of part (a) into CNF form (clauses)
(c) Prove that John likes peanuts using resolution.

OR

3'. Consider the following knowledge base.
\[
\forall x: \forall y: cat(x) \land fish(y) \rightarrow \text{likes-to-eat}(x,y)
\]
\[
\forall x: \text{calico}(x) \rightarrow \text{cat}(x)
\]
\[
\forall x: \text{tuna}(x) \rightarrow \text{fish}(x)
\]
\[
\text{tuna}(\text{Charlie})
\]
\[
\text{tuna}(\text{Herb})
\]
\[
\text{calico}(\text{Puss})
\]

(a) Convert the above w.f.f.'s into Horn clauses.
(b) Convert the Horn clauses into a PROLOG program.
(c) Write a PROLOG query corresponding to the question, “What does Puss like to eat?” and show how it will be answered by your program.
4. (a) What do you mean by back propagation in multi-layer neural network?
(b) For a back propagation training of neural network, derive the weight update rules for
   1. Final Layer and
   2. Intermediate or hidden layer

OR

4'. For the data given in the following table, show the first iteration in trying to compute
the membership value for the Input variable $X_1$ and $X_2$ in the output region $R^1$ and $R^2$. Use a $2 \times 3 \times 3 \times 2$ neural network.

<table>
<thead>
<tr>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$R^1$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>0.02</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Initial weights connecting elements in the layers in the network ($2 \times 3 \times 3 \times 2$) are

$$
\begin{array}{cccc}
W^1_{11} = 0.5 & W^2_{11} = 0.10 & W^2_{12} = 0.30 \\
W^1_{12} = 0.4 & W^2_{12} = 0.55 & W^2_{13} = 0.35 \\
W^1_{13} = 0.1 & W^2_{13} = 0.35 & W^2_{21} = 0.35 \\
W^1_{21} = 0.2 & W^2_{21} = 0.20 & W^2_{22} = 0.25 \\
W^1_{22} = 0.6 & W^2_{22} = 0.45 & W^2_{31} = 0.45 \\
W^1_{23} = 0.2 & W^2_{23} = 0.35 & W^2_{32} = 0.30 \\
W^1_{31} = 0.25 & & & \\
W^1_{32} = 0.15 & & & \\
W^1_{33} = 0.60 & & & \\
\end{array}
$$

5. (a) Explain Max-min compositional rule of inference. Let $R$ be a fuzzy relation between fuzzy sets $A$ and $B$ on Universe of Discourse $X$, $Y$ respectively.

$$
R = \begin{bmatrix}
    y_1 & y_2 & y_3 \\
x_1 & 0.1 & 0.2 & 0.3 \\
x_2 & 0.4 & 0.5 & 0.6 \\
x_3 & 0.7 & 0.8 & 0.9 \\
\end{bmatrix}
$$

Infer value of $B'$ using max-min composition for the following two values of $A'$

(i) \[ \left\{ \frac{0.1}{x_1} + \frac{0.5}{x_2} + \frac{1.0}{x_3} \right\} \]

(ii) \[ \left\{ \frac{0.2}{x_1} + \frac{0.6}{x_2} + \frac{0.4}{x_3} \right\} \]

(b) Describe Genetic Algorithm. Explain with an example.
(c) Explain Non-Monotonic Reasoning.