Maximum Marks: 60

Credits: 04

Duration: Three Hours

**Answer all the questions.**

**Assume suitable data if missing.**

**Notations used have their usual meaning.**

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Write brief answers for the following:</td>
<td>[12]</td>
</tr>
<tr>
<td></td>
<td>i) List the Umbrella activities in a process framework.</td>
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<td></td>
<td>ii) Write Hooker’s General Principles for Software Engineering</td>
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<td></td>
<td>iii) List Evolutionary Software Process Models</td>
<td></td>
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<td></td>
<td>iv) What is the Manifesto for Agile Software Development given by Beck?</td>
<td></td>
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<td></td>
<td><strong>OR</strong></td>
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<tr>
<td>1'</td>
<td>Clearly explain the Extreme Programming method of agile software development. What is pair programming and what are its advantages?</td>
<td>[12]</td>
</tr>
<tr>
<td>2(a)</td>
<td>Briefly describe the criteria for choosing agile development over plan driven approach.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>What are the main phases and features of Scrum? Clearly describe the sprint cycle.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(a)</td>
<td>List and briefly describe the guidelines for Agile Modeling.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(b)</td>
<td>Explain the phases of Adaptive Software Development (ASD).</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a)</td>
<td>List and very briefly explain the seven distinct tasks of Requirements Engineering.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Using the example of a prospective Secure Home system, illustrate all the components of requirements elicitation phase.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a)</td>
<td>What is Software Configuration Item?</td>
<td>[04]</td>
</tr>
<tr>
<td>4(b)</td>
<td>What is a Version? Briefly explain the concept of Version Control.</td>
<td>[04]</td>
</tr>
<tr>
<td>4(c)</td>
<td>What is a Baseline? How are Baselines verified?</td>
<td>[04]</td>
</tr>
</tbody>
</table>

Contd....2.
5(a) Compare and Contrast any TWO of the following:
   (i) Quality Control & Quality Assurance
   (ii) Conventional Design & Object Oriented Design
   (iii) Software Engineering & Software Re-Engineering

5(b) Explain the concept of Cost of Quality (CoQ) as a metric for Software Quality Assurance. Also, calculate the Cost of Quality from the time-sheet given below for a software development project:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Project-Activity</th>
<th>Hours Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Training</td>
<td>10-hours</td>
</tr>
<tr>
<td>2</td>
<td>Requirements Gathering</td>
<td>25-hours</td>
</tr>
<tr>
<td>3</td>
<td>Requirements Review</td>
<td>5-hours</td>
</tr>
<tr>
<td>4</td>
<td>Requirements Rework</td>
<td>6-hours</td>
</tr>
<tr>
<td>5</td>
<td>Coding</td>
<td>20-hours</td>
</tr>
<tr>
<td>6</td>
<td>Code Review</td>
<td>6-hours</td>
</tr>
<tr>
<td>7</td>
<td>Code Rework</td>
<td>2-hours</td>
</tr>
<tr>
<td>8</td>
<td>Testing</td>
<td>10-hours</td>
</tr>
<tr>
<td>9</td>
<td>Test Rework</td>
<td>5-hours</td>
</tr>
<tr>
<td>10</td>
<td>Implementation</td>
<td>18-hours</td>
</tr>
</tbody>
</table>
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.   Question                                                                                                        M.M.
1(a)   Construct class diagram based upon following description – Library keeps catalogue                           [06]
        of books which is indexed according to area and within an area, sorted based upon
        author name. Books are kept in racks which are accessible to its users.

1(b)   What is visibility of a feature in a class? What are its possible values? How is it represented in class diagram? Describe.

         OR

1'(a)  Construct class diagram based upon following description – Directory contains subdirectory and files. Each directory and file is owned by a user. Directories and files have read, write and execute permission for owner, users belonging to group of the owner, and other users

1'(b)  What is qualified association? Give two distinct examples of qualified association.

2(a)   Give a realistic examples for each of the followings –
        • Propagation of operations
        • Reification

2(b)   What is enumeration? Give a realistic example of enumeration.

3(a)   How can signal be organised using generalisation? Take an example to explain.

3(b)   Describe as to how concurrency within an object is represented in its state diagram.
3'(a) Construct state diagram for a device whose description is as given below — 

The device has three buttons X, Y and Z and three lights Red, Blue and Green. Pressing Z puts on lights according to following – i) Immediately after power on, Pressing Z puts on Red light only. ii) Pressing X followed by Z, puts on Green light only. iii) Pressing Y followed by Z, puts on Blue light only. iv) Any other combination is ignored by the device.

3'(b) Differentiate among signal event, change event and time event. Take suitable example to explain.

4(a) Construct sequence diagram for purchasing an item from an automatic vending machine.

4(b) Give example of a use case diagram covering include, extend and generalization relation. Briefly describe your diagram.

5(a) List steps for constructing domain class model.

5(b) How is use case identified? Describe guidelines in this regard.
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meanings.

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

Q.No. | Question | M.M.
---|---|---
1(a) | What are the characteristics of wireless links? With the help of suitable diagrams, discuss hidden terminal problem, exposed terminal problem, and fading. | [05]
1(b) | Consider the following two cases in case of Code-Division Multiple Access (CDMA).
(i) Let there be a single sender who is assigned an M-bit code (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.
(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(s) side(s) as well as at the receiver(s) side(s) in both the cases. Write all intermediate steps and the expressions used.

OR

1'(a) | Describe 802.15 used in Wireless Personal Area Networks (WPAN). Draw a diagram showing an 802.15 piconet. | [04]
1'(b) | What is meant by a handoff in GSM? With the help of suitable diagrams, describe . | [08]
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?

2(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.

2(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.

3(a) With the help of suitable diagrams, describe mobility management in cellular networks including (i) how calls are routed to a mobile user, and (ii) how handoffs are carried out in GSM.

OR

3(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.

3(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.
4(a) How jitter can be removed at the receiver for audio? Describe two playout strategies: fixed playout delay, and adaptive playout delay.

4(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 \( r_1 - t_1 \) be the most recent sample delay, let \( r_2 - t_2 \) 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.

OR

4(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?

5(a) With the help of suitable diagrams, describe Content Distribution Networks (CDNs).

5(b) What is meant by policing? What are the parameters used for policing? With the help of a suitable diagram, describe Weighted Fair Queuing (WFQ). Discuss how one can combine leaky bucket with WFQ for provable maximum delay in a queue.
Question 1 is compulsory and answer any four from the remaining questions. Assume suitable data if missing. Notations used have their usual meaning.

Q.No.  Question  
1(a)  What is the key difference between I-Frames, P-Frames and B-Frames? [03]  
1(b)  Explain why lossy data compression is sometimes preferred over lossless. [03]  
1(c)  What features of MIDI make it suitable for use in the MPEG-4 audio compression standard? [03]  
1(d)  List the limitations of workstation operating systems for multimedia communication. [03]  

Answer any four from the remaining questions

2  Briefly describe five ways in which content can be formatted and delivered in a Multimedia System [12]  

3  In MPEG audio compression, what is  
i. frequency masking? [12]  
ii. temporal masking?  
Briefly describe the cause of each kind of masking in the human auditory system?  

4  List the different colour models that are often used in different applications. What is the CMYK colour model? Give an application in which this colour model is mostly used and explain the reason. [12]  

contd...2
5 Consider the following block of frequency domain values from a video frame arising during MPEG compression:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>196</td>
<td>207</td>
<td>1</td>
<td>129</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>129</td>
<td>199</td>
</tr>
<tr>
<td>1</td>
<td>73</td>
<td>73</td>
<td>194</td>
</tr>
<tr>
<td>75</td>
<td>78</td>
<td>139</td>
<td>135</td>
</tr>
</tbody>
</table>

Apply successively to this block: (i) MPEG quantisation using a constant quantisation value of 64. (ii) Zig-zag scanning. (iii) Run length encoding.

6 What are the requirements of communication system associated with multimedia applications?

7 With the aid of diagrams, describe the following digitization formats:
   i. 4:2:0
   ii. SIF
   iii. CIF
Question

1 Attempt any three parts.
   1(a) Differentiate between star and snowflake schema. Consider a data-warehouse consisting of three dimensions time, doctor and patient. There are two measures- count and charge. Count is number of patients for a doctor and charge is the fee of a doctor. Design a star schema design for this data-warehouse.
   1(b) What is a data warehouse? Why a separate data warehouse in enterprises is required besides database?
   1(c) Briefly explain each major task in data preprocessing.
   1(d) What are concept hierarchies? Explain using suitable example. Describe why are they useful in data mining?

2 Attempt any three parts.
   2(a) Write and explain the a-priori algorithm. Find all the frequent item-sets for the following transaction database using a-priori algorithm. Assume minimum support to be 50%.

<table>
<thead>
<tr>
<th>TID</th>
<th>Items Bought</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>{K,A,D,B}</td>
</tr>
<tr>
<td>T2</td>
<td>{D,A,C,B,E}</td>
</tr>
<tr>
<td>T3</td>
<td>{C,A,B,E}</td>
</tr>
<tr>
<td>T4</td>
<td>{B,A,D}</td>
</tr>
</tbody>
</table>
2(b) Explain the following terms in context of classification:
Training set, accuracy, precision, sensitivity, specificity [05]

2(c) Briefly explain BIRCH clustering algorithm. State its advantages and disadvantages. [05]

2(d) What are the main goals in time series data mining? What types of movements are used to characterize a time series? Explain each. [05]

3 Attempt any two parts. [15]

3(a) In what way, Web mining differs from classical data mining? Draw the block diagram to demonstrate Web search engine architecture and discuss the different components of a search engine. [7.5]

3(b) Write down the PageRank algorithm. What do you mean by Google's Monkey? Explain its importance in PageRank algorithm. [7.5]

3(c) Discuss the importance of Data preprocessing in Web usage mining. Draw the block diagram of data preparation phase of Web usage mining process and discuss each module in detail. [7.5]

4 Attempt any two parts. [15]

4(a) Name and discuss the difficulties of the keyword-based retrieval. Also, discuss the preprocessing tasks performed in the keyword-based retrieval systems. [7.5]

4(b) What is social networking? List and describe different applications of social networking. [7.5]

4(c) Name a few commercial and academic CBIR systems. Draw the block diagram of a CBIR system and discuss. [7.5]