



**JEPPIAAR INSTITUTE OF TECHNOLOGY**

**Self Belief | Self Discipline | Self Respect**



## **QUESTION BANK**

**REGULATION :2017**

**YEAR : III**

**SEMESTER : 06**

**BATCH : 2017-2021**

**DEPARTMENT**

**OF**

**INFORMATION TECHNOLOGY**



## **JEPPIAAR INSTITUTE OF TECHNOLOGY**

**“Self-Belief | Self Discipline | Self Respect”**



### **INSTITUTION VISION**

Jeppiaar Institute of Technology aspires to provide technical education in futuristic technologies with the perspective of innovative, industrial and social application for the betterment of humanity.

### **INSTITUTIONMISSION**

- To produce competent and disciplinedhigh quality professionals with the practical skills necessary to excel as innovative professionals and entrepreneurs for the benefit of the society.
- To improve the quality of education through excellence in teaching and learning, research, leadership and by promoting the principles of scientific analysis, and creative thinking.
- To provide excellent infrastructure, serene and stimulating environment that is most conducive to learning.
- To strive for productive partnership between the Industry and the Institute for research and development in the emerging fields and creating opportunities for employability.
- To serve the global community by instilling ethics, values and life skills among the students needed to enrich their lives.



## **JEPPIAAR INSTITUTE OF TECHNOLOGY**

**“Self-Belief | Self Discipline | Self Respect”**



### **DEPARTMENT VISION**

To facilitate the evolution of problem solving skills along with knowledge application in the field of Information Technology, understanding industrial and global requirements for the benefit of the society.

### **DEPARTMENT MISSION**

- To produce creative and productive computing graduates in software development being aware of global requirements and maximize employability.
- To enhance evolution of professional skills and development of leadership traits among the students to grow into successful entrepreneurs.
- To offer students an advantageous infrastructure to apply their research thoughts and develop their technical expertise .
- To escalate the moral code and honesty in the professional activities.

### **Program Educational Objectives (PEOs)**

**PEO1:** To provide students with a fundamental knowledge in Science, mathematics and computing skills for creative and innovative application.

**PEO2:** To enable students competent and employable by providing excellent Infrastructure to learn and contribute for the welfare of the society.

**PEO3:** To channelize the potentials of the students by offering state of the art amenities to undergo research and higher education.

**PEO4:** To evolve computing engineers with multi-disciplinary understanding and maximize Job Opportunities.

**PEO5:** To facilitate students obtain profound understanding nature and social requirements and grow as professionals with values and integrity.

### **Program Specific Outcomes (PSOs)**

**PSO 1:** To create the ability to analyze and enhance coding skills by participating in various competitions.

**PSO 2:** Students are able to provide solutions for Social Problems by creating Mobile Application Development using Android Studio and Chatbot.

**PSO 3:** Students are able to deal with real time problems using Machine Learning Tools and Big data Analytics.

## BLOOM'S TAXONOMY

### **Definition:**

**Bloom's taxonomy** is a classification system used to define and distinguish different levels of human cognition like thinking, learning, and understanding.

### **Objectives:**

- To classify educational learning objectives into levels of complexity and specificity.  
The classification covers the learning objectives in cognitive, affective and sensory domains.
- To structure curriculum learning objectives, assessments and activities.

### **Levels in Bloom's Taxonomy:**

- **BTL 1 – Remember** - The learner recalls, restate and remember the learned information.
- **BTL 2 – Understand** - The learner embraces the meaning of the information by interpreting and translating what has been learned.
- **BTL 3 – Apply** - The learner makes use of the information in a context similar to the one in which it was learned.
- **BTL 4 – Analyze** - The learner breaks the learned information into its parts to understand the information better.
- **BTL 5 – Evaluate** - The learner makes decisions based on in-depth reflection, criticism and assessment.
- **BTL 6 – Create** - The learner creates new ideas and information using what has been previously learned.

## TABLE OF CONTENTS

<b>IT8601 COMPUTATIONAL INTELLIGENCE</b>		
<b>Unit No.</b>	<b>Topic</b>	<b>Page No.</b>
	<b>Syllabus</b>	<b>1.1</b>
I	<b>Introduction</b>	<b>1.11</b>
II	<b>Knowledge Representation and Reasoning</b>	<b>1.21</b>
III	<b>Uncertainty</b>	<b>1.34</b>
IV	<b>Learning</b>	<b>1.43</b>
V	<b>Intelligence and Applications</b>	<b>1.52</b>
<b>CS8592 OBJECT ORIENTED ANALYSIS AND DESIGN</b>		
	<b>Syllabus</b>	<b>2</b>
I	<b>Human Values</b>	<b>2.1</b>
II	<b>Engineering Ethics</b>	<b>2.8</b>
III	<b>Engineering and Social Experimentation</b>	<b>2.15</b>
IV	<b>Safety, Responsibility and Rights</b>	<b>2.22</b>
V	<b>Global Issues</b>	<b>2.43</b>
<b>IT8602 MOBILE COMMUNICATION</b>		
	<b>Syllabus</b>	<b>3.1</b>
I	<b>Network Layer Security and Transport Layer Security</b>	<b>3.3</b>
II	<b>E-Mail Security and Firewalls</b>	<b>3.13</b>
III	<b>Introduction to Computer Forensics</b>	<b>3.23</b>
IV	<b>Evidence collection and Forensic Tools</b>	<b>3.33</b>
V	<b>Analysis and Validation</b>	<b>3.43</b>
<b>IT8091 BIG DATA ANALYSIS</b>		
	<b>Syllabus</b>	<b>4.1</b>
I	<b>Introduction to Big Data</b>	<b>4.4</b>

<b>II</b>	<b>Clustering and Classification</b>	<b>4.15</b>
<b>III</b>	<b>Association and Recommendation System</b>	<b>4.23</b>
<b>IV</b>	<b>Stream Memory</b>	<b>4.29</b>
<b>V</b>	<b>NOSQL Data Management for Big Data and Visualization</b>	<b>4.33</b>

### **CS8092 COMPUTER GRAPHICS AND MULTIMEDIA**

	<b>Syllabus</b>	<b>5.1</b>
<b>I</b>	<b>Illumination and Color Models</b>	<b>5.3</b>
<b>II</b>	<b>Two Dimensional Graphics</b>	<b>5.8</b>
<b>III</b>	<b>Three Dimensional Graphics</b>	<b>5.14</b>
<b>IV</b>	<b>Multimedia System Design and Multimedia File Handling</b>	<b>5.21</b>
<b>V</b>	<b>Hypermedia</b>	<b>5.29</b>

### **IT8076 SOFTWARE TESTING**

	<b>Syllabus</b>	<b>6.1</b>
<b>I</b>	<b>Introduction</b>	<b>6.2</b>
<b>II</b>	<b>Test Case Design Strategies</b>	<b>6.10</b>
<b>III</b>	<b>Levels of Testing</b>	<b>6.16</b>
<b>IV</b>	<b>Test Management</b>	<b>6.24</b>
<b>V</b>	<b>Test Automation</b>	<b>6.30</b>

<b>IT8601</b>	<b>COMPUTATIONAL INTELLIGENCE</b>	<b>L T P C 3 0 0 3</b>
<b>OBJECTIVES:</b>		
<ul style="list-style-type: none"> <li>• To provide a strong foundation on fundamental concepts in Computational Intelligence.</li> <li>• To enable Problem-solving through various searching techniques.</li> <li>• To apply these techniques in applications which involve perception, reasoning and learning.</li> <li>• To apply Computational Intelligence techniques for information retrieval</li> <li>• To apply Computational Intelligence techniques primarily for machine learning.</li> </ul>		
<b>UNIT I INTRODUCTION</b>		<b>9</b>
Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing- Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining-Genetic Algorithms.		
<b>UNIT II KNOWLEDGE REPRESENTATION AND REASONING</b>		<b>9</b>
Proposition Logic - First Order Predicate Logic – Unification – Forward Chaining -Backward Chaining - Resolution – Knowledge Representation - Ontological Engineering - Categories and Objects – Events – Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - Prolog Programming.		
<b>UNIT III UNCERTAINTY</b>		<b>9</b>
Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.		
<b>UNIT IV LEARNING</b>		<b>9</b>
Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables - The EM Algorithm – Reinforcement Learning		
<b>UNIT V INTELLIGENCE AND APPLICATIONS</b>		<b>9</b>
Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AI applications Language Models - Information Retrieval – Information Extraction - Machine Translation – Machine Learning		
Symbol-Based – Machine Learning: Connectionist – Machine Learning.		
<b>TOTAL: 45 PERIODS</b>		
<b>OUTCOMES:</b> Upon completion of the course, the students will be able to		
<ul style="list-style-type: none"> <li>• Provide a basic exposition to the goals and methods of Computational Intelligence.</li> <li>• Study of the design of intelligent computational techniques.</li> <li>• Apply the Intelligent techniques for problem solving</li> <li>• Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning.</li> </ul>		
<b>TEXT BOOKS:</b> 1. Stuart Russell, Peter Norvig, —Artificial Intelligence: A Modern Approach—, Third Edition, Pearson Education / Prentice Hall of India, 2010.		
2. Elaine Rich and Kevin Knight, —Artificial Intelligence—, Third Edition, Tata McGraw-Hill, 2010.		
<b>REFERENCES:</b> 1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.		
2. Dan W.Patterson, —Introduction to Artificial Intelligence and Expert Systems—, PHI, 2006. 3. Nils J. Nilsson, —Artificial Intelligence: A new Synthesis—, Harcourt Asia Pvt. Ltd.,		

SubjectCode:IT8601

Subject Name: COMPUTATIONAL INTELLIGENCE

Year/Semester:III/06

Subject Handler:Mr.N.Prabhakaran

## UNIT -1- INTRODUCTION

**Introduction to Artificial Intelligence-Search-Heuristic Search-A\* algorithm-Game Playing- Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.**

### PART – A

Q.N O	QUESTIONS
1.	<p><b>What is artificial intelligence? BTL1</b>  The exciting new effort to make computers think machines with minds in the full and literal sense. Artificial intelligence systemizes and automates intellectual tasks and is therefore potentially relevant to any sphere of human intellectual activities.</p>
2.	<p><b>Define Turing test. BTL1</b>  The Turing test proposed by Alan Turing was designed to provide a satisfactory operational definition of intelligence. Turing defined intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to fool an interrogator.</p>
3.	<p><b>List the capabilities that a computer should possess for conducting a Turing Test. BTL1</b>  The capabilities that a computer should possess for conducting a Turing Test are,</p> <ul style="list-style-type: none"> <li>✓ Natural Language Processing;</li> <li>✓ Knowledge Representation;</li> <li>✓ Automated Reasoning;</li> <li>✓ Machine Language.</li> </ul>
4.	<p><b>Define an agent. BTL1</b>  An agent is anything that can be viewed as perceiving its environment through sensors and acting upon the environment through effectors.</p>
5.	<p><b>Define rational agent. (DEC 2011) (APRIL/MAY 2015)BTL1</b>  A rational agent is one that does the right thing. Here right thing is one that will cause agent to be more successful. That leaves us with the problem of deciding how and when to evaluate the agent's success.</p>
6.	<p><b>Define an Omnipotent agent. BTL1</b>  An omnipotent agent knows the actual outcome of its action and can act accordingly; but omniscience is impossible in reality.</p>
7.	<p><b>What are the factors that a rational agent should depend on at any given time? BTL2</b>  The factors that a rational agent should depend on at any given time are,</p> <ul style="list-style-type: none"> <li>✓ The performance measure that defines criterion of success;</li> <li>✓ Agent's prior knowledge of the environment;</li> <li>✓ Action that the agent can perform;</li> <li>✓ The agent's percept sequence to date.</li> </ul>

8.	<p><b>List the measures to determine agent's behavior.</b> BTL1</p> <p>The measures to determine agent's behavior are,</p> <ul style="list-style-type: none"> <li>✓ Performance measure,</li> <li>✓ Rationality,</li> <li>✓ Omniscience,</li> <li>✓ Learning and</li> <li>✓ Autonomy.</li> </ul>
9.	<p><b>Recognise the various types of agent programs.</b> (DEC 2012) BTL1</p> <p>The various types of agent programs are,</p> <ul style="list-style-type: none"> <li>✓ Simple reflex agent program;</li> <li>✓ Agent that keep track of the world;</li> <li>✓ Goal based agent program;</li> <li>✓ Utility based agent program.</li> </ul>
10.	<p><b>Name the components of a learning agent.</b> BTL1</p> <p>The components of a learning agent are,</p> <ul style="list-style-type: none"> <li>✓ Learning element;</li> <li>✓ Performance element;</li> <li>✓ Critic;</li> <li>✓ Problem generator.</li> </ul>
11.	<p><b>List out some of the applications of Artificial Intelligence.</b> BTL1</p> <p>Some of the applications of Artificial Intelligence are,</p> <ul style="list-style-type: none"> <li>✓ Autonomous planning and scheduling;</li> <li>✓ Game playing;</li> <li>✓ Autonomous control;</li> <li>✓ Diagnosis;</li> <li>✓ Logistics planning;</li> <li>✓ Robotics.</li> </ul>
12.	<p><b>What is depth-limited search?</b> BTL1</p> <p>Depth-limited avoids the pitfalls of DFS by imposing a cut off of the maximum depth of a path. This cutoff can be implemented by special depth limited search algorithm or by using the general search algorithm with operators that keep track of the depth.</p>
13.	<p><b>Define breadth-first search.</b> BTL1</p> <p>The breadth-first search strategy is a simple strategy in which the root-node is expanded first, and then all the successors of the root node are expanded, then their successors and so on. It is implemented using TREE-SEARCH with an empty fringe that is a FIFO queue, assuring that the nodes that are visited first will be expanded first.</p>
14.	<p><b>Describe problem formulation.</b> BTL1</p> <p>Problem formulation is the process of deciding what actions and states to consider for a goal that has been developed in the first step of problem solving.</p>
15.	<p><b>List the four components of a problem.</b> BTL1</p> <p>The four components of a problem are,</p> <ul style="list-style-type: none"> <li>✓ An initial state;</li> <li>✓ Actions;</li> <li>✓ Goal test;</li> <li>✓ Path cost.</li> </ul>
16.	<p><b>Define iterative deepening search.</b> BTL1</p> <p>Iterative deepening is a strategy that sidesteps the issue of choosing the best depth limit by trying all possible depth limits: first depth 0, then depth 1, then depth 2&amp; so on.</p>

17.	<p><b>Mention the criteria's for the evaluation of search strategy.(MAY/JUNE 2014) BTL2</b></p> <p>The criteria's for the evaluation of search strategy are,</p> <ul style="list-style-type: none"> <li>✓ Completes;</li> <li>✓ Time;</li> <li>✓ complexity;</li> <li>✓ Space complexity;</li> <li>✓ Optimality.</li> </ul>
18.	<p><b>Define the term percept. BTL1</b></p> <p>The term percept refers to the agents perceptual inputs at any given instant. An agent's percept sequence is the complete history of everything that the agent has perceived.</p>
19.	<p><b>What is Constraint Satisfaction Problem. BTL2</b></p> <p>A constraint satisfaction problem is a special kind of problem satisfies some additional structural properties beyond the basic requirements for problem in general. In a CSP, the states are defined by the values of a set of variables and the goal test specifies a set of constraint that the value must obey.</p>
20.	<p><b>List some of the uninformed search techniques. BTL1</b></p> <p>Some of the uninformed search techniques are,</p> <ul style="list-style-type: none"> <li>✓ Breadth-First Search(BFS);</li> <li>✓ Depth-First Search(DFS);</li> <li>✓ Uniform Cost Search;</li> <li>✓ Depth Limited Search;</li> <li>✓ Iterative Deepening Search;</li> <li>✓ Bidirectional Search.</li> </ul>
21.	<p><b>Define Abstraction. (May 2012) BTL1</b></p> <p>Abstraction is the process by which data and programs are defined with a representation similar in form to its meaning (semantics), while hiding away the implementation details. Abstraction tries to reduce and factor out details so that the programmer can focus on a few concepts at a time. A system can have several abstraction layers whereby different meanings and amounts of detail are exposed to the programmer. For example, low-level abstraction layers expose details of the computer hardware where the program run, while high-level layers deal with the business logic of the program.</p>
22.	<p><b>What does Software Agent mean? (NOV/DEC 2013) BTL1</b></p> <p>A software agent is a piece of software that functions as an agent for a user or another program, working autonomously and continuously in a particular environment. It is inhibited by other processes and agents, but is also able to learn from its experience in functioning in an environment over a long period of time.</p>
23.	<p><b>Define the effect of heuristic accuracy on performance.(NOV/DEC 2013) BTL1</b></p> <p>A heuristic is a method that might not always find the best solution but is guaranteed to find a good solution in reasonable time.</p> <p>By sacrificing completeness it increases efficiency. Useful in solving tough problems which could not be solved any other way. Solutions take an infinite time or very long time to compute. The classic example of heuristic search methods is the travelling salesman problem.</p>
24.	<p><b>Give the structure of an agent. (MAY/JUNE 2014) BTL1</b></p> <pre> graph TD     Agent[Agent] -- "sensors" --&gt; World["What the world is like now"]     World --&gt; Action["What action I should do now"]     Action --&gt; Effectors[Effectors]     Env[Environment] &lt;--&gt; Action   </pre>

25.	<p><b>Justify ,why problem formulation should follow goal formulation ?(APRIL/MAY 2015) BTL5</b></p> <p>In goal formulation, we decide which aspects of the world we are interested in, and which can be ignored or abstracted away. Then in problem formulation we decide how to manipulate the important aspects (and ignore the others). If we did problem formulation first we would not know what to include and what to leave out. That said, it can happen that there is a cycle of iterations between goal formulation, problem formulation, and problem solving until one arrives at a sufficiently useful and efficient solution.</p>
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### PART - B

1. i) How did you describe PEAS description for at least four agent types? (7M) BTL1  
ii) How did you describe PEAS? (6M) BTL1

Answer:Page. 4-Elaine Rich

Agent Type	Performance Measure	Environment	Actuators	Sensors
Medical diagnosis system	Healthy patient, minimize costs, lawsuits	Patient, hospital, staff	Display questions, tests, diagnoses, treatments, referrals	Keyboard entry of symptoms, findings, patient's answers
Satellite image analysis system	Correct image categorization	Downlink from orbiting satellite	Display categorization of scene	Color pixel arrays
Part-picking robot	Percentage of parts in correct bins	Conveyor belt with parts, bins	Jointed arm and hand	Camera, joint angle sensors
Refinery controller	Maximize purity, yield, safety	Refinery, operators	Valves, pumps, heaters, displays	Temperature, pressure, chemical sensors

(7M)

PEAS description

- ✓ Performance Measure – measuring the performances (2M)
- ✓ Environment – the environment for the agent to act in (2M)
- ✓ Actuators – the agent act through the actuators (1M)
- ✓ Sensors – the agent perceives through the sensor (1M)

- 2 Explain in detail any of the four agent structure (or)

Describe in detail about the following:

- i) Simple reflex agent.(3M)
- ii) Model based agent.(3M)
- iii) Utility based agent.(3M)
- iv) Goal based agent(4M)(Dec 2012) BTL1

Answer:Page. 18-Elaine Rich

The various types of agent programs are,

- ✓ Simple reflex agent program; (1M)

	<ul style="list-style-type: none"> <li>✓ Diagram (1M)</li> </ul> <p>function SIMPLE-REFLEX-AGENT(percept) returns an action Static: rules, a set of condition – action rules</p> <pre> State &lt;- INTERPRET – INPUT (Percept) Rule &lt;- RULE-MATCH (STATE, RULES) Action &lt;- RULE-ACTION[rule] return action </pre> <ul style="list-style-type: none"> <li>✓ Model based reflex agent; (2M)</li> <li>✓ Diagrams (2M)</li> </ul> <p><b>function REFLEX-AGENT-WITH-STATE(<i>percept</i>) returns an action</b></p> <p><b>static:</b> <i>state</i>, a description of the current world state  <i>rules</i>, a set of condition-action rules  <i>action</i>, the most recent action, initially none</p> <pre> state ← UPDATE-STATE(state, action, percept) rule ← RULE-MATCH(state, rules) action ← RULE-ACTION[rule] return action </pre> <ul style="list-style-type: none"> <li>✓ Goal based agent program; (2M)</li> <li>✓ Diagram (2M)</li> <li>✓ Utility based agent program. (2M)</li> <li>✓ Diagram (1M)</li> </ul>
3	<b>Explain in detail Model based reflex agent.(13M) (May 2012) BTL2</b> <b>Answer:Page. 18-Elaine Rich</b> Diagram (3M)
	Algorithm (5M) <pre> function REFLEX-AGENT-WITH-STATE(<i>percept</i>) returns an action static: <i>state</i>, a description of the current world state <i>rules</i>, a set of condition-action rules <i>action</i>, the most recent action, initially none  <i>state</i> ← UPDATE-STATE(<i>state</i>, <i>action</i>, <i>percept</i>) <i>rule</i> ← RULE-MATCH(<i>state</i>, <i>rules</i>) <i>action</i> ← RULE-ACTION[<i>rule</i>] return <i>action</i> </pre>
4	Explanation - it keeps track of the current state of the world-using an internal model- then it chooses and action – as reflex agent (5M) <b>Inference the Goal based reflex agent.(13M) (May 2012) BTL2</b> <b>Answer:Page. 18-Elaine Rich</b> Diagram (3M)

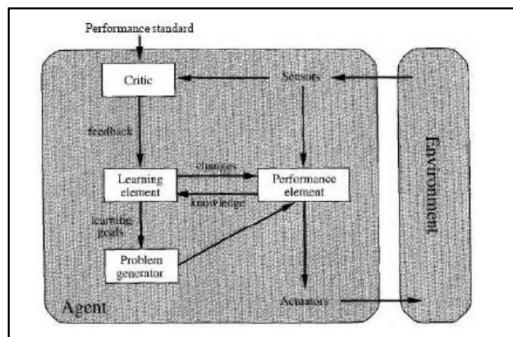
	<p><b>Algorithm</b> (5M)</p> <p>Explanation -it keeps track of the world state as well as a set of goals it is trying to achieve and chooses an action that will eventually lead to the achievement of the goal. (5M)</p>
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5 **Explain in detail learning agent .(13M) (May 2013)BTL2**

**Answer:Page. 18-Elaine Rich**

Diagram

(5M)



**Explanation**

A learning agent can be divided into four conceptual components

- ✓ Element responsible for making improvements (2M)
- ✓ performance element, which is responsible for selecting external actions. (2M)
- ✓ The learning element (2M)
- ✓ CRITICfeedback from the critic on how the agent is doing and determines how the performance element should be modified to do better in the future. (2M)

6 **Summarize depth-First search .(13M) (May 2012)BTL2**

**Answer:Page. 160-Elaine Rich**

- ✓ Explanation - extends the current path as far as possible before backtracking (5M)
- ✓ Algorithm (5M)
- ✓ Working – example diagram (3M)

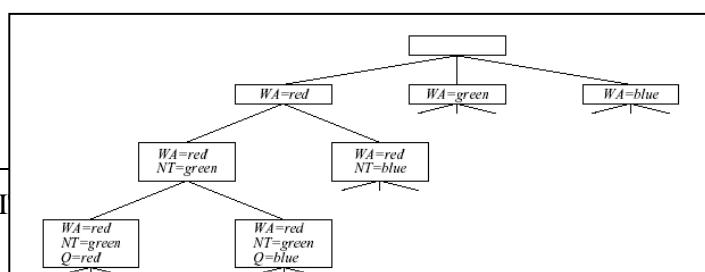
7 **Define CSP and Discuss about backtracking search for CSPs.(13M) (APRIL/MAY 2015)BTL2**

**Answer:Page. 68-Elaine Rich**

Types explanation -A Constraint Satisfaction Problem(or CSP) is defined by a set of variables , $X_1, X_2, \dots, X_n$ ,and a set of constraints  $C_1, C_2, \dots, C_m$ . Each variable  $X_i$  has a nonempty domain  $D_i$ , of possible values.

Each constraint  $C_i$  involves some subset of variables and specifies the allowable combinations of values for that subset (5M)

Working flow (3M)



	<p>Explanation- CSP can be viewed as a standard search problem as follows :</p> <ul style="list-style-type: none"> <li>✓ Initial state : the empty assignment { },in which all variables are unassigned.</li> <li>✓ Successor function : a value can be assigned to any unassigned variable,provided that it does not conflict with previously assigned variables.</li> <li>✓ Goal test : the current assignment is complete.</li> <li>✓ Path cost : a</li> </ul>	(5M)
8	<p><b>Interpret the uninformed search strategies.(13M) (May/June2009)BTL2</b></p> <p><b>Answer:Page. 57-Elaine Rich</b></p> <p>Introduction</p> <ul style="list-style-type: none"> <li>✓ No additional information</li> <li>✓ beyond that provided in the</li> <li>✓ problem definition</li> <li>✓ Not effective</li> <li>✓ No information about number of steps or path cost</li> </ul> <ul style="list-style-type: none"> <li>✓ Breath first search</li> <li>✓ Depth first search</li> <li>✓ Depth limited search</li> <li>✓ Iterative deepening search</li> <li>✓ Bi directional search</li> </ul>	(3M)
9	<p><b>Summarize in detail about production system characteristics. (13M) BTL2</b></p> <p><b>Answer : Page :</b></p> <p>Explanation – it is the good way to describe the operation</p> <ul style="list-style-type: none"> <li>✓ Monotonic production system</li> <li>✓ Non monotonic production system</li> <li>✓ Partially commutative system</li> <li>✓ Commutative production system</li> <li>✓ Non monotonic partially commutative system</li> <li>✓ Production systems not partially commutative</li> </ul>	(1M)
10	<p><b>Discuss about the following:</b></p> <p>i) <b>Greedy best-first search. (4M)</b></p> <p>ii) <b>A* search .(4M)</b></p> <p>iii) <b>Memory bounded heuristic search. (5M) BTL2</b></p> <p><b>Answer:Page. 166-Elaine Rich</b></p> <p><b>Greedy best-first search.</b></p> <p>Explanation</p> <p>Working</p> <p><b>A* search</b></p> <p>Explanation</p> <p>Working</p> <p><b>Memory bounded heuristic search</b></p> <p>Explanation</p>	(2M)

	Working	(3M)
11	<p>i) Solve any two Informed Search Strategies with an example. (7M) (May/June 2016) BTL3  ii) Explain the algorithm for generate and test simple hill climbing. (6M) (May/June 2016) BTL2</p> <p><b>Answer:</b>Page. 52-Elaine Rich</p> <p><b>Informed Search Strategies</b></p> <ul style="list-style-type: none"> <li>✓ Heuristic search (1M)</li> <li>✓ Generate and test (1M)</li> <li>✓ Hill climbing (1M)</li> <li>✓ Best first search (1M)</li> <li>✓ Problem reduction (1M)</li> <li>✓ Constraint satisfaction (1M)</li> <li>✓ Mean end analysis (1M)</li> </ul>	
	<b>Generate and test simple hill climbing.</b>	
	<p><b>Generate and test</b></p> <ul style="list-style-type: none"> <li>✓ Algorithm (2M)</li> <li>✓ Example (1M)</li> </ul> <p><b>Hill climbing</b></p> <ul style="list-style-type: none"> <li>✓ Simple hill climbing (1M)</li> <li>✓ Steepest ascent hill climbing (2M)</li> </ul>	
	<b>PART * C</b>	
1	<p><b>Explain crypt arithmetic problem for the below</b></p> <p><b>Problem:</b> SEND</p> <p>+MORE</p> <p>.....</p> <p><b>Initial state: MONEY</b></p> <p><b>No two letters have the same value. The sums of the digits must be shown in the problem. (15M)</b></p> <p>BTL4</p> <p><b>Answer:</b>Page. Notes</p> <p>S=9  E=5  N=6  D=7  M=1  O=0  R=8  Y=2</p>	
2	<p><b>Explain crypt arithmetic problem for the below</b></p> <p><b>Problem:</b> CROSS</p> <p>+DANGER</p> <p>.....</p>	

**Initial state: CROSS**

**No two letters have the same value. The sums of the digits must be shown in the problem. (15M)**

BTL4

**Answer:Page. Notes**

**C=9**

**R=6**

**O=2**

**S=3**

**R=6**

**A=5**

**D=1**

**N=8**

**G=7**

**E=4**

## UNIT -2- KNOWLEDGE REPRESENTATION AND REASONING

**Proposition Logic - First Order Predicate Logic – Unification – Forward Chaining -Backward Chaining - Resolution – Knowledge Representation - Ontological Engineering - Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - Prolog Programming.**

### PART – A

Q. NO	QUESTIONS
1	<p><b>What are the standard quantifiers of First Order Logic? BTL1</b>  The First Order Logic contains two standard quantifiers. They are:</p> <p>Universal Quantifiers      <math>\forall</math>  </p> <p>Existential Quantifiers    <math>\exists</math>  </p>
2	<p><b>Define Universal Quantifier with an example. BTL1</b>  To represent —All elephants are mammal—Raj is an elephant is represented by Elephant(Raj) and —Raj is a mammal. The first order logic is given by  <b><math>\forall</math> Elephant(x) <math>\Rightarrow</math> Mammal(x)</b></p> <p>Refers to —For all. P is any logical expression, which is equivalent to the conjunction(i.e. the ) of all sentences obtained by substituting the name of an object for the variable x where if appears in p. The above sentence is equivalent to <b>Elephant(Raj)<math>\Rightarrow</math>Mammal(Raj)</b></p> <p><b>Elephant(John)<math>\Rightarrow</math>Mammal(John)</b></p> <p>Thus it is true if and only if, all the above sentences are true that is if p is true forall objects x in the universe. Hence, is called universal quantifier.</p>
3	<p><b>Recognize is the use of equality symbol? BTL1</b>  The equality symbol is used to make the statements more effective that two terms refer to the same object.  <b>Eg: Father (John)=Henry</b></p>
4	<p><b>Define Higher Order Logic. BTL1</b>  The Higher Order Logic allows quantifying over relations and functions as well as over objects.  Eg: The two objects are equal if and only if, all the properties to them are equivalent.  <math>x, y(x=y)( p p(x) p(y))</math></p>
5	<p><b>Describe the first Order Logic. BTL1</b>  First Order Logic, a representation language that is far more powerful than propositional logic. First Order Logic commits to the existence of objects and relations.  <b>Eg: One plus two equals three Objects – one,two&amp; three Relations&gt;equals Functions-plus</b></p>
6	<p><b>What is called declarative approach? BTL1</b>  The representation language makes it easy to express the knowledge in the form of sentences. This simplifies the construction problem enormously. This is called as declarative approach.</p>
7	<p><b>State the aspects of a knowledge representation language. BTL2</b>  A knowledge representation language is defined in two aspects:  <b>Syntax:</b> The syntax of a language describes the possible configuration that can constitute sentences.  <b>Semantics:</b> It determines the facts in the world to which the sentences refer.</p>

8	<b>What is called entailment? BTL2</b> The generations of new sentences that are necessarily true given the old sentences are true. This relation between sentences is called <b>entailment</b> .
9	<b>What is meant by tuple? BTL1</b> A tuple is a collection of objects arranged in a fixed order and is written with angle brackets surrounding the objects. {<Richard the Lionheart, King John>,<King John, Richard the Lion heart>}
10	<b>Define propositional Logic? BTL1</b> Propositional Logic is a declarative language because its semantics is based on a truth relation between sentences and possible worlds. It also has sufficient expressive power to deal with partial information, using disjunction and negation.
11	<b>What is compositionality in propositional logic? BTL2</b> Propositional Logic has a third property that is desirable in representation languages, namely compositionality. In a compositionality language, the meaning of sentences is a function of the meaning of its parts. For example, —S1^S2   is related to the meanings of —S1 and S2  .
12	<b>Define Symbols. BTL1</b> The basic syntactic elements of first order logic are the symbols that stand for objects, relations and functions. The symbols are in three kinds. Constant symbols which stand for objects, Predicate symbols which stand for relations and Function symbol which stand for functions.
13	<b>Describe ground term, Inference. BTL1</b> The term without variables is called ground term. The task of deriving the new sentence from the old is called Inference.
14	<b>Describe Data log. BTL1</b> The applications of query tools are The set of first order definite clauses with no function symbols is called datalog. Eg: “The country Nono, an enemy of America” Enemy(Nono, America) The absence of function symbols makes inference much easier.
15	<b>What is Pattern Matching? BTL2</b> The —inner loop   of the algorithm involves finding all possible unifiers such that the premise of a rule unifies with a suitable set of facts in the knowledge base. This is called Pattern Matching.
16	<b>What is Data Complexity? BTL1</b> The complexity of inference as a function of the number of ground facts in the database is called data complexity.
17	<b>Define Prolog. BTL1</b> Prolog programs are sets of definite clauses written in a notation somewhat different from standard first-order logic.
18	<b>List the principal sources of Parallelism? BTL1</b> The first called <b>Or-Parallelism</b> comes from the possibility of a goal unifying with many different clauses in the knowledge base. Each gives rise to an independent branch in the search space that can lead to a potential solution and branches can be solved in parallel. The second called <b>AND-Parallelism</b> comes from the possibility of solving each conjunct in the body of an implication in parallel.
19	<b>Define conjunctive normal form. BTL1</b> First Order resolution requires that sentences be in conjunctive normal form that is, a conjunction of clauses, where each clause is a disjunction of literals. Literals can contain variables, which are assumed to universally quantified.

20	<b>Define Skolemization.</b> BTL1 Skolemization is the process of removing existential quantifiers by elimination.
21.	<b>What is the other way to deal with equality?</b> BTL2 Another way to deal with an additional inference rule is Demodulation Para modulation
22.	<b>Inference the ontology of situation calculus.</b> BTL2 Situations which denote the states resulting from executing actions. This approach is called Situation Calculus. ✓ <b>Situations</b> are logical terms consisting of the initial situation and all situations that are generated by applying an action to a situation. ✓ <b>Fluent</b> are functions and predicates that vary from one situation to the next, such as the location of the agent ✓ Atemporal or eternal predicates and functions are also allowed.
23.	<b>Define unification.(Dec 2012) (May 2012)</b> BTL1 Lifted inference rule require finding substitutions that make different logical expressions look identical(same).this is called unification
24.	<b>Distinguish between predicate and propositional logic? (Dec 2011)</b> BTL4 Propositional logic (also called sentential logic) is the logic that includes sentence letters (A,B,C) and logical connectives, but not quantifiers. The semantics of propositional logic uses truth assignments to the letters to determine whether a compound propositional sentence is true. Predicate logic is usually used as a synonym for first-order logic. Syntactically, first-order logic has the same connectives as propositional logic, but it also has variables for individual objects, quantifiers, symbols for functions, and symbols for relations. The semantics include a domain of discourse for the variables and quantifiers to range over, along with interpretations of the relation and function symbols.
25.	<b>With an example show objects properties functions and relations. (Dec 2012)</b> BTL3 Example Evil king john brother of Richard rules England in 1200   Objects:john,Richard,england,1200 Relation :Brother of Properties:evil,king Functions:ruled
26.	<b>Describe synchronic and diachronic sentence. ( May 2012)</b> BTL1 Sentences dealing with same time are called synchronic sentences, sentences that allow reasoning —across time   are called diachronic sentence
27.	<b>Define Modus Ponens rule in Propositional logic.(MAY/JUNE 2014)</b> BTL1 The standard patterns of inference that can be applied to derive chains of conclusions that lead to the desired goal is said to be Modus Ponens's rule.
28.	<b>What is the significance in using the unification algorithm? (Nov/Dec 2012)</b> BTL2 Unification is an algorithmic process of solving equations between symbolic expressions.

**PART – B**

1	<b>Give the Syntax and Semantics of a first order logic in detail with an eg. Explain predicate logic (May 2013)(13M)</b> BTL3 <b>Answer:Page. 82-Elaine Rich</b> ✓ Introduction- The best way to find usage of First order logic is through examples. The examples can be taken from some simple domains. In knowledge representation, a domain is just some part of the world about which we wish to express some knowledge. (2M) ✓ Assertions and queries in first-order logic (5M) ✓ Example (3M)
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	✓ The kinship domain	(3M)
2	<p><b>Explain about inference rule with an algorithm in a first order logic. What are the steps to convert first order logic sentence to normal form? Formulate your opinion about inference rules for propositional logic. (Dec 2012) (13M) BTL4</b></p> <p><b>Answer:Page. 99-Elaine Rich</b></p> <p>Explanation : An Inference Rule is a rule for obtaining a new formula [the consequence] from a set of given formulae [the premises].</p> <ul style="list-style-type: none"> <li>✓ A most famous inference rule is Modus Ponens: (3M)</li> <li>✓ Product rule (5M)</li> <li>✓ Base rule (5M)</li> </ul> <p>Let D denote Disease and "T=+ve" denote the positive Tes.</p> <p>Then,</p> $P(D=true T=+ve) = \frac{P(T=+ve D=true) * P(D=true)}{P(T=+ve D=true) * P(D=true) + P(T=+ve D=false) * P(D=false)}$ $= \frac{0.95 * 0.01}{0.95 * 0.01 + 0.05 * 0.99}$ $= 0.161$	
3	<p><b>Demonstrate forward chaining and backward chaining in detail for a first order definite Clauses. (May 2012) (13M) BTL3</b></p> <p><b>Answer:Page. 134-Elaine Rich</b></p> <p>Introduction –</p> <ul style="list-style-type: none"> <li>✓ Using a deduction to reach a conclusion from a set of antecedents is called forward chaining. (2M)</li> <li>✓ Example (6M)</li> </ul> <p>Function FOL-FC-ASK (KB, <math>\alpha</math>) returns a substitution or false Inputs: KB, the knowledge base, a set of first – order definite clauses A, the query, an atomic sentence</p> <p>Local variables: new, the new sentences inferred on each iteration Repeat until new is empty New <math>\square</math> {}</p> <p>For each sentence r in KB do</p> <p style="padding-left: 20px;">(P1 <math>\wedge</math> .... <math>\wedge</math> Pn <math>\Rightarrow</math> q) <math>\square</math> STANDARDIZE – APART(r)</p> <p>For each <math>\theta</math> such that SUBSET (<math>\theta</math>, P1 <math>\wedge</math> .... <math>\wedge</math> Pn) = SUBSET(<math>\theta</math>, P11 <math>\wedge</math> .... <math>\wedge</math> P 1)</p> <p>For some, P11..... Pn Q1 <math>\square</math> SUBSET (<math>\theta</math>,q)in KB</p> <p>If q1 is not a renaming of some sentence already in KB or new then do Add q1 to new</p> <p style="padding-left: 20px;"><math>\Phi \square</math> UNIFY (q1, <math>\alpha</math>)</p> <p>If <math>\varphi</math> is not fail then return <math>\varphi</math></p> <p>Add new to KB Return false</p> <ul style="list-style-type: none"> <li>✓ Algorithm (5M)</li> </ul>	

4	<p><b>Calculate the completeness proof of resolution. (Nov/Dec 2014). (13M) BTL3</b></p> <p><b>Answer:Page. 108-Elaine Rich</b></p> <p>The generalized resolution inference rule provides a complete proof system for first order logic, using knowledge bases in conjunctive normal form. (1M)</p> <ul style="list-style-type: none"> <li>✓ Completeness theorem (2M)</li> <li>✓ Incompleteness theorem (2M)</li> <li>Steps (8M)</li> <li>✓ Move forward           <ul style="list-style-type: none"> <li>¬ <math>\forall x p</math> becomes for all <math>x \neg p</math></li> <li>¬ <math>\forall x p</math> becomes for all <math>x \neg p</math></li> </ul> </li> <li>✓ Standardize variables</li> <li>✓ Elimination of extensional qualifiers</li> <li>✓ Drop universal qualifiers</li> <li>✓ Learning heuristics</li> </ul>
5	<p><b>Explain unification algorithm used for reasoning under predicate logic with an example. (Apr /May11)(13M) BTL2</b></p> <p><b>Answer:Page. 99,108-Elaine Rich</b></p> <p>The use of unification to identify appropriate substitutions for variables eliminates the instantiation step in first-order proofs, making the process much more efficient. (1M)</p> <ul style="list-style-type: none"> <li>✓ Completeness theorem (2M)</li> <li>✓ Incompleteness theorem (2M)</li> <li>Steps (8M)</li> <li>✓ Move forward           <ul style="list-style-type: none"> <li>¬ <math>\forall x p</math> becomes for all <math>x \neg p</math></li> <li>¬ <math>\forall x p</math> becomes for all <math>x \neg p</math></li> </ul> </li> <li>✓ Standardize variables</li> <li>✓ Elimination of extensional qualifiers</li> <li>✓ Drop universal qualifiers</li> <li>✓ Learning heuristics</li> </ul>
6	<p><b>Describe in detail the steps involved in the knowledge engineering process. (Apr/May11)(13M) BTL2</b></p> <p><b>Answer:Page. 79-Elaine Rich</b></p> <p>A knowledge engineer is someone who investigates a particular domain, learns what concepts are important in that domain, and creates a formal representation of the objects and relations in the domain. We will illustrate the knowledge engineering process in an electronic circuit domain that should already be fairly familiar, (3M)</p> <p>Steps (10M)</p> <ul style="list-style-type: none"> <li>✓ Identify the task.</li> <li>✓ Assemble the relevant knowledge.</li> <li>✓ Decide on a vocabulary of predicates, functions, and constants</li> <li>✓ Encode general knowledge about the domain.</li> <li>✓ Encode a description of the specific problem instance</li> <li>✓ Pose queries to the inference procedure and get answers.</li> <li>✓ Debug the knowledge base.</li> </ul>
7	<p><b>Differentiate propositional logic with FOL .List the inference rules along with suitable examples for first order logic. Write the algorithm for deciding entailment in propositional logic(13M) (May/June 2014) BTL4</b></p> <p><b>Answer:Page. 99-Elaine Rich</b></p> <p>It is a way of representing knowledge.</p> <ul style="list-style-type: none"> <li>✓ In logic and mathematics, a propositional calculus or logic is a formal system in which formulae representing <i>propositions</i> can be formed by combining atomic</li> </ul>

	<p>propositions using <i>logical connectives</i> (2M)</p> <p>Example</p> <p>Some facts in propositional logic:</p> <p>It is raining. - RAINING</p> <p>It is sunny - SUNNY</p> <p>It is windy – WINDY</p> <ul style="list-style-type: none"> <li>✓ Algorithm (5M)</li> <li>✓ Working (6M)</li> </ul>
8	<p><b>(i) Summarize about Minimax algorithm in detail.(6M) BTL2</b></p> <p><b>(ii) Discuss Alpha, Beta pruning and Alpha-Beta algorithm.(7M) BTL2</b></p> <p><b>Answer:Page. 233,236-Elaine Rich</b></p> <ul style="list-style-type: none"> <li>✓ Minimax algorithm</li> </ul> <p>consider games with two players, whom we will call MAX and MIN. MAX moves first, and then they take turns moving until the game is over. At the end of the game, points are awarded to the winning player and penalties are given to the loser. (6M)</p> <ul style="list-style-type: none"> <li>✓ Alpha, Beta pruning</li> </ul> <p>Introduction- A two-ply game tree. The nodes are —MAX nodes», in which it is AMX's turn to move, and the nodes are —MIN nodes». The terminal nodes show the utility values for MAX; the other nodes are labeled with their minimax values. MAX's best move at the root is <math>a_1</math>, because it leads to the successor with the highest minimax value, and MIN's best reply is <math>b_1</math>, because it leads to the successor with the lowest minimax value (2M)</p> <ul style="list-style-type: none"> <li>✓ Diagram (5M)</li> </ul>

**PART - C**

1	<p><b>Explain resolution in predicate logic with suitable example.(15M) BTL5</b></p> <p><b>Answer:Page. 108-Elaine Rich</b></p> <p>The use of unification to identify appropriate substitutions for variables eliminates the instantiation step in first-order proofs, making the process much more efficient. (3M)</p> <ul style="list-style-type: none"> <li>✓ Completeness theorem (2M)</li> <li>✓ Incompleteness theorem (2M)</li> <li>Steps (8M)</li> <li>✓ Move forward           <ul style="list-style-type: none"> <li><math>\neg \forall x p</math> becomes for all <math>x \neg p</math></li> <li><math>\neg \forall x p</math> becomes for all <math>x \neg p</math></li> </ul> </li> <li>✓ Standardize variables</li> <li>✓ Elimination of extensional qualifiers</li> <li>✓ Drop universal qualifiers</li> </ul>
2	<p><b>Consider the following sentences:</b></p> <ul style="list-style-type: none"> <li>✓ John like all kinds of food</li> <li>✓ Apples are food</li> <li>✓ Chicken is food</li> <li>✓ Anything anyone eats and isn't killed is food</li> <li>✓ Bill eats peanuts and still alive</li> <li>✓ Sue eats everything Bill eats</li> </ul> <p>i) Translate these sentences into formulae in predicate logic.</p> <p>ii) Convert the above FOL into clause form. (15M) BTL6</p> <p><b>Answer:Notes</b></p> <ul style="list-style-type: none"> <li>✓ Translate these sentences into formulae in predicate logic. (8M)</li> <li>✓ Convert the above FOL into clause form (7M)</li> </ul>
3	<p><b>Develop the following well-formed clause form with sequence of steps.</b></p> <p><math>\forall x: [\text{Roman}(x) \wedge \text{know}(x, \text{Marcus})]</math>  <math>\rightarrow [\text{hate}(x, \text{Caesar}) \vee (\forall y: \exists z: \text{hate}(y, z))]</math>  <math>\rightarrow \text{thinkcrazy}(x, y)]</math> BTL6</p> <p><b>Answer: Notes</b></p> <ul style="list-style-type: none"> <li>✓ Translate these sentences into formulae in predicate logic. (8M)</li> <li>✓ Convert the above FOL into clause form (7M)</li> </ul>
4	<p><b>Analyze on resolution principles and procedures. (15M) BTL4</b></p> <p><b>Answer:Page. 108-Elaine Rich</b></p> <p>The use of unification to identify appropriate substitutions for variables eliminates the instantiation step in first-order proofs, making the process much more efficient. (3M)</p> <ul style="list-style-type: none"> <li>✓ Completeness theorem (2M)</li> <li>✓ Incompleteness theorem (2M)</li> <li>Steps (8M)</li> <li>✓ Move forward           <ul style="list-style-type: none"> <li><math>\neg \forall x p</math> becomes for all <math>x \neg p</math></li> <li><math>\neg \forall x p</math> becomes for all <math>x \neg p</math></li> </ul> </li> <li>✓ Standardize variables</li> <li>✓ Elimination of extensional qualifiers</li> <li>✓ Drop universal qualifiers</li> <li>✓ Learning heuristics</li> </ul>

### UNIT 3 - UNCERTAINTY

**Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.**

#### PART - A

<b>1.</b> <b>What are representations types of knowledge? BTL2</b> Four General Representation Types <ul style="list-style-type: none"> <li>✓ Logical Representations</li> <li>✓ Semantic Networks</li> <li>✓ Production Rules</li> <li>✓ Frames</li> </ul>
<b>2.</b> <b>Describe a frame ?BTL1</b> Frames represent an alternative way to structure and organise knowledge. A frame system is a hierarchy of frames. Each Frame has: <ul style="list-style-type: none"> <li>✓ a name</li> <li>✓ slots: properties of the entity that has the name, and their values.</li> </ul>
<b>3.</b> <b>Define Uncertainty. BTL1</b> Uncertainty means that many of the simplifications that are possible with deductive inference are no longer valid.
<b>4.</b> <b>State the reason why first order, logic fails to cope with that the mind like Medical diagnosis. BTL3</b> Three reasons: <ul style="list-style-type: none"> <li>✓ Laziness: It is hard to lift complete set of antecedents of consequence, needed to ensure and exception less rule.</li> <li>✓ Theoretical Ignorance: Medical science has no complete theory for the domain.</li> <li>✓ Practical ignorance: Even if we know all the rules, we may be uncertain about a particular item needed.</li> </ul>
<b>5.</b> <b>Demonstrate is the need for probability theory in uncertainty? BTL3</b> Probability provides the way of summarizing the uncertainty that comes from our laziness and ignorance. Probability statements do not have quite the same kind of semantics known as evidences.
<b>6.</b> <b>Demonstrate is the need for utility theory in uncertainty? BTL1</b> Utility theory says that every state has a degree of usefulness, or utility to In agent, and that the agent will prefer states with higher utility. The use utility theory to represent and reason with preferences.
<b>7.</b> <b>What Is Called As Decision Theory? BTL2</b> Preferences As Expressed by Utilities Are Combined with Probabilities in the General Theory of Rational Decisions Called Decision Theory. Decision Theory = Probability Theory + Utility Theory.
<b>8.</b> <b>Define conditional probability. BTL1</b> Once the agents has obtained some evidence concerning the previously unknown propositions making up the domain conditional or posterior probabilities with the notation $p(A/B)$ is used. This is important that $p(A/B)$ can only be used when all be is known.
<b>9.</b> <b>When probability distribution is used? BTL3</b> If we want to have probabilities of all the possible values of a random variable probability distribution is used. Eg: $P(\text{weather}) = (0.7, 0.2, 0.08, 0.02)$ . This type of notations simplifies many equations.

10.	<b>What is an atomic event? BTL2</b> An atomic event is an assignment of particular values to all variables, in other words, the complete specifications of the state of domain.
11.	<b>Define joint probability distribution. BTL1</b> Joint probability distribution completely specifies an agent's probability assignments to all propositions in the domain. The joint probability distribution $p(x_1, x_2, \dots, x_n)$ assigns probabilities to all possible atomic events; where $x_1, x_2, \dots, x_n$ =variables.
12.	<b>What is meant by belief network? BTL3</b> <ul style="list-style-type: none"> <li>✓ A belief network is a graph in which the following holds</li> <li>✓ A set of random variables</li> <li>✓ A set of directive links or arrows connects pairs of nodes.</li> <li>✓ The conditional probability table for each node</li> <li>✓ The graph has no directed cycles.</li> </ul>
13.	<b>What are called as Poly trees? BTL2</b> The algorithm that works only on singly connected networks known Poly trees. Here at most one undirected path between any two nodes is present.
14.	<b>What is a multiple connected graph? BTL2</b> A multiple connected graph is one in which two nodes are connected by more than one path.
15.	<b>List the three basic classes of algorithms for evaluating multiply connected graphs. BTL1</b> The three basic classes of algorithms for evaluating multiply connected graphs <ul style="list-style-type: none"> <li>✓ Clustering methods;</li> <li>✓ Conditioning methods;</li> <li>✓ Stochastic simulation methods.</li> </ul>
16.	<b>What is called as principle of Maximum Expected Utility (MEU)? BTL2</b> The basic idea is that an agent is rational if and only if it chooses the action that yields the highest expected utility, averaged over all the possible outcomes of the action. This is known as MEU
17.	<b>What is meant by deterministic nodes? BTL2</b> A deterministic node has its value specified exactly by the values of its parents, with no uncertainty.
18.	<b>Write the properties of fuzzy sets. (MAY/JUNE2016) BTL2</b> Properties: <ul style="list-style-type: none"> <li>✓ Distributivity Associativity</li> <li>✓ Commutativity</li> <li>✓ Idempotency</li> </ul>
19.	<b>What are representations types of knowledge? BTL1</b> Four General Representation Types <ul style="list-style-type: none"> <li>✓ Logical Representations</li> <li>✓ Semantic Networks</li> <li>✓ Production Rules</li> <li>✓ Frames</li> </ul>
20.	<b>List the three basic classes of algorithms for evaluating multiply connected graphs.BTL1</b> The three basic classes of algorithms for evaluating multiply connected graphs <ul style="list-style-type: none"> <li>✓ Clustering methods;</li> <li>✓ Conditioning methods;</li> <li>✓ Stochastic simulation methods.</li> </ul>

**PART \* B**

1	<b>Describe in detail about dempster -shafer theory. (April/May-2017) (13M) BTL-3</b> <b>Answer:Page. 181-Elaine Rich</b>	
	✓ Introduction (2M)	
	✓ Possible conclusions (2M)	
	✓ Frame of discernment (2M)	
	✓ Mass function (2M)	
	✓ Belief (2M)	
	✓ Plausibility (2M)	
	✓ Belief interval (1M)	
2	<b>How to get the exact inference form Bayesian network. How to get the approximate inference form Bayesian network. How to construct Bayesian network (April/May 2015) (13M) BTL3</b> <b>Answer:Page. 179-Elaine Rich</b>	
	✓ Bayesian theory (2M)	
	✓ Bayesian network - A Bayesian network is a directed acyclic graph whose nodes correspond to random variables; each node has a conditional distribution for the node, given its parents. Bayesian networks provide a concise way to represent conditional independence relationships in the domain (3M)	
	✓ Working (5M)	
	✓ Example (3M)	

3	<p><b>What is the entire temporal model. In temporal model explain filtering and prediction (Dec 2012) (May 2012)(13 M) BTL3</b></p> <p><b>Answer:Page. 188-Elaine Rich</b></p> <p>A learning algorithm is good if it produces hypothesis that do a good job of predicting the classification of example prediction quality can be estimated in advance on it can be estimated after the fact. (3M)</p> <ul style="list-style-type: none"> <li>✓ Collect a large set of example. (2M)</li> <li>✓ Divide it into two disjoint sets, the training set and the test set. (2M)</li> <li>✓ Apply the learning algorithm to training set, generating a hypothesis ‘h’. (2M)</li> <li>✓ Measure the percentage of example in the test set that is correctly classified by ‘h’. (2M)</li> <li>✓ Repeat step 1 to 4 for different size of training sets and different randomly selected training sets of each size. (2M)</li> </ul>
4	<p><b>Define uncertain knowledge, prior probability and conditional probability.State the Baye's theorem. (13 M) BTL3</b></p> <p><b>Answer:Page. 172-Elaine Rich</b></p> <p>Bayes Rule and its use – Recall (4M)</p> $P(A \wedge B) = P(A B).P(B)^*$ $P(A \wedge B) = P(B A).P(A)$ <p>Bayes rule (2M)</p> $P(Y X) = P(X Y).P(Y)/ P(X)$ <p>Applying Bayes's rule (3M)</p> <p>Normalization. (4M)</p>
5	<p><b>How it is useful for decision making under uncertainty? Explain belief networks briefly? (May/June 2014)(13 M) BTL3</b></p> <p><b>Answer:Page. 174-Elaine Rich</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Possible conclusions (2M)</li> <li>✓ Frame of discernment (2M)</li> <li>✓ Mass function (2M)</li> <li>✓ Belief (2M)</li> <li>✓ Plausibility (2M)</li> <li>✓ Belief interval (1M)</li> </ul>

### PART \* C

1	<p><b>Analyze the certainty and uncertainty factors.(15M) BTL-4</b></p> <p><b>Answer:Page. 174-Elaine Rich</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Possible conclusions (2M)</li> <li>✓ Frame of discernment (2M)</li> <li>✓ Mass function (2M)</li> <li>✓ Belief (2M)</li> <li>✓ Plausibility (2M)</li> <li>✓ Belief interval (1M)</li> </ul>
2	<p><b>i) Explain in detail Frame based system.(7M) BTL4</b></p> <p><b>ii) Discuss the Frame based representation languages.(8M) BTL-3</b></p> <p><b>Answer:Page. 291-Elaine Rich</b></p> <p><b>Frame based system</b> (2M)</p> <ul style="list-style-type: none"> <li>✓ A frame is a data structure with typical knowledge about a particular object or concept. Frames, first proposed by Marvin Minsky in the 1970s. Frames as a knowledge representation technique (2M)</li> <li>✓ The concept of a frame is defined by a collection of slots. Each slot describes a particular attribute or operation of the frame.</li> </ul>

	<ul style="list-style-type: none"> <li>✓ Typical information included in a slot (3M)           <ul style="list-style-type: none"> <li>✓ Frame name.</li> <li>✓ Relationship of the frame to the other frames</li> <li>✓ Slot value.</li> <li>✓ Default slot value.</li> <li>✓ Range of the slot value.</li> <li>✓ Procedural information.</li> <li>✓ WHEN CHANGED and WHEN NEEDED</li> </ul> </li> </ul>
3	<p><b>Summarize how to build a knowledge base with an example. (15M) BTL-6</b></p> <p><b>Answer:</b>Page. 112-Elaine Rich</p> <ul style="list-style-type: none"> <li>✓ In some problems the knowledge base is consistent and in some it is not. For example consider the case when a Boolean expression is evaluated. The knowledge base now contains theorems and laws of Boolean Algebra which are always true. On the contrary consider a knowledge base that contains facts about production and cost. These keep varying with time. Hence many reasoning schemes that work well in consistent domains are not appropriate in inconsistent domains. (3M)</li> <li>○ team (Pee-Wee-Reese) =Brooklyn–Dodger</li> <li>○ batting-average(Three-Finger-Brown) = 0.106 – height (Pee-Wee-Reese) = 6.1</li> <li>○ bats (Three Finger Brown) =right</li> </ul> <p>Example : (7M)</p> <ul style="list-style-type: none"> <li>- given a set of relations and values, one may infer other values or relations.</li> <li>- a predicate logic (a mathematical deduction) is used to infer from a set of attributes.</li> <li>- inference through predicate logic uses a set of logical operations to relate individual data.</li> <li>- the symbols used for the logic operations are:</li> </ul> <p style="text-align: center;">" → " (implication),      " ¬" (not),      " V" (or),      " Λ" (and),"      ∀ " (for all),      " ∃ " (there exists).</p> <p>Examples of predicate logic statements :</p> <ol style="list-style-type: none"> <li>1. "Wonder" is a name of a dog:      dog(wonder)</li> <li>2. All dogs belong to the class of animals: <math>\forall x: \text{dog}(x) \rightarrow \text{animal}(x)</math></li> <li>3. All animals either live on land or in water:      <math>\forall x : \text{animal}(x) \rightarrow \text{live}(x, \text{land}) \vee \text{live}(x, \text{water})</math></li> </ol> <p>From these three statements we can infer that :</p> <p style="padding-left: 40px;">" Wonder lives either on land or on water."</p> <p>✓ Explanation (5M)</p>

## UNIT-4 LEARNING

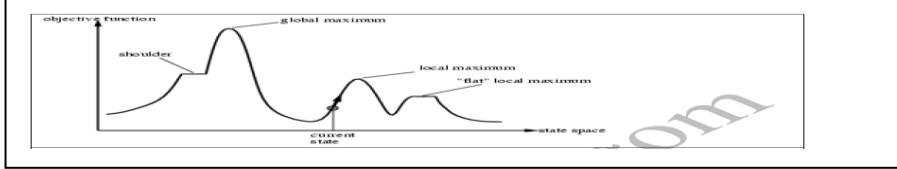
**Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning**

### PART \* A

1.	<b>Define state-space search.</b> BTL1 The most straightforward approach is to use state-space search. Because the descriptions of actions in a planning problem specify both preconditions and effects, it is possible to search in either direction: either forward from the initial state or backward from the goal
8.	<b>Define conditional probability.</b> BTL1 Once the agents has obtained some evidence concerning the previously unknown propositions making up the domain conditional or posterior probabilities with the notation $p(A/B)$ is used. This is important that $p(A/B)$ can only be used when all be is known.
9.	<b>When probability distribution is used?</b> BTL3 If we want to have probabilities of all the possible values of a random variable probability distribution is used. Eg: $P(\text{weather}) = (0.7, 0.2, 0.08, 0.02)$ . This type of notations simplifies many equations.
10.	<b>What is an atomic event?</b> BTL2 An atomic event is an assignment of particular values to all variables, in other words, the complete specifications of the state of domain.
11.	<b>Define joint probability distribution.</b> BTL1 Joint probability distribution completely specifies an agent's probability assignments to all propositions in the domain. The joint probability distribution $p(x_1, x_2, \dots, x_n)$ assigns probabilities to all possible atomic events; where $x_1, x_2, \dots, x_n$ =variables.
12.	<b>What is meant by belief network?</b> BTL3 <ul style="list-style-type: none"> <li>✓ A belief network is a graph in which the following holds</li> <li>✓ A set of random variables</li> <li>✓ A set of directive links or arrows connects pairs of nodes.</li> <li>✓ The conditional probability table for each node</li> <li>✓ The graph has no directed cycles.</li> </ul>
7.	<b>What is action monitoring?</b> BTL2 The process of checking the preconditions of each action as it is executed, rather than checking the preconditions of the entire remaining plan. This is called action monitoring.
8.	<b>Define planning.</b> BTL1 Planning can be viewed as a type of problem solving in which the agent uses beliefs about actions and their consequences to search for a solution.

9.	<b>What Is Called As Decision Theory? BTL2</b> <ul style="list-style-type: none"> <li>✓ Preferences As Expressed by Utilities Are Combined with Probabilities in the General Theory of Rational Decisions Called Decision Theory. Decision Theory = Probability Theory + Utility Theory.</li> </ul>
10.	<b>Define conditional probability. BTL1</b> <ul style="list-style-type: none"> <li>✓ Once the agents has obtained some evidence concerning the previously unknown propositions making up the domain conditional or posterior probabilities with the notation <math>p(A/B)</math> is used. This is important that <math>p(A/B)</math> can only be used when all be is known.</li> </ul>
11.	<b>When probability distribution is used? BTL3</b> <ul style="list-style-type: none"> <li>✓ If we want to have probabilities of all the possible values of a random variable probability distribution is used. Eg: <math>P(\text{weather}) = (0.7, 0.2, 0.08, 0.02)</math>. This type of notations simplifies many equations.</li> </ul>
12.	<b>What are the different types of planning?(May/June 2014) BTL1</b> The different types of planning are, <ul style="list-style-type: none"> <li>✓ Situation space planning;</li> <li>✓ Progressive planning;</li> <li>✓ Regressive planning;</li> <li>✓ Partial order planning;</li> <li>✓ Fully instantiated planning.</li> </ul>
13.	<b>Define a solution. BTL1</b> A solution is defined as a plan that an agent can execute and that guarantees the achievement of goal.
14.	<b>What is meant by belief network? BTL3</b> <ul style="list-style-type: none"> <li>✓ A belief network is a graph in which the following holds</li> <li>✓ A set of random variables</li> <li>✓ A set of directive links or arrows connects pairs of nodes.</li> <li>✓ The conditional probability table for each node</li> <li>✓ The graph has no directed cycles.</li> </ul>
15.	<b>What are Forward state-space search and Backward state-space search? BTL3</b> <ul style="list-style-type: none"> <li>✓ Forward state-space search: It searches forward from the initial situation to the goal situation.</li> <li>✓ Backward state-space search: It searches backward from the goal situation to the initial situation.</li> </ul>
16.	<b>What is called as Markov Decision problem? BTL2</b> The problem of calculating an optimal policy in an accessible, stochastic environment with a known transition model is called a Markov Decision Problem(MDP).
17.	<b>Define Dynamic Belief Network. BTL2</b> A Belief network with one node for each state and sensor variable for each time step is called a Dynamic Belief Network.(DBN).
18.	<b>Define Dynamic Decision Network. BTL1</b> A decision network is obtained by adding utility nodes, decision nodes for action in DBN. DDN calculates the expected utility of each decision sequence.
19.	<b>What is Bayesian Networks? (MAY/JUNE2016) BTL1</b> Graphical model for reasoning under uncertainty <ul style="list-style-type: none"> <li>○ Nodes represents variables</li> <li>○ Arc represents direct connections between variables.</li> </ul>

20.	<b>What is meant by Execution monitoring? BTL2</b> Execution monitoring is related to conditional planning in the following way. An agent that builds a plan and then executes it while watching for errors is, in a sense, taking into account the possible conditions that constitute execution errors.
21.	<b>What is meant by learning? BTL3</b> Learning is a goal-directed process of a system that improves the knowledge or the knowledge representation of the system by exploring experience and prior knowledge.
22.	<b>Define informational equivalence and computational equivalence. BTL1</b> A transformation from one representation to another causes no loss of information; they can be constructed from each other. The same information and the same inferences are achieved with the same amount of effort.
23.	<b>Define knowledge acquisition and skill refinement. BTL1</b> knowledge acquisition (example: learning physics) — learning new symbolic information coupled with the ability to apply that information in an effective manner skill refinement (example: riding a bicycle, playing the piano) — occurs at a subconscious level by virtue of repeated practice
24.	<b>What is Explanation-Based Learning? BTL2</b> The background knowledge is sufficient to explain the hypothesis of Explanation-Based Learning. The agent does not learn anything factually new from the instance. It extracts general rules from single examples by explaining the examples and generalizing the explanation.
25.	<b>Define Knowledge-Based Inductive Learning. BTL1</b> Knowledge-Based Inductive Learning finds inductive hypotheses that explain set of observations with the help of background knowledge.
26.	<b>What is truth preserving? BTL1</b> An inference algorithm that derives only entailed sentences is called sound or truth preserving.
27.	<b>Define Inductive learning. How the performance of inductive learning algorithms can be measured. BTL1</b> Learning a function from examples of its inputs and outputs is called inductive learning. It is measured by their learning curve, which shows the prediction accuracy as a function of the number of observed examples.
28	<b>List the advantages of Decision Trees BTL1</b> The advantages of Decision Trees are, It is one of the simplest and successful forms of learning algorithm. It serves as a good introduction to the area of inductive learning and is easy to implement.
29	<b>What is the function of Decision Trees? BTL3</b> A decision tree takes as input an object or situation by a set of properties, and outputs a yes/no decision. Decision tree represents Boolean functions.
29	<b>List some of the practical uses of decision tree learning. BTL4</b> Some of the practical uses of decision tree learning are, Designing oil platform equipment Learning to fly
30	<b>What is the task of reinforcement learning? BTL4</b> The task of reinforcement learning is to use rewards to learn a successful agent function.
31	<b>Define Passive learner and Active learner. BTL2</b> A passive learner watches the world going by, and tries to learn the utility of being in various states. An active learner acts using the learned information, and can use its problem generator to suggest explorations of unknown portions of the environment.

32	<b>State the factors that play a role in the design of a learning system. BTL4</b> The factors that play a role in the design of a learning system are, ✓ Learning element ✓ Performance element Critic ✓ Problem generator
33	<b>What is memorization?BTL4</b> Memorization is used to speed up programs by saving the results of computation. The basic idea is to accumulate a database of input/output pairs; when the function is called, it first checks the database to see if it can avoid solving the problem from scratch.
34	<b>Define Q-Learning.BTL2</b> The agent learns an action-value function giving the expected utility of taking a given action in a given state. This is called Q-Learning.
35	<b>Define supervised learning &amp; unsupervised learning. (Nov/Dec 2014)(May/June 2013)BTL2</b> Any situation in which both inputs and outputs of a component can be perceived is called supervised learning. Learning when there is no hint at all about the correct outputs is called unsupervised learning.
36	<b>Define Bayesian learning.BTL1</b> Bayesian learning simply calculates the probability of each hypothesis, given the data, and makes predictions on that basis. That is, the predictions are made by using all the hypotheses, weighted by their probabilities, rather than by using just a single —best hypothesis.
37	<b>What is utility-based agent?BTL3</b> A utility-based agent learns a utility function on states and uses it to select actions that maximize the expected outcome utility.
38	<b>What is reinforcement learning? (Dec 2012) (May 2012)BTL1</b> Reinforcement learning refers to a class of problems in machine learning which postulate an agent exploring an environment in which the agent perceives its current state and takes actions. The environment, in return, provides a reward (which can be positive or negative). Reinforcement learning algorithms attempt to find a policy for maximizing cumulative reward for the agent over the course of the problem.
39	<b>What is the important task of reinforcement learning?BTL3</b> The important task of reinforcement learning is to use rewards to learn a successful agent function.
	<b>PART * B</b>
1	<b>Explain Planning with state space search with an example. Explain the concept of planning with state space search using suitable examples(May 2013)(April/May 2015) (13 M) BTL5</b> <b>Answer:Page. 25-Elaine Rich</b> <ul style="list-style-type: none"> <li>✓ In addition to finding goals, local search algorithms are useful for solving pure optimization problems, in which the aim is to find the best state according to an objective function. (2M)</li> <li>✓ Diagram (3M)</li> </ul>  <p>State Space Landscape - landscape has both —location (defined by the state) and</p>

	<p>elevationl(defined by the value of the</p> <ul style="list-style-type: none"> <li>✓ heuristic cost function or objective function)</li> <li>(5M)</li> </ul> <p>✓ Explanation</p> <p>(3M)</p>
2	<p><b>Explain partial order planning with example (Dec 2012) (May 2012) (13 M) BTL3</b></p> <p><b>Answer:Page. 262-Elaine Rich</b></p> <p>A partially ordered collection of steps (5M)</p> <ul style="list-style-type: none"> <li>○ <b>Start step</b> has the initial state description and its effect</li> <li>○ <b>Finish step</b> has the goal description as its precondition</li> <li>○ <b>Causal links</b> from outcome of one step to precondition of another step <ul style="list-style-type: none"> <li>○ <b>Temporal ordering</b> between pairs of steps</li> </ul> </li> </ul> <p><b>Diagram (3M)</b></p> <pre> graph TD     Start([Start]) --&gt; AtH1[At(HWS)]     AtH1 --&gt; GoHWS[Go(HWS)]     GoHWS --&gt; AtH2[At(HWS)]     AtH2 -- Sells[HWS, Drill] --&gt; BuyDrill[Buy(Drill)]     BuyDrill --&gt; AtH3[At(HWS)]     AtH3 --&gt; GoSM[Go(SM)]     GoSM --&gt; AtSM1[At(SM)]     GoSM --&gt; BuyMilk[Buy(Milk)]     BuyMilk --&gt; AtSM2[At(SM)]     BuyMilk -- Sells[SM, Milk] --&gt; BuyBan[Buy(Ban.)]     BuyBan --&gt; AtSM3[At(SM)]     AtSM1 -- Sells[SM, Milk] --&gt; BuyMilk     AtSM2 -- Sells[SM, Ban.] --&gt; BuyBan     AtSM3 --&gt; GoHome[Go(Home)]     GoHome --&gt; AtHome[At(Home)]     GoHome --&gt; HaveMilk[Have(Milk)]     GoHome --&gt; HaveBan[Have(Ban.)]     GoHome --&gt; HaveDrill[Have(Drill)]     HaveMilk --&gt; Finish([Finish])     HaveBan --&gt; Finish     HaveDrill --&gt; Finish   </pre> <p><b>Explanation (5M)</b></p>

3	<p><b>Explain in detail about conditional planning? (May 2013) (13 M) BTL4</b></p> <p><b>Answer:</b>Page. 269-Elaine Rich</p> <p>Conditional planning is also known as contingency planning, this approach deals with bounded indeterminacy by constructing a conditional plan with different branches for the different contingencies that could arise (5M)</p> <p>Contingency Problem - trees of actions contingency branching point in the tree of actions agent design different from the previous two cases: the agent must act on incomplete plans (3M)</p> <p>Contegency exploration (5M)</p>
4	<p><b>Elloborate Backward state space search? (May 2012) (13M) BTL4</b></p> <p><b>Answer:</b>Page. 269-Elaine Rich</p> <p>Backward state-space search: It searches backward from the goal situation to the initial situation. (2M)</p> <p>Diagram (4M)</p> <p>Explanation (7M)</p>
5	<p><b>For Blocks World explain STRIPS. (May 2013) BTL5</b></p> <p><b>Answer:</b> Notes 43</p> <p>Introduction (1M)</p> <ul style="list-style-type: none"> <li>✓ The world consists of:</li> <li>✓ A flat surface such as a table top</li> <li>✓ An adequate set of identical blocks which are identified by letters.</li> <li>✓ The blocks can be stacked one on one to form towers of apparently unlimited height.</li> <li>✓ The actions it can perform include <ul style="list-style-type: none"> <li>✓ <i>stack(X,Y)</i>: put block X on block Y. The arm must already be holding X and the surface of Y must be clear. (3M)</li> <li>✓ <i>unstack(X,Y)</i>: remove block X from block Y. The arm must be empty and block X must have no blocks on top of it. (3M)</li> <li>✓ <i>pickup(X)</i>: pickup block X from the table. The arm must be empty and there must be nothing on top of X. (3M)</li> <li>✓ <i>putdown(X)</i>: put block X on the table. The arm must have been holding block X. (3M)</li> </ul> </li> </ul>
6	<p><b>Explain with an example learning in decision trees. (May/June2009) (13 M) BTL6</b></p> <p><b>Answer:</b>Page. 364-Elaine Rich</p> <p>Introduction - A decision tree takes as input an object or situation by a set of properties, and outputs a yes/no decision. Decision tree represents Boolean functions (2M)</p> <p>Example: suggesting an app to the end user (5M)</p> <p>Diagram (3M)</p> <p>Explanation (3M)</p>

## UNIT 5- INTELLIGENCE AND APPLICATIONS

**Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-All applications – Language Models - Information Retrieval – Information Extraction - Machine Translation – Machine Learning - Symbol-Based – Machine Learning: Connectionist – Machine Learning.**

### PART \* A

1.	<b>Define an expert system. BTL1</b> An expert system is a computer program that attempts to mimic human experts by the system's capability to render advice, to teach and execute intelligent tasks.
2.	<b>Define natural language processing. BTL1</b> Natural language processing is a program that permits (to a certain degree) a human-computer dialogue in a conversational, day-to-day language (a natural language like English, French, or Dutch)
3.	<b>Describe speech recognition and understanding. Why is it useful? BTL1</b> Speech or voice recognition is a data input method. For example, the computer recognizes and understands one (or a few) word commands. Speech understanding on the other hand is the computer's ability to understand a spoken language. That is, the computer understands the meaning of sentences and paragraphs through syntax and semantics.
4.	<b>Define an intelligent agent. Why is it useful? BTL2</b> An intelligent agent is a program that runs in the background and learns your patterns, like any other agent working for you. It learns your needs to serve you better. The little paperclip guy that shows up in Microsoft Word is an example of an intelligent agent.
5.	<b>List the major benefits of intelligent computer-aided instruction BTL2</b> The major benefits are: <ul style="list-style-type: none"><li>✓ Individualized,</li><li>✓ self-adjusted level of instruction;</li><li>✓ immediate feedback;</li><li>✓ portability;</li><li>✓ consistency;</li><li>✓ Better control of updating and variety of presentations.</li></ul>
6.	<b>Define the ES development environment and contrast it with the consultation environment. BTL1</b> The development environment includes the activities and support that are necessary to acquire and represent the knowledge as well as to make inferences and provide explanations. The major players in this environment are the knowledge engineer and the domain expert who act as builders. Once the system is completed it is used for consultation by the nonexpert user via the consultation environment.

7.	<p><b>List and define the major components of an ES. BTL2</b></p> <p>The major components are:</p> <ul style="list-style-type: none"> <li>✓ <b>Knowledge base</b>--the software that represents the knowledge.</li> <li>✓ <b>Inference engine</b>--the reasoning mechanism.</li> <li>✓ <b>User interface</b>--the hardware and software that provide the dialogue between people and the computer.</li> <li>✓ <b>Domain expert</b>--the individual who is considered an expert.</li> <li>✓ <b>Knowledge engineer</b>--the individual who acquires and represents the knowledge.</li> <li>✓ <b>Explanation facility</b>--the software that answers questions such as "Why" and "How."</li> <li>✓ <b>Blackboard</b>--a workplace for storing and working on intermediate information.</li> <li>✓ <b>Reasoning improvement</b>--a facility (not available commercially) for improving the reasoning capabilities of an ES.</li> <li>✓ <b>User</b>--the non-expert who uses the machine for consultation. <b>Hardware</b>--the hardware that is needed to support the ES.</li> </ul>
8.	<p><b>What is the role of a knowledge engineer? BTL1</b></p> <p>Major duties are to acquire and represent the knowledge. Some knowledge engineers do the computer programming as well.</p>
9.	<p><b>Describe how expert systems perform inference BTL2</b></p> <p>The brain of an expert system is the inference engine that provides a methodology for reasoning about information in the knowledge base. Inference can be performed using semantics networks, production rules, and logic statements.</p>
10.	<p><b>What are the major activities performed in the ES blackboard (workplace)? BTL2</b></p> <p>The blackboard records intermediate hypotheses and decisions, devises a plan of how to attack a problem, provides an agenda of actions awaiting execution, and lists the candidate solutions to be examined.</p>
11.	<p><b>Describe generic categories of ES applications BTL2</b></p> <p>Genetic categories of ES applications are:</p> <ul style="list-style-type: none"> <li>✓ <b>Rule-based ES.</b> Knowledge is represented by a series of rules.</li> <li>✓ <b>Frame-based systems.</b> Knowledge is represented as a series of frames (an object-oriented approach).</li> <li>✓ <b>Hybrid systems.</b> Involve several approaches such as fuzzy logic and neural networks.</li> <li>✓ <b>Model-based systems.</b> Structured around a model that simulates the structure and function of the system under study.</li> <li>✓ <b>Ready-made systems.</b> Utilize prepackaged software.</li> <li>✓ <b>Real-time systems.</b> Systems designed to produce a just-in-time response.</li> </ul>
12.	<p><b>Describe some of the limitations of ES. BTL1</b></p> <p>Knowledge is not always readily available.</p> <ul style="list-style-type: none"> <li>✓ It can be difficult to extract expertise from humans. There are frequently multiple correct assessments. Time pressures.</li> <li>✓ Users have cognitive limits.</li> <li>✓ ES works well only within a narrow domain of knowledge.</li> <li>✓ Most experts do not have an independent means to validate results. Vocabulary is often limited and difficult to understand.</li> <li>✓ Help from knowledge engineers is difficult to obtain and costly. Potential for lack of trust on the part of the end-users.</li> <li>✓ Knowledge transfer is subject to biases.</li> </ul>

13.	<p><b>Describe the success factors of ES. BTL1</b></p> <p>Success factors are:</p> <ul style="list-style-type: none"> <li>✓ Level of knowledge must be sufficiently high.</li> <li>✓ Expertise must be available from at least one expert.</li> <li>✓ The problem to be solved must be fuzzy.</li> <li>✓ The problem must be narrow in scope.</li> <li>✓ The shell must be of high quality and naturally store and manipulate the knowledge.</li> <li>✓ The user interface must be friendly to novice users.</li> <li>✓ The problem to be solved must be difficult and important enough to justify the development of a system.</li> <li>✓ Knowledgeable developers with good people skills are needed. The impact of the ES must be considered.</li> <li>✓ The impact should be favorable. Management support is needed.</li> </ul>
14.	<p><b>What is a ready-made (off-the-shelf) ES? BTL2</b></p> <p>Ready-made systems are sold in computer stores or via the Web to people who want to buy general expertise in a certain area. For example, the system WINE advises a user what wine is most appropriate for certain types of meals.</p>
15.	<p><b>What is a real-time ES? BTL1</b></p> <p>In real-time ES the conclusions (recommendations) are derived fast so a process can be impacted immediately. They are used in quality control and robotics (e.g., to correct a malfunction).</p>
16.	<p><b>What are the benefits of deploying an ES on the Web? BTL1</b></p> <p>The expertise is made available to a wider audience, use of a common interface, etc.</p>
17.	<p><b>How can an ES help a decision maker in Web use? BTL3</b></p> <p>An ES can advise a user on how to proceed in doing his/her work (Web searches, database access, etc.).</p>
18.	<p><b>What is meta knowledge? How meta knowledge is represents in rule-based expert systems? AN (MAY/JUNE2016) BTL2</b></p> <p>Meta Knowledge: Knowledge about knowledge Meta Knowledge is represented in rule-based expert systems as meta rules.</p>
19.	<p><b>Write any four earliest expert systems. (MAY/JUNE2016) BTL1</b></p> <p>Four earliest expert systems: DENDRAL, MYCIN, PROSPECTOR, XCON</p>
	<b>PART * B</b>
1	<p><b>How did you describe Rule-Based system Architecture? (13M) BTL-3</b></p> <p><b>Answer:Notes</b></p> <p>Introduction : The production rules as knowledge representation mechanism are used in the design of many "Rule-based systems" also called "Production systems" (2M)</p> <p>Types of rules (6M)</p> <ul style="list-style-type: none"> <li>■ Knowledge Declarative Rules:</li> <li>■ Inference Procedural Rules</li> <li>■ Meta rules</li> </ul> <p>Examples and explanation of production rules : (5M)</p> <ul style="list-style-type: none"> <li>- IF condition THEN action</li> <li>- IF premise THEN conclusion</li> <li>- IF proposition p<sub>1</sub> and proposition p<sub>2</sub> are true THEN proposition p<sub>3</sub> is true</li> </ul>

2

- i) Examine about Associative or semantic network architecture. (7M) BTL4  
 ii) Examine about frame architecture. (6M) BTL4

**Answer: Notes**

Associative or semantic network architecture.

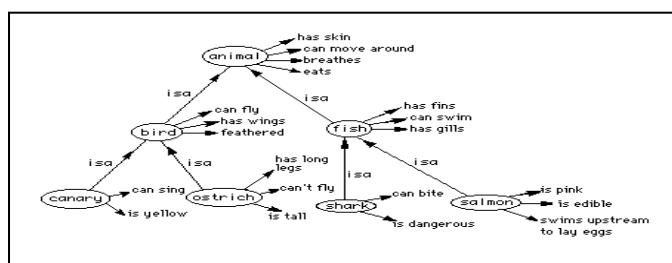
Introduction

(4M)

- A classic representation technique for propositional information
- Propositions – a form of declarative knowledge, stating facts (true/false)
- Propositions are called “atoms” – cannot be further subdivided.
- Semantic nets consist of nodes (objects, concepts, situations) and arcs (relationships between them).

Diagram

(3M)



frame architecture

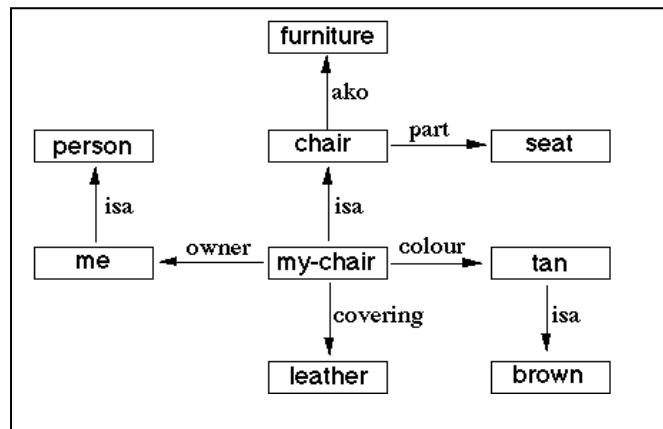
Introduction

(4 M)

- One type of schema is a frame (or script – time-ordered sequence of frames).
- Frames are useful for simulating commonsense knowledge.
- Semantic nets provide 2-dimensional knowledge; frames provide 3-dimensional.
- Frames represent related knowledge about narrow subjects having much default knowledge

Diagram

(2M)



3

- (i) How do you examine Performance measure in Knowledge acquisition? (7M)BTL4  
 (ii) Describe in detail about Characteristic feature of expert system. (6M)BTL-4

**Answer:Page. 422-Elaine Rich**

Performance measure in Knowledge acquisition:

(7M)

- Expert may not have required knowledge in some areas
- Expert may not be consciously aware of required knowledge needed
- Expert may not be able to communicate the knowledge needed to knowledge engineer

Knowledge engineer may not be able to structure knowledge for entry into knowledge base

	<p>Characteristic feature of expert system. (6M)</p> <ul style="list-style-type: none"> <li>✓ simulate human reasoning</li> <li>✓ perform reasoning over representations</li> <li>✓ tend to be solved using heuristics</li> <li>✓ provide explanations and justifications</li> <li>✓ Knowledge Based System (IKBS)</li> </ul>
4	<p><b>Can you apply the facts to describe</b></p> <p>i) <b>Decision tree architecture. (7M)</b></p> <p>ii) <b>Blackboard system Architecture. (6M) BTL6</b></p> <p><b>Answer:Notes</b></p> <p>Decision tree architecture (4M)</p> <ul style="list-style-type: none"> <li>✓ Knowledge for ES may be stored in the form of Decision tree.</li> <li>✓ Special tree building editor used.</li> <li>✓ New nodes will be added when additional rules are added.</li> <li>✓ Traversing technique to identify the attributes.</li> <li>✓ Diagram (2M)</li> </ul> <pre> graph TD     Patrons[Patrons] -- None --&gt; No1[No]     Patrons -- Some --&gt; Yes1[Yes]     Patrons -- Full --&gt; Hungry[Hungry]     Hungry -- Yes --&gt; Type[Type]     Hungry -- No --&gt; No2[No]     Type -- French --&gt; Yes2[Yes]     Type -- Italian --&gt; No3[No]     Type -- Thai --&gt; FriSat[Fri/Sat]     FriSat -- Burger --&gt; Yes3[Yes]     FriSat -- No --&gt; No4[No]     FriSat -- Yes --&gt; Yes4[Yes]   </pre> <p>Blackboard system Architecture. (4M)</p> <ul style="list-style-type: none"> <li>✓ There are 3 components</li> <li>✓ There are number of <i>knowledge sources</i>.</li> <li>✓ A data structure called <i>Blackboard</i> which contains current problem state and information needed by the knowledge sources.</li> <li>✓ <i>Control Information</i> – Monitors changes in the blackboard.</li> </ul> <p>Diagram (2M)</p>

5

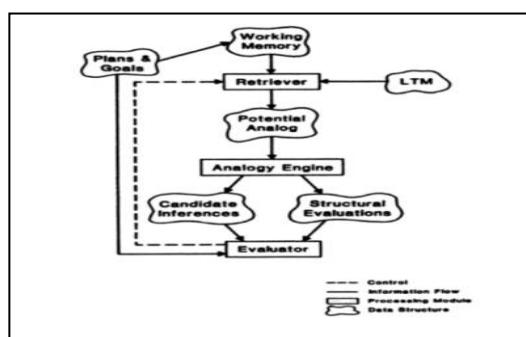
- i) What conclusion can you infer from Analogical reasoning Architecture?(6M) BTL3  
ii) Explain in detail about Neural Network Architecture? (7M) BTL4

**Answer:**Page. 379-Elaine Rich

Analogical reasoning Architecture (4M)

Analogy-based reasoning: This term is sometimes used, as a synonym to case-based reasoning, to describe the typical case-based approach

Diagram (2M)



Neural Network Architecture (4M)

Examples of neural network production rules :

- IF condition THEN action
- IF premise THEN conclusion
- IF proposition p<sub>1</sub> and proposition p<sub>2</sub> are true THEN proposition p<sub>3</sub> is true

Explanation: (3M)

6

- i) Evaluate in detail about knowledge acquisition.(13M) BTL5

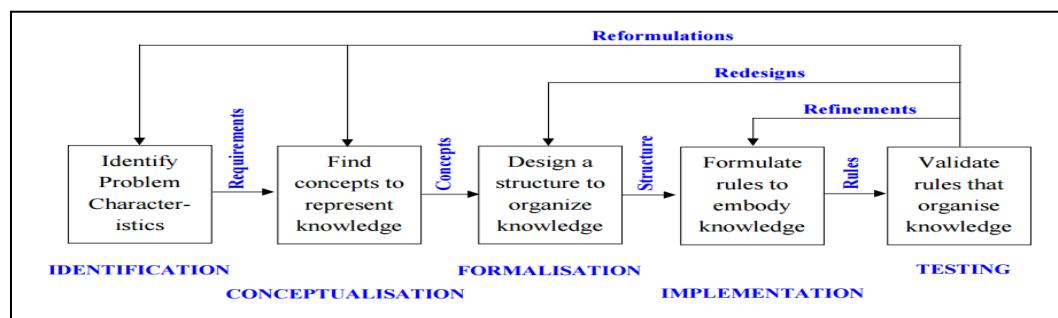
**Answer:**Page. 422-Elaine Rich

Introduction (3M)

- ✓ The knowledge acquisition component allows the expert to enter their knowledge or expertise into the expert system, and to refine it later as and when required.
- ✓ The knowledge acquisition process is usually comprised of three principal stages:

Knowledge Elicitation (3M)

Stages of Knowledge Acquisition (4M)



Levels of Knowledge Analysis (3M)

7

**Integrate your opinion about DART, MYCIN and XCON.(13M) BTL5****Answer:Page. Notes**

DART it is an automated consultant service

(5M)

Finding the fault

Check the violation

Infer the problem

The fault if found

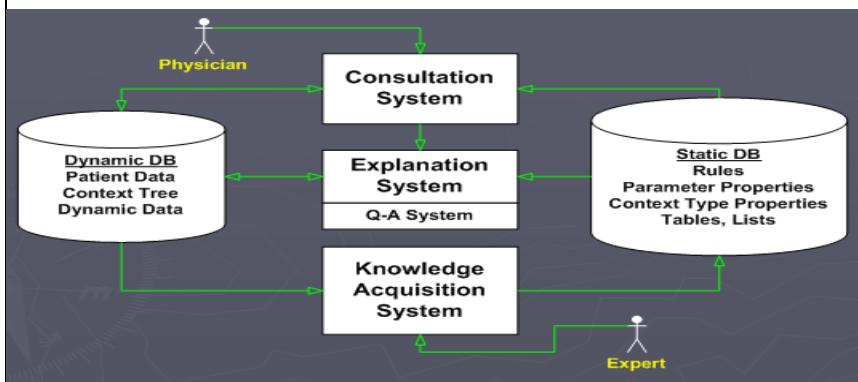
MYCIN

(5M)

- ✓ Mycin operated using a fairly simple inference engine, a knowledge base of ~500 rules.
- ✓ Disease DIAGNOSIS and Therapy SELECTION
- ✓ Advice for non-expert physicians with time considerations and incomplete evidence on:

Bacterial infections of the blood

Expanded to meningitis and other ailments



XCON

(3M)

- ✓ Expert system to configure VAX -11/780 computers
- ✓ Developed by collaboration between Carnegie Mellon University and Digital Equipment Corporation

Domain

Task

Input

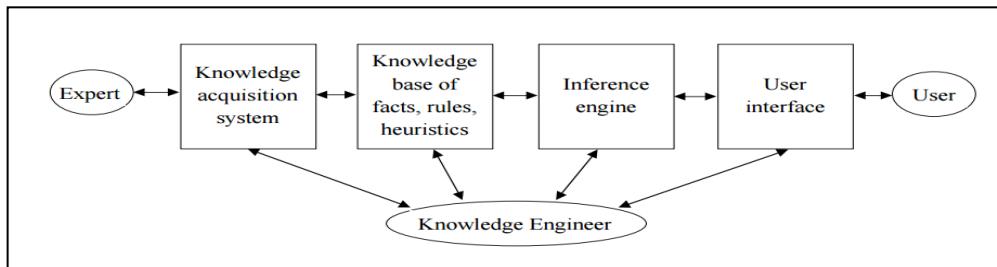
Output

8

**Explain the architecture of Expert System with neat diagram. (13M) BTL3****Answer:Page. 424-Elaine Rich**

Introduction: diagram

(3M)

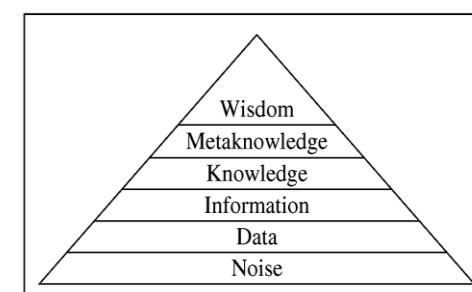
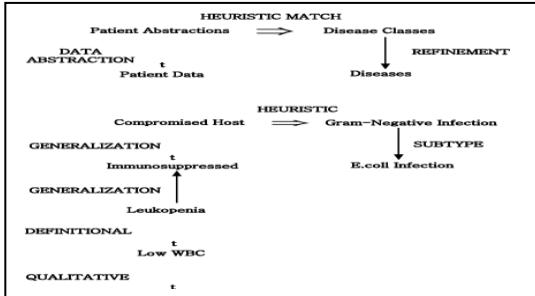


Knowledge Base: Knowledge about problem domain in the form of static and dynamic databases.

(3M)

Inference Engine: It consists of inference mechanism and control strategy. (2M)

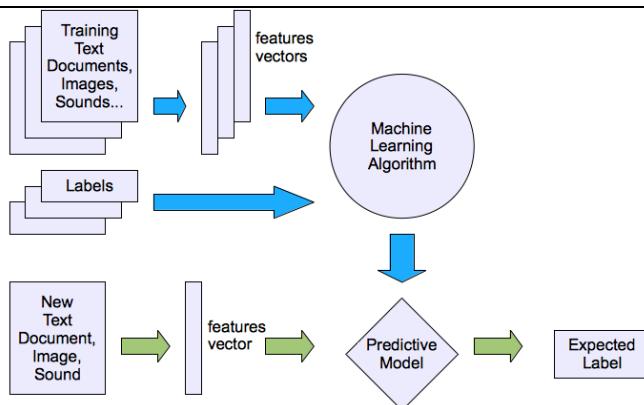
Knowledge Acquisition: Knowledge acquisition module allows system to acquire knowledge about the problem domain (3M)

	User Interfaces: Allows user to communicate with system in interactive mode (2M)
9	<p><b>Discuss Knowledge Acquisition. (13M) BTL2</b>  <b>Answer:Page. 422-Elaine Rich</b></p> <p>Knowledge acquisition includes the elicitation, collection, analysis, modeling and validation of knowledge.</p> <ul style="list-style-type: none"> <li>✓ Issues in Knowledge Acquisition (2M)</li> <li>✓ Techniques for Knowledge Acquisition (2M)</li> <li>✓ Protocol-generation techniques (2M) <ul style="list-style-type: none"> <li>Include many types of interviews (unstructured, semi-structured and structured), reporting and observational techniques.</li> </ul> </li> <li>✓ Protocol analysis techniques (2M) <ul style="list-style-type: none"> <li>Used with transcripts of interviews or text-based information to identify basic knowledge objects within a protocol, such as goals,</li> </ul> </li> <li>✓ Hierachy-generation techniques (2M)</li> <li>✓ Matrix-based techniques (1M)</li> <li>✓ Sorting techniques (1M)</li> <li>✓ Limited-information and constrained-processing tasks (1M)</li> <li>✓ Diagram-based techniques (1M)</li> </ul>
10	<p>i) Write short notes on Meta knowledge. (6M) BTL3  ii) Write short notes on Heuristics. (7M) BTL3</p> <p><b>Answer:Page. 425-Elaine Rich</b></p> <p>Meta knowledge (6M)</p> <ul style="list-style-type: none"> <li>✓ Meta knowledge is knowledge about knowledge and expertise.</li> <li>✓ Most successful expert systems are restricted to as small a domain as possible.</li> </ul> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;">  <p>The diagram shows a pyramid divided into six horizontal layers. From top to bottom, the layers are labeled: Wisdom, Metaknowledge, Knowledge, Information, Data, and Noise.</p> <p><b>Wisdom:</b> Using knowledge in a beneficial way  <b>Metaknowledge:</b> Rules about knowledge  <b>Knowledge:</b> Rules about using information  <b>Information:</b> Potentially useful for knowledge  <b>Data:</b> Potentially useful information  <b>Noise:</b> No apparent information.</p> </div> <p>Heuristics (7M)</p> <p>Expert systems apply heuristics to guide the reasoning and thus reduce the search area for a solution. It is about practice, accurate judgment, one's ability of evaluation, and guessing</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;">  <pre> graph TD     PD[Patient Data] -- DATA ABSTRACTION --&gt; PA[Patient Abstractions]     PA -- HEURISTIC MATCH --&gt; DC[Disease Classes]     DC -- REFINEMENT --&gt; D[Diseases]          I[Immunosuppressed] -- GENERALIZATION --&gt; CH[Compromised Host]     CH -- HEURISTIC --&gt; GNI[Gram-Negative Infection]     GNI -- SUBTYPE --&gt; EI[E. coli Infection]   </pre> <p>The flowchart illustrates the heuristic process for disease diagnosis. It starts with Patient Data, which is abstracted into Patient Abstractions. These are then matched against Disease Classes, leading to a refined list of Diseases. Below this, a Compromised Host (e.g., Immunosuppressed) is identified through Generalization from Leukopenia and Low WBC. This leads to a Gram-Negative Infection, which is further refined into an E. coli Infection.</p> </div>

<b>11</b>	<b>Illustrate in detail about expert system Shells. (13M) BTL5</b>
	<b>Answer:Page. 424-Elaine Rich</b>
	Introduction (3M)
	It consists of knowledge base (2M)
	the inference mechanism (2M)
	the working memory (2M)
	user interface (2M)
	diagram (3M)

**PART \* C**

<b>1</b>	<b>Explain the need, significance and evolution of XCON expert system.(15M) BTL5</b>
	<b>Answer: Notes</b>
	<b>XCON</b>
	<ul style="list-style-type: none"> <li>✓ Expert system to configure VAX -11/780 computers</li> <li>✓ Developed by collaboration between Carnegie Mellon University and Digital Equipment Corporation</li> <li>✓ Stages (1M)</li> <li>✓ Identification (2M)</li> <li>✓ Conceptualization (2M)</li> <li>✓ Formalization (2M)</li> <li>✓ Implementation (2M)</li> <li>✓ Testing and evaluation (2M)</li> <li>✓ Maintenance (2M)</li> <li>✓ Domain (1M)</li> <li>✓ Task (1M)</li> <li>✓ Input (1M)</li> <li>✓ Output (1M)</li> </ul>
<b>2</b>	<b>Design an expert system for Travel recommendation and discuss its roles.(15M)</b>
	<b>BTL6</b>
	<b>Answer: Notes</b>
	<ul style="list-style-type: none"> <li>✓ Roles (5M)</li> <li>✓ Tickets</li> <li>✓ Source</li> <li>✓ Destination</li> <li>✓ Availability checker</li> <li>✓ updater</li> <li>✓ Example case study (5M)</li> <li>✓ Explanation (5M)</li> </ul>
<b>3</b>	<b>Analyze any two machine learning algorithms with an example.(15M) BTL4</b>
	<b>Answer:Page. 355-Elaine Rich</b>
	<ul style="list-style-type: none"> <li>✓ Machine learning is the systematic study of algorithms and systems that improve their knowledge or performance (learn a model for accomplishing a task) with experience (from available data /examples) (1M)</li> </ul>
	<b>(i) Supervised learning</b>
	<ul style="list-style-type: none"> <li>✓ The computer is presented with example inputs and their desired outputs, given by a "teacher", and the goal is to learn a general rule that maps inputs to outputs. (2M)</li> </ul>
	Diagram (3M)



## Classification

### Example 1

(3M)

Suppose you have a basket and it is filled with different kinds of fruits. Your task is to arrange them as groups. For understanding let me clear the names of the fruits in our basket. You already learn from your previous work about the physical characters of fruits. So arranging the same type of fruits at one place is easy now.

- ✓ Your previous work is called as training data in data mining. You already learn the things from your train data; this is because of response variable

No	SIZE	COLOR	SHAPE	FRUIT NAME
1	Big	Red	Rounded shape with a	Apple
2	Small	Red	Heart-shaped to nearly globular	Cherry
3	Big	Green	Long curving cylinder	Banana
4	Small	Green	Round to oval, Bunch shape	Grape

means just a decision variable.

- ✓ Suppose you have taken a new fruit from the basket then you will see the size, color and shape of that particular fruit.
- ✓ If size is Big , color is Red , shape is rounded shape with a depression at the top, you will conform the fruit name as apple and you will put in apple group.
- ✓ If you learn the thing before from training data and then applying that knowledge to the test data (for new fruit), this type of learning is called as Supervised Learning.

### Dimension reduction

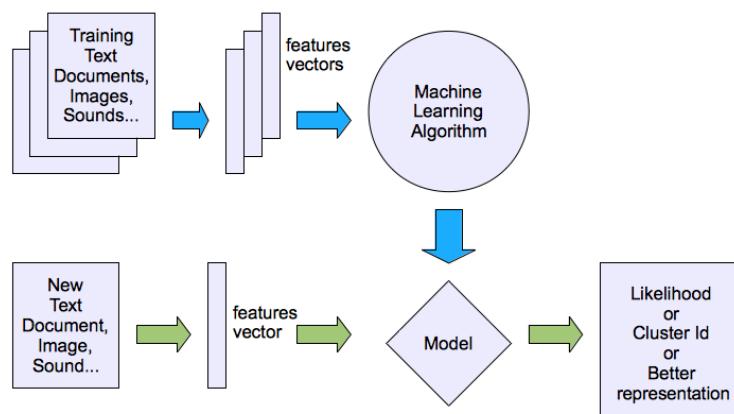
(3M)

- ✓ Dimensionality reduction simplifies inputs by mapping them into a lower-dimensional space.

- ✓ Topic modeling is a related problem, where a program is given a list of human language documents and is tasked to find out which documents cover similar topics.

Diagram

(3M)



**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**QUESTION BANK**

**SUBJECT : CS8592 Object Oriented Analysis and Design**  
**SEM /YEAR : VI/Third Year**

<b>UNIT -1- UNIFIED PROCESS AND USE CASE DIAGRAMS</b>	
<b>PART A</b>	
<b>Q.No</b>	<b>QUESTIONS</b>
1.	<p><b>What is Object Oriented analysis &amp; Design? (April/May 2017) BTL1</b></p> <p><b>Object-oriented analysis and design (OOAD)</b> is a popular technical approach for analyzing and designing an application, system, or business by applying object-oriented programming, as well as using visual modeling throughout the development life cycles</p>
2.	<p><b>List the 4 phases in UP. BTL1</b></p> <p>The Unified Process is an iterative and incremental development process. The four phases are</p> <ul style="list-style-type: none"> <li>• Inception</li> <li>• Elaboration</li> <li>• Construction</li> <li>• Transition</li> </ul>
3.	<p><b>Compose your views on iterative Development and write it benefits. BTL6</b></p> <p>Iterative development is a way of breaking down the software development of a large application into smaller chunks. In iterative development, feature code is designed, developed and tested in repeated cycles</p> <ul style="list-style-type: none"> <li>• Risks are mitigated earlier, because elements are integrated progressively.</li> <li>• Changing requirements and tactics are accommodated.</li> <li>• Improving and refining the product is facilitated, resulting in a more robust product.</li> <li>• Organizations can learn from this approach and improve their process.</li> </ul>
4.	<p><b>Define UML. BTL1</b></p> <p><b>Unified Modeling language (UML)</b> is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system</p>
5.	<p><b>What is a POS system? List the components of POS system. BTL1</b></p> <p>A POS system is a computerized application used (in part) to record sales and handle payments; it is typically used in a retail store</p> <p>It includes hardware components such as a computer and bar code scanner, and software to run the system</p>
6.	<p><b>Define Use Case. Point out what test can help find useful use cases? (April/May 2017) BTL4</b></p> <ul style="list-style-type: none"> <li>• A use case is a list of actions or event steps typically defining the interactions between a role and a system to achieve a goal. The actor can be a human or other external system</li> <li>• It is used widely in developing tests at system or acceptance level</li> </ul>
7.	<p><b>Illustrate the relationship used in Use case. BTL3</b></p>

	<p>There can be 5 relationship types in a use case diagram.</p> <ul style="list-style-type: none"> <li>• Association between actor and use case</li> <li>• Generalization of an actor</li> <li>• Extend between two use cases</li> <li>• Include between two use cases</li> <li>• Generalization of a use case</li> </ul>
8.	<p><b>List out the advantages of Use case Modeling. BTL1</b></p> <ul style="list-style-type: none"> <li>• The use case diagram provides a comprehensive summary of the whole software system</li> <li>• feedback can be obtained at a very early stage of the development from the customers and the end users.</li> <li>• it requires the identification of exceptional scenarios for the use cases.</li> <li>• The use case model can be utilized in several other aspect of software development</li> </ul>
9.	<p><b>Classify the 3 kinds of actors in use case. BTL4</b></p> <ul style="list-style-type: none"> <li>• Actors can be:</li> <ol style="list-style-type: none"> <li>1. Human</li> <li>2. Systems/Software</li> <li>3.Hardware</li> <li>4.Timer/Clock</li> </ol> </ul>
10.	<p><b>Show the important deals in Inception of the POS system? Mention the requirements of Inception phase BTL3</b></p> <p>The POS system.</p> <ul style="list-style-type: none"> <li>• Project scope, project vision, and the business case</li> <li>• Reach stakeholder agreement on the project vision and business case</li> </ul>
11.	<p><b>Interpret the meaning of Generalization and specialization. BTL2</b></p> <p><b>Generalization</b> is the process of extracting shared characteristics from two or more classes, and combining them into a generalized superclass</p> <p><b>Specialization</b> means creating new subclasses from an existing class.</p>

12.	<p><b>Difference between Include and Extend use case relationships. (April/May 2017) BTL4</b></p> <p><b>Extend</b> is used when a use case conditionally adds steps to another first class use case</p> <p><b>Include</b> is used to extract use case fragments that are duplicated in multiple use cases</p>
13.	<p><b>Distinguish between method and message in object. (Nov/Dec 2015) BTL2</b></p> <p><b>The core difference between a method call and a message is this:</b></p> <ul style="list-style-type: none"> <li>• a method call only happens in your code: in ASM it's translated by a PUSH of the passed arguments.</li> <li>• a kernel message is mostly something sent to the kernel which is tracked and send back to a certain processes</li> </ul>
16.	<p><b>Discuss the Strength and Weakness of the Use case Diagram. BTL2</b></p> <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Use case modeling is that it requires the identification of exceptional scenarios for the use cases</li> <li>• The use case model can be utilized in several other aspect of software development as well, e.g. Cost Estimation, Project Planning, Test Case Preparation and User Documentation</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• They do not capture the non-functional requirements easily.</li> <li>• There might be a learning curve for the developer and/or specially, the client in using these use cases.</li> </ul>
17.	<p><b>Interpret the meaning of event, state. BTL2</b></p> <p><b>Event:</b> It is the occurrence that is relevant to an object or application.</p> <p><b>State:</b> state of an object is determined by the value of some of its attributes and the presence or absences of links with other objects.</p> <p><b>Transition:</b> It is the movement from one state to another, triggered by an event.</p>
21	<p><b>What is object oriented system development methodology? BTL1</b></p> <p>Object oriented system development methodology is a way to develop software by building self contained modules or objects that can be easily replaced, modified and reused.</p>
22	<p><b>What is iterative evolutionary development? BTL1</b></p> <ul style="list-style-type: none"> <li>• The iterative lifecycle is based on the successive enlargement and refinement of a system through multiple iterations, with cyclic feedback and adaptation as core drivers to converge upon a suitable system.</li> <li>• The system grows incrementally over time, iteration by iteration and thus this approach is also known as iterative and incremental development.</li> </ul>
23	<p><b>Define use case generalization? BTL1</b></p> <p>Use case generalization is used when you have one or more use cases that are rally specializations of more general case.</p>
24	<p><b>Explain object? (Nov/Dec 2018) BTL1</b></p> <p>An object is a combination of data and logic; the representation of some real-world entity.</p>
25	<p><b>Describe the Primary goals in the Design of UML. (Nov/Dec 2016) BTL2</b></p> <p>It provide users with a ready-to-use, expressive visual modeling language so they can develop and exchange meaningful models. It provide extensibility and specialization mechanisms to extend the core concepts.</p>

26	<p><b>Discuss the main advantages of object oriented development? BTL2</b></p> <ul style="list-style-type: none"> <li>• High level of abstraction</li> <li>• Seamless transition among different phases of software development</li> <li>• Encouragement of good programming techniques</li> <li>• Promotion of reusability</li> </ul>
<b>PART B</b>	
1	<p><b>i) Explain in detail about the Unified process in object oriented Analysis and Design? Explain the phases with neat diagrams. (7m) (April/May 2017, May/June 2016, April/May 2011) BTL4</b></p> <p><b>Answer:</b> pg.no:18 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>The Unified Process is an iterative and incremental development process</p> <p><b>Diagram(1m)</b></p> <p><b>Explanation(4m)</b></p> <ul style="list-style-type: none"> <li>• Iterative Development</li> <li>• UP Practices and Concepts</li> <li>• The UP Phases and Schedule</li> <li>• The UP Disciplines (was Workflows)</li> <li>• The Agile UP</li> <li>• The Sequential "Waterfall"</li> </ul> <p><b>ii) What is UML activity Diagram? Using an example explain the features of basic UML activity diagram notation. (April/May 2017, May/June 2016) BTL4 (6m)</b></p> <p><b>Answer:</b> pg.no:477-478 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <ul style="list-style-type: none"> <li>• A UML activity diagram shows sequential and parallel activities in a process.</li> </ul> <p><b>Diagram(1m)</b></p> <p><b>Explanation(3m)</b></p> <ul style="list-style-type: none"> <li>• A UML activity diagram shows sequential and parallel activities in a process.</li> <li>• They are useful for modeling business processes, workflows, data flows, and complex algorithms.</li> <li>• Basic UML activity diagram notation illustrates an action, partition, fork, join, and object node.</li> </ul>
2	<p><b>Write a problem statement for Library Management System. Design the UML Use Case diagram, Activity diagram, Class diagram, Sequence diagram, State chart diagram, Package diagram, and Component and Deployment diagram. (13m) (May/June 2016) BTL6</b></p> <p><b>Answer:</b> pg.no:7, Refer notes</p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(5m)</b></p> <p><b>End-Users:</b></p> <ul style="list-style-type: none"> <li>• Librarian: To maintain and update the records and also to cater the needs of the users. Reader: Need books to read and also places various requests to the librarian.</li> <li>• Vendor: To provide and meet the requirement of the prescribed books.</li> </ul>
3	<p><b>Define use case Diagram? Model a use case diagram for a Banking System. Explain the business rules you are considering. b) Consider the following use Cases that play a role in the Banking System you have modeled: 1. Deposit 2. Withdraw Model sequence diagrams for the above two use cases. (13m) (Nov/Dec 2018) BTL1</b></p> <p><b>Answer:</b> pg.no:61-63 in Craig Larman book</p>

	<p><b>Definition (2m)</b></p> <ul style="list-style-type: none"> <li>A use case diagram is an excellent picture of the system context; it makes a good context diagram that is, showing the boundary of a system, what lies outside of it, and how it gets used.</li> </ul> <p><b>Explanation(8m)</b></p> <ul style="list-style-type: none"> <li>It serves as a communication tool that summarizes the behavior of a system and its actors.</li> <li>Background</li> <li>Use Cases and Adding Value</li> <li>Use Cases and Functional Requirements</li> <li>Use Case Types and Formats</li> <li>Fully Dressed Example: Process Sale</li> <li>Relating use cases- Include, Exclude, Generalize</li> <li>Example with diagram-ATM, Library Management System etc</li> </ul> <p><b>Diagram(3m)</b></p>
4	<p><b>(i).What is a POS system? Briefly explain about Inception Phase. (8m) BTL4</b></p> <p><b>Answer:</b> pg.no:33,47 in Craig Larman book</p> <p><b>Explanation(4m)</b></p> <ul style="list-style-type: none"> <li>The Next Gen POS System</li> <li>Architectural Layers and Case Study Emphasis</li> <li>Iterative Development and Iterative Learning</li> <li>Inception is the initial short step to establish a common vision and basic scope for the Project.</li> <li>It will include analysis of perhaps 10% of the use cases, analysis of the critical non-Functional requirement, creation of a business case, and preparation of the development Environment so that programming can start in the elaboration phase.</li> <li>Inception in one Sentence: Envision the product scope, vision, and business case.</li> </ul> <p><b>Diagram(4m)</b></p> <p><b>(ii). Comparison between Association and attributes. (5m) BTL4</b></p> <p><b>Answer:</b> pg.no:150,158 in Craig Larman book</p> <p><b>Explanation(5m)</b></p> <ul style="list-style-type: none"> <li>Association is a group of links having common structure and common behavior.</li> <li>Association depicts the relationship between objects of one or more classes.</li> <li>A link can be defined as an instance of an association</li> <li>A set of attributes for the objects that are to be instantiated from the class.</li> <li>Generally, different objects of a class have some difference in the values of the attributes.</li> <li>Attributes are often referred as class data</li> </ul>
5	<p><b>(i).Explain the purpose of usecase model? Identify the actors, scenarios, and usecases for a library Management system. (8m) (Nov/Dec 2016) BTL5</b></p> <p><b>Answer:</b> pg.no:58,64, refer notes in Craig Larman book</p> <p><b>Categories(8m)</b></p> <p><b>Actors of the Library Management System(4m)</b></p> <ul style="list-style-type: none"> <li>Member</li> <li>Administrator</li> <li>Librarian</li> <li>Guest</li> </ul> <p><b>Use cases of Library Management System(4m)</b></p> <ul style="list-style-type: none"> <li>Login</li> <li>View User Details</li> <li>View Books</li> <li>View Members</li> <li>Reserve Books</li> <li>Search Books</li> <li>Issue Books</li> <li>Return Books</li> </ul>

	<ul style="list-style-type: none"> <li>• Add/Remove Books</li> </ul> <p>Add/Remove Members</p> <p><b>(ii). Rank the 3 kinds of actors and explain the 3 common Use Case formats. BTL5 (5m)</b></p> <p><b>Answer:</b> pg.no:63,80 in Craig Larman book</p> <p><b>Use case(5m)</b></p> <ul style="list-style-type: none"> <li>• Primary actor has user goals fulfilled through using services of the SuD. For example, the cashier</li> <li>• Supporting actor provides a service (for example, information) to the SuD. The automated payment authorization service is an example</li> <li>• Offstage actor has an interest in the behavior of the use case, but is not primary or supporting; for example, a government tax agency</li> </ul>
6	<p><b>List the various UML diagram and examine the purpose of each diagram. (13m) BTL1</b></p> <p><b>Answer:</b> pg.no:133,249-250, refer notes in Craig Larman book</p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(5m)</b></p> <ul style="list-style-type: none"> <li>• Class Diagram. Class diagrams are the most common diagrams used in UML</li> <li>• Object Diagram. Object diagrams can be described as an instance of class diagram.</li> <li>• Component Diagram.</li> <li>• Deployment Diagram.</li> <li>• Use Case Diagram.</li> <li>• Sequence Diagram.</li> <li>• Collaboration Diagram.</li> <li>• Statechart Diagram.</li> </ul>

## PART C

1	<p><b>For the NextGen POS system design the following Conceptual class hierarchies. (15m) BTL2</b></p> <p><b>(i). Conceptual super class</b></p> <p><b>(ii). Conceptual subclass</b></p> <p><b>(iii). Authorization Transaction classes.</b></p> <p><b>(iv). Abstract Conceptual classes.</b></p> <p><b>Answer:</b> pg.no:535-540 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>A conceptual superclass definition is more general or encompassing than a subclass definition.</p> <p><b>Explanation(10m)</b></p> <p>For example, consider the superclass <i>Payment</i> and its subclasses (<i>CashPayment</i>, and so on). Assume the definition of <i>Payment</i> is that it represents the transaction of transferring money (not necessarily cash) for a purchase from one party to another, and that all payments have an amount of money transferred.</p> <p><b>Diagram(3m)</b></p>
2	<p><b>Explain the benefits and concepts of use case and use case model and analyze the relating use cases have in Library management system. (15m) BTL4</b></p> <p><b>Answer:</b> pg.no: 11, refer notes in Craig Larman book</p> <p><b>Explanation(10m)</b></p> <p><b>Actors of the Library Management System</b></p> <ul style="list-style-type: none"> <li>• Member</li> <li>• Administrator</li> <li>• Librarian</li> <li>• Guest</li> </ul> <p><b>Use cases of Library Management System</b></p>

	<ul style="list-style-type: none"> <li>• Login</li> <li>• View User Details</li> <li>• View Books</li> <li>• View Members</li> <li>• Reserve Books</li> <li>• Search Books</li> <li>• Issue Books</li> <li>• Return Books</li> <li>• Add/Remove Books</li> </ul> <p>Add/Remove Members</p> <p><b>Diagram(5m)</b></p>
3	<p><b>Explain with example, how use case modeling is used to describe functional requirements. Identify the actors, scenario and use cases for the example. (15m) BTL5</b></p> <p>Answer: pg.no:58,64 in Craig Larman book</p> <p><b>Diagram(3m)</b></p> <p><b>Definition(2m)</b></p> <p>A use case is a collection of related success and failure scenarios that describe an actor using a system to support a goal. Use cases are text documents, not diagrams, and use-case modeling is primarily an act of writing text, not drawing diagrams.</p> <p><b>Explanation(8m)</b></p> <p>A use case diagram is an excellent picture of the system context; it makes a good context diagram that is, showing the boundary of a system, what lies outside of it, and how it gets used. It serves as a communication tool that summarizes the behavior of a system and its actors.</p> <ul style="list-style-type: none"> <li>• Background</li> <li>• Use Cases and Adding Value</li> <li>• Use Cases and Functional Requirements</li> <li>• Use Case Types and Formats</li> <li>• Fully Dressed Example: Process Sale</li> <li>• Relating use cases- Include, Exclude, Generalize</li> <li>• Example with diagram-ATM, Library Management System etc</li> </ul>

- 4 **By considering your own application, perform and analyze the object oriented system Development and give the use case model for the same (use include, extend and generalization). (15m) BTL4**

**Answer:** pg.no:494,497,260 in Craig Larman book

**Explanation(10m)**

**Diagram(5m)**

To draw a use case diagram, we should have the following items identified.

- Functionalities to be represented as use case
- Actors
- Relationships among the use cases and actors.
- The name of a use case is very important. The name should be chosen in such a way so that it can identify the functionalities performed.
- Give a suitable name for actors.
- Show relationships and dependencies clearly in the diagram.
- Do not try to include all types of relationships, as the main purpose of the diagram is to identify the requirements.
- Use notes whenever required to clarify some important points.

- 5 **A University conducts examinations and the results are announced. Prepare a report for the following:**

**(i)Print the marks in the register number order semester wise for each department**

**(ii)Print the Arrear list semester wise.**

**(iii)Prepare a Rank list for each department.**

**(iv)Prepare the final aggregate mark list for final year students.**

**Identify the problem statement and Design and Explain the classes for each sequence. Draw a detailed flow chart using state chart diagrams. Design this system using Rational Rose. Design all the UML diagrams for designing this system. (15m) BTL6**

**Answer:** Pg.no:489,11,refer notes in Craig Larman book

**Explanation(10m)**

- Print the marks in the register number order semester wise for each department
- Print the Arrear list semester wise. Prepare a Rank list for each department
- Prepare the final aggregate mark list for final year students.

**Diagram(5m)**

## UNIT 2- STATIC UML DIAGRAMS

**Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams**

### PART A

1	<p><b>Define design Class Diagram? When to use Class Diagrams? (May/June 2016) BTL1</b></p> <p>A class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects</p> <p>The class diagrams are widely used in the modeling of object oriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages</p>
2	<p><b>Define Aggregation. BTL1</b></p> <p><b>Aggregation</b> is defined as a “part-of” or “has-a” relationship, with the ability to navigate from the whole to its parts. An aggregate object is an object that is composed of one or more other objects</p>
3	<p><b>List out the Components of Domain model? BTL1</b></p> <p>A domain model contains:</p> <ul style="list-style-type: none"> <li>• conceptual classes</li> <li>• associations between conceptual classes</li> <li>• attributes of a conceptual class</li> </ul>
4	<p><b>Distinguish abstract use case and concrete Use Case. BTL4</b></p> <p>A <b>concrete</b> use case is initiated by an actor and constitutes a complete flow of events. "Complete" means that an instance of the use case performs the entire operation called for by the actor.</p> <p>An <b>abstract</b> use case is never instantiated in itself</p>
5	<p><b>Express the meaning of Elaboration and What are the tasks performed in elaboration? (Nov/Dec 2015) BTL2</b></p> <p><b>Elaboration</b> is the second of the four phases in the RUP approach. It is to define and baseline the architecture of the system in order to provide a stable basis for the bulk of the design and implementation effort in the Construction phase</p> <p><b>Task Performed:</b></p> <ul style="list-style-type: none"> <li>• Elaboration are to address known risk factors and to establish and validate the system architecture.</li> <li>• During the Elaboration phase the project team is expected to capture a healthy majority of the system requirements</li> </ul>
6	<p><b>Compare and Contrast of Sequence and Collaboration diagram. BTL5</b></p> <p><b>Sequence diagrams</b> shows object interaction in timely manner(so no need of numbering the messages).</p> <p><b>Collaboration diagram</b> doesn't show object interaction in timely manner.</p>
7	<p><b>Define Domain Model. BTL1</b></p> <p>The <b>domain model</b> is a representation of meaningful real-world concepts pertinent to the domain that need to be modelled in software</p>
8	<p><b>Demonstrate how to create a Domain model. (Nov/Dec 2015,2016) BTL3</b></p> <ul style="list-style-type: none"> <li>• Identify Candidate Conceptual classes</li> <li>• Draw them in a Domain Model and Add associations necessary to record the responsibility and collaboration.</li> <li>• Add attributes necessary for information to be preserved</li> </ul>
9	<p><b>Express why we call a domain model a “Visual Dictionary”. (Nov/Dec 2016) BTL2</b></p>

	<p>It's easy to understand the terms of domain model and especially their relationships in a visual language, so domain model is called as Visual Dictionary</p>
10	<p><b>Define Conceptual class. (May/June 2016) BTL1</b></p> <ul style="list-style-type: none"> <li>• A domain model contains conceptual classes</li> <li>• A conceptual class is an idea, thing, or object</li> </ul>
11	<p><b>Compare Aggregation and Composition. BTL5</b></p> <ul style="list-style-type: none"> <li>• A directional association between objects.</li> <li>• Aggregation is also called a “Has-a” relationship.</li> </ul>  <ul style="list-style-type: none"> <li>• A restricted aggregation is called composition</li> <li>• When an object contains the other object it is called composition.</li> </ul> 
12	<p><b>Illustrate the usage of Description or specification class. BTL3</b></p> <p>There needs to be a description about an item or service,</p> <ol style="list-style-type: none"> <li>1. Independent of the current existence of any examples of those items or services.</li> <li>2. Deleting instances of things they describe (for example, Item) results in a loss of information that needs to be maintained, due to the incorrect association of information with the deleted thing.</li> <li>3. It reduces redundant or duplicated information.</li> </ol>
13	<p><b>Generalize the purpose of association relationship. BTL6</b></p> <p><b>Association</b> is a relationship between classifiers which is used to show that instances of classifiers could be either linked to each other or combined logically or physically into some aggregation</p>
14	<p><b>Define attribute? List out the types of attributes. (Nov/Dec 2018) BTL1</b></p> <p>An attribute is a specification that defines a property of an object, element, or file</p> <p>Types:</p> <ul style="list-style-type: none"> <li>• Single valued attributes</li> <li>• Multi valued attributes</li> <li>• Compound /Composite attributes</li> <li>• Simple / Atomic attributes</li> <li>• Stored attributes</li> <li>• Derived attributes</li> <li>• Complex attributes</li> <li>• Key attributes</li> <li>• Non key attributes</li> <li>• Required attributes</li> <li>• Optional/ null value attributes</li> </ul>
15	<p><b>Give the meaning of abstract conceptual class. BTL2</b></p> <p>It is useful to identify abstract classes in the domain model because they constrain what classes it is possible to have concrete instances of, thus clarifying the rules of the problem domain.</p>
16	<p><b>How to create Domain model? BTL6</b></p> <ul style="list-style-type: none"> <li>• Identify Candidate Conceptual classes</li> <li>• Draw them in a Domain Model and Add associations necessary to record the responsibility and</li> </ul>

	<p>collaboration.</p> <ul style="list-style-type: none"> <li>• Add attributes necessary for information to be preserved</li> </ul>
17	<p><b>Compare qualified association and reflexive association. BTL5</b></p> <ul style="list-style-type: none"> <li>• The reflexive association is used when objects in the same class can be associated</li> <li>• Qualified associations provide the same functionality as indexes</li> </ul>
18	<p><b>Point out the main goals of Establishing conceptual class Hierarchies. BTL4</b></p> <p>A conceptual model is the first step before drawing a UML diagram. It helps to understand the entities in the real world and how they interact with each other</p>
19	<p><b>What Artifacts May Start in Inception? BTL2</b></p> <p>Some sample artifacts are Vision and Business Case, Use-Case Model, Supplementary Specification, Glossary, Risk List &amp; Risk Management Plan, Prototypes and proof-of-concepts etc.</p>
20	<p><b>Illustrate what Tests Can Help Find Useful Use Cases? BTL2</b></p> <ol style="list-style-type: none"> <li>1. The Boss Test</li> <li>2. The EBP Test</li> <li>3. The Size Test</li> </ol>
21	<p><b>List the key ideas for Planning the Next Iteration? BTL1</b></p> <p>Organize requirements and iterations by risk, coverage, and criticality.</p>
22	<p><b>How to Create a Domain Model? BTL6</b></p> <p>The current iteration requirements under design:</p> <ol style="list-style-type: none"> <li>1. Find the conceptual classes (see a following guideline).</li> <li>2. Draw them as classes in a UML class diagram.</li> <li>3. Add associations and attributes.</li> </ol>
23	<p><b>Define Requirements and mention its types. BTL1</b></p> <p>Requirements are capabilities and conditions to which the system and more broadly, the project must conform.</p> <ol style="list-style-type: none"> <li>1. Functional</li> <li>2. Reliability</li> <li>3. Performance</li> <li>4. Supportability</li> </ol>
<b>PART B</b>	
1	<p><b>(i)Distinguish between the Concepts of Component and Deployment Diagram with an example of Book bank system. BTL2 (13m)</b></p> <p><b>Answer:</b> pg.no:651-653 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <ul style="list-style-type: none"> <li>• A component is a code module. Component diagrams are physical analogs of class diagram.</li> </ul> <p><b>Explanation(8m)</b></p> <p>Deployment diagrams show the physical configurations of software and hardware</p> <p><b>Diagram(3m)</b></p>
2	<p><b>Constructs the design for Library information system which comprises and following notations. (13m) (i). Aggregation and Composition (ii).Generalization and Specialization. (iii). Association (Nov/Dec 2015) BTL6</b></p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(5m)</b></p> <p><b>Answer:</b> pg.no:264,refer notes in Craig Larman book</p> <p><b>Aggregation (2m)</b> is a vague kind of association in the UML that loosely suggests whole-part</p>

	<p>relationships (as do many ordinary associations). It has no meaningful distinct semantics in the UML versus a plain association, but the term is defined in the UML.</p> <p><b>Composition(2m)</b>, also known as composite aggregation, is a strong kind of whole-part aggregation and is useful to show in some models. A composition relationship implies that</p> <p><b>Generalization(2m)</b> is the process of extracting shared characteristics from two or more classes, and combining them into a generalized superclass.</p> <p><b>Specialization(2)</b> means creating new subclasses from an existing class</p> <p>An <b>Attribute</b> is a logical data value of an object.</p> <p>An <b>Association</b> is a relationship between classes</p>
3	<p><b>i)Summarize the Elaboration phase. Discuss the differences between elaboration and inception with suitable diagram for university domain. (Nov/Dec 2015,April/May 2017)</b></p> <p><b>BTL2 (8m) Answer:</b> pg.no:33,123,127 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <ul style="list-style-type: none"> <li>Elaboration is the initial series of iterations during which the team does serious investigation, implements (programs and tests) the core architecture, clarifies most requirements, and tackles the high-risk issues.</li> </ul> <p><b>Explanation(6m)</b></p> <ul style="list-style-type: none"> <li>In the UP, "risk" includes business value.</li> <li>Therefore, early work may include implementing scenarios that are deemed important, but are not especially technically risky.</li> <li>Inception is the initial short step to establish a common vision and basic scope for the Project.</li> </ul> <p><b>ii)Describe a suitable example showing the various relationships used in Use Case and also give a short note on each relationship. BTL2 (5m)</b></p> <p><b>Answer:</b> pg.no:61-63 in Craig Larman book <b>Relationship(5m)</b></p> <p>To draw a use case diagram, we should have the following items identified.</p> <ul style="list-style-type: none"> <li>Functionalities to be represented as use case</li> <li>Actors</li> <li>Relationships among the use cases and actors.</li> <li>The name of a use case is very important. The name should be chosen in such a way so that it can identify the functionalities performed.</li> <li>Give a suitable name for actors.</li> <li>Show relationships and dependencies clearly in the diagram.</li> <li>Do not try to include all types of relationships, as the main purpose of the diagram is to identify the requirements.</li> <li>Use notes whenever required to clarify some important points.</li> </ul>
4	<p><b>(i).Describe the strategies used to identify the conceptual classes. (5m) (Nov/Dec 2018) (April/May 2017) BTL2</b></p> <p><b>Answer:</b> pg.no:14,136 in Craig Larman book</p> <p><b>Conceptual Class(5m)</b></p> <ul style="list-style-type: none"> <li>The domain model illustrates conceptual classes or vocabulary in the domain. Informally, a conceptual class is an idea, thing, or object.</li> <li>More formally, a conceptual class may be considered in terms of its symbol, intension, and extension</li> <li>Symbol words or images representing a conceptual class.</li> </ul>

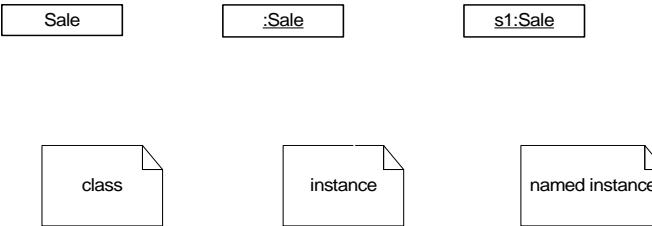
	<ul style="list-style-type: none"> <li>• Intension the definition of a conceptual class.</li> <li>• Extension the set of examples to which the conceptual class applies</li> </ul> <p><b>(ii).Describe the steps to create a domain model used for representing the conceptual classes. (8m) (May/June 2016) BTL2</b></p> <p><b>Answer:</b> pg.no:134 in Craig Larman book</p> <p><b>Explanation(5m)</b></p> <p>The current iteration requirements under design:</p> <ol style="list-style-type: none"> <li>1. Find the conceptual classes (see a following guideline).</li> <li>2. Draw them as classes in a UML class diagram.</li> <li>3. Add associations and attributes.</li> </ol> <p><b>Diagram(3m)</b></p>
5	<p><b>(i).Illustrate the concepts of Domain model with example. (7m)</b></p> <p><b>Answer:</b> pg.no:134 in Craig Larman book</p> <p><b>Domain Model(5m)</b></p> <ul style="list-style-type: none"> <li>• Applying UML notation, a domain model is illustrated with a set of class diagrams in which no operations (method signatures) are defined.</li> <li>• It provides a conceptual perspective. It may show: <ul style="list-style-type: none"> <li>• domain objects or conceptual classes</li> <li>• associations between conceptual classes</li> <li>• attributes of conceptual classes</li> </ul> </li> </ul> <p><b>Diagram(2m)</b></p> <p><b>(ii).Show when to model with Description classes with example. (6m) BTL3</b></p> <p><b>Answer:</b> pg.no:147 in Craig Larman book</p> <p><b>Explanation (6m)</b></p> <ul style="list-style-type: none"> <li>• A class represents a collection of objects having same characteristic properties that exhibit common behavior.</li> <li>• It gives the blueprint or description of the objects that can be created from it.</li> <li>• Creation of an object as a member of a class is called instantiation</li> </ul>
6	<p><b>Describe in detail about the Class Diagram. (13m) (Nov/Dec 2018) (May/June 2016) BTL1</b></p> <p><b>Answer:</b> pg.no:249-250 in Craig Larman book</p> <p><b>Definition (2m)</b></p> <p>A static view of the class definitions is usefully shown with a design class diagram.</p> <p><b>Explanation(8m)</b></p> <p>This illustrates the attributes and methods of the classes.</p> <ul style="list-style-type: none"> <li>• relationships used in class diagram</li> <li>• Generalization(class to class)</li> <li>• Association (object to object)</li> <li>• Aggregation (object to object)</li> <li>• Composition (object to object)</li> </ul> <p><b>Diagram(3m)</b></p>

### PART C

1	<p><b>With a suitable example explain how to design a class. Give all possible representation in a class (such as: name, attribute, visibility, methods, and responsibilities). BTL6 (15m)</b></p> <p><b>Answer:</b> pg.no:333 in Craig Larman book</p> <p><b>Explanation(10m)</b></p>
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	<ul style="list-style-type: none"> <li>• <b>Name:</b> The first row in a class shape.</li> <li>• <b>Attributes:</b> The second row in a class shape. Each attribute of the class is displayed on a separate line.</li> <li>• <b>Methods:</b> The third row in a class shape. Also known as operations, methods are displayed in list format with each operation on its own line.</li> <li>• <b>Interfaces:</b> A collection of operation signatures and/or attribute definitions that define a cohesive set of behaviors.</li> <li>• <b>Inheritance:</b> The process of a child or sub-class taking on the functionality of a parent or superclass, also known as generalization.</li> <li>• <b>Bidirectional association:</b> The default relationship between two classes.</li> </ul> <p><b>Diagram(5m)</b></p>
2	<p><b>Explain the concepts of Finding Description classes with the example of Airline and mobile phone company. BTL5 (15m)</b></p> <p><b>Answer:</b> pg.no:147 in Craig Larman book</p> <p><b>Explanation(10m)</b></p> <p>The class diagram is one of the most commonly used diagrams in UML, as explained in depth in our guide on class diagrams. Software engineers and business professionals often choose class diagrams to map the structure of particular systems because they clearly display the various classes, attributes, operations, and relationships between objects.</p> <p><b>Diagram(5m)</b></p>

<b>UNIT-3 DYNAMIC AND IMPLEMENTATION UML DIAGRAMS</b>	
<b>Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams</b>	
<b>Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams</b>	
<b>PART A</b>	
1	<p><b>Express the use of Sequence Diagram. BTL2</b></p> <ul style="list-style-type: none"> <li>• A <b>sequence diagram</b> shows object interactions arranged in time sequence.</li> <li>• It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario</li> <li>• Sequence diagrams are sometimes called event diagrams or event scenarios</li> </ul>
2	<p><b>Distinguish sequence diagram and communication diagram. BTL2</b></p> <ul style="list-style-type: none"> <li>• A sequence diagram shows time sequence as a geometric dimension, but the relationships among roles are implicit</li> <li>• A collaboration diagram shows the relationships among roles geometrically and relates messages to the relationships, but time sequences are less clear because they are implied by the sequence numbers</li> </ul>
3	<p><b>Demonstrate what do you mean by sequence diagram in UML? Where and for what it is used? BTL3</b></p> <p>A sequence diagram is a type of interaction diagram because it describes how and in what order a group of objects works together.</p> <p>These diagrams are used by software developers and business professionals to understand requirements for a new system or to document an existing process. Represent the details of a UML use case.</p> <ul style="list-style-type: none"> <li>• Model the logic of a sophisticated procedure, function, or operation.</li> <li>• See how objects and components interact with each other to complete a process.</li> <li>• Plan and understand the detailed functionality of an existing or future scenario.</li> </ul>
4	<p><b>What is meant by System Behavior? Nov/Dec 2015 BTL1</b></p> <ul style="list-style-type: none"> <li>• It is useful to understand what the external events are that our system must respond to, and to examine the details regarding what our system is supposed to do in response to those external events.</li> <li>• This is useful because we design and program primarily to service these events.</li> <li>• They are the driving force that define our software. The results of this investigation are referred to as the System Behavior model.</li> </ul>
5	<p><b>Define Package. Draw UML notation for Package. BTL1</b></p> <p><b>Package</b> is a namespace used to group together elements that are semantically related and might change together.</p>
6	<p><b>Analyze the use of UML Package Diagram BTL4</b></p> <ul style="list-style-type: none"> <li>• A package diagram is a UML diagram composed only of packages and the dependencies between them.</li> <li>• A package is a UML construct that enables you to organize model elements, such as use cases or classes, into groups.</li> </ul>

7	<b>Define Logical architecture. (Nov/Dec 2018) BTL1</b>
	The logical architecture, describes the system in terms of its conceptual organization in layers, packages, classes, interfaces and subsystems.
8	<b>Formulate the guideline to be followed when designing with layers. BTL6</b>
	The essential ideas of using layers:
	Organize the large - scale logical structure of a system into discrete layers of distinct, related responsibilities, with a clean, cohesive separation of concerns such that the "lower" layers are low - level and general services, and the higher layers are more application specific.
	Collaboration and coupling is from higher to lower layers; lower - to - higher layer coupling is avoided.
9	<b>List the layers of architectural layers. (April/May 2017) BTL1</b>
	The layers include:
	<ul style="list-style-type: none"> <li>• User Interface</li> <li>• Application Logic and Domain Objects</li> <li>• Technical Services</li> </ul>
	<b>Layers are:</b>
	<ul style="list-style-type: none"> <li>• strict layered architecture</li> <li>• relaxed layered architecture</li> </ul>
10	<b>Differentiate strict layered and relaxed layered architecture. BTL2</b>
	<b>Strict layered architecture:</b> a layer only calls upon the services of the layer directly below it. This design is common in network protocol stacks
	<b>Relaxed layered architecture:</b> a higher layer calls upon several lower layers
11	<b>Summarize the Model View separation principle. BTL5</b>
	The <b>Model - View Separation principle</b> states that model (domain) objects should not have direct knowledge of view (UI) objects, at least as view objects.
	<b>Example:</b> a Register or Sale object should not directly send a message to a GUI window object ProcessSaleFrame, asking it to display something, change color, close, and so forth.
12	<b>List the common UML Interaction diagram notation. BTL1</b>
	<ul style="list-style-type: none"> <li>• Patterns, principles, and idioms can be applied to improve the quality of the Interaction Diagrams</li> </ul>
	 <p>The diagram displays six UML interaction diagram notations arranged in two rows. The top row contains three boxes: 'Sale' (a simple rectangle), ':Sale' (a rectangle with a colon and a hyphen), and 's1:Sale' (a rectangle with a label 's1:' preceding the name). The bottom row contains three boxes: 'class' (a rectangle with a small document icon), 'instance' (a rectangle with a small document icon), and 'named instance' (a rectangle with a small document icon).</p>
13	<b>Name the layers in the 3 tier architecture. BTL1</b>
	<b>Three-tier architecture</b> (Model View Controller - MVC), in software engineering, is a client-server architecture in which presentation, application processing, and data management functions are physically separated
14	<b>Show the relationship between Interaction and Class diagram . (Nov/Dec 2015) BTL3</b>
	<b>Interaction diagrams</b> are models that describe how group of objects collaborate to realize some behavior.
	A <b>class diagram</b> describes the static structure of a system. It shows how a system is structured rather than how it behaves.

15	<b>Express the meaning of Facade. BTL2</b> Facade pattern hides the complexities of the system and provides an interface to the client using which the client can access the system
16	<b>Differentiate Class diagram and Interaction diagram. BTL4</b> <b>Interaction diagrams</b> are models that describe how group of objects collaborate to realize some behavior. <b>A class diagram</b> describes the static structure of a system. It shows how a system is structured rather than how it behaves.
17	<b>Illustrate the term Classifier. May/June 2016 BTL3</b> <b>A classifier</b> is an abstract metaclass classification concept that serves as a mechanism to show interfaces, classes, datatypes and components. <b>A classifier</b> describes a set of instances that have common behavioral and structural features
18	<b>Summarize SSD. BTL2</b> An SSD shows system events for one scenario of a use case, therefore it is generated from inspection of a use case
19	<b>Summarize the benefits of using layers. BTL5</b> <ul style="list-style-type: none"> <li>Source code changes are rippling throughout the system - many parts of the systems are highly coupled.</li> <li>Application logic is intertwined with the user interface, so it cannot be reused with a different interface or distributed to another processing node.</li> </ul>
20	<b>Compare and Contrast asynchronous and synchronous message. BTL4</b> In UML, filled arrowheads show a synchronous message, while stick arrowheads show an asynchronous message. <ul style="list-style-type: none"> <li>If a caller sends asynchronous message, it must wait until the message is done, such as invoking a subroutine. asynchronous calls in multithreaded applications and in message-oriented middleware</li> </ul>
21	<b>What is meant by link? BTL1</b> <ul style="list-style-type: none"> <li>A link is a connection path between two objects; it indicates some form of navigation and visibility between the objects is possible .</li> <li>More formally, a link is an instance of an association.</li> </ul> <b>For example</b> , there is a link or path of navigation from a Register to a Sale, along which messages may flow, such as the make 2 Payment message.
22	<b>List the approaches for identifying classes. BTL1</b> The four alternative approaches for identifying classes: <ul style="list-style-type: none"> <li>The noun phrase approach.</li> <li>The common class patterns approach.</li> <li>The use-case driven, sequence/collaboration modeling approach.</li> <li>The classes, responsibilities and collaborators (CRC) approach.</li> </ul>
23	<b>Evaluate How to create an instance? BTL5</b> <ul style="list-style-type: none"> <li>Any message can be used to create an instance, but there is a convention in the UML to use a message named create for this purpose.</li> <li>If another (perhaps less obvious) message name is used, the message may be annotated with a special feature called a UML stereotype, like so: «create».</li> <li>The create message may include parameters, indicating the passing of initial values. This indicates, for example, a constructor call with parameters in Java.</li> </ul>
24	<b>Give the guidelines for naming a class. BTL1</b> The guidelines for naming classes: <ul style="list-style-type: none"> <li>The class name should be singular.</li> <li>One general rule for naming classes is that you should use names with which the users or clients</li> </ul>

	<p>are comfortable.</p> <ul style="list-style-type: none"> <li>• The name of a class should reflect its intrinsic nature Use readable name.</li> <li>• Capitalize class names.</li> </ul>
25	<p><b>What is meant by Pure Fabrication? BTL1</b></p> <ul style="list-style-type: none"> <li>• This is another GRASP pattern.</li> <li>• A Pure Fabrication is an arbitrary creation of the designer, not a software class whose name is inspired by the Domain Model. A use-case controller is a kind of Pure Fabrication.</li> </ul>
26	<p><b>Discover the major Difference between Component and Deployment Diagram. BTL3</b></p> <p><b>Component diagram</b> have different elements of the system that have been grouped together and contains the link between these components.</p> <p>A <b>Deployment diagram</b> describes on which hardware elements do these components reside</p>
27	<p><b>Define State Chart Diagram. BTL1</b></p> <p><b>Statechart diagram</b> is one of the five UML diagrams used to model the dynamic nature of a system.</p>
28	<p><b>What is package diagram? BTL4</b></p> <p><b>Package diagram:</b> It is a kind of structural diagram, shows the arrangement and organization of model elements in middle to large scale project.</p>
29	<p><b>Compare Activity and state chart diagram BTL5</b></p> <p>Mention the Elements of an Activity Diagram.</p> <p><b>Activity diagrams</b> are similar to the procedural flow charts. <b>Activity diagrams</b> support description of parallel activities and synchronization aspects involved in different activities</p>
30	<p><b>Formulate the purpose of Interaction Diagram. BTL6</b></p> <p><b>Interaction diagrams</b> are models that describe how a group of objects collaborate in some behavior - typically a single use-case.</p>
	<b>PART B</b>
1	<p><b>(i).Illustrate the relationship between sequence diagram (Nov/Dec 2018) and Use Case with example. (8m) (Nov/Dec2016) BTL3</b></p> <p>Answer: pg.no:176,222 in Craig Larman book</p> <p><b>Relationship(8m)</b></p> <p>Sequence Diagram models the collaboration of objects based on a time sequence. It shows how the objects interact with others, in a particular, scenario of a use case.</p> <p>For example: Visual Paradigm can automate this process by generating a flow of events of a use case to a sequence diagram</p> <p><b>(ii).Demonstrate the Interaction Diagram notations and explain it? (5m)</b></p> <p>Answer: pg.no:221 in Craig Larman book</p> <p><b>Diagram(5m)</b></p> <p>Patterns, principles, and idioms can be applied to improve the quality of the Interaction Diagrams</p> <div style="text-align: center; margin-top: 20px;">   </div>
2	<p><b>(i).Describe briefly about the logical architecture (Nov/Dec 2018) and UML package diagram. (7m) BTL1</b></p>

	<p><b>Answer:</b> pg.no: 197-199 in Craig Larman book</p> <p><b>Explanation(5m)</b></p> <ul style="list-style-type: none"> <li>• Layer is a coarse-grained grouping of classes, packages, or subsystems that has cohesive (strongly related) responsibilities for a major aspect of the system</li> <li>• Application layer is the focus of Use Cases</li> <li>• Higher layers (such as UI layer) call upon services of lower layers, but not normally vice versa.</li> </ul> <p><b>Diagram(2m)</b></p> <p><b>(ii).Identify the relationship between Domain layer and Domain model. (6m) BTL1</b></p> <p><b>Answer:</b> pg.no:134-136 in Craig Larman book</p> <p><b>Domain Layer(6m)</b></p> <ul style="list-style-type: none"> <li>• A Conceptual model in the field of computer science is also known as a domain model.</li> <li>• A conceptual model represents 'concepts' (entities) and relationships between them.</li> <li>• A domain model in problem solving and software engineering is a conceptual model of all the topics related to a specific problem. It describes the various entities, their attributes, roles, and relationships, plus the constraints that govern the problem domain</li> </ul>
3	<p><b>What is Model View separation principle? Examine the motivation for Model View separation. (13m) (April/May 2017, May/June 2016) BTL1</b></p> <p><b>Answer:</b> pg.no:209,331 in Craig Larman book</p> <p><b>Diagram(2m)</b></p> <p><b>Definition(2m)</b></p> <p>The <b>Model - View Separation principle</b> states that model (domain) objects should not have direct knowledge of view (UI) objects, at least as view objects.</p> <p><b>Explanation(7m)</b></p> <p><b>Example:</b> a Register or Sale object should not directly send a message to a GUI window object ProcessSaleFrame, asking it to display something, change color, close, and so forth.</p>
4	<p><b>(i).What are the benefits of using layers? Provide the relationship between Domain layer and Domain model. (7m) BTL1</b></p> <p><b>Answer:</b> pg.no:134-136 in Craig Larman book</p> <p><b>Benefits(5m)</b></p> <ul style="list-style-type: none"> <li>• A Conceptual model in the field of computer science is also known as a domain model.</li> <li>• A conceptual model represents 'concepts' (entities) and relationships between them.</li> <li>• A domain model in problem solving and software engineering is a conceptual model of all the topics related to a specific problem. It describes the various entities, their attributes, roles, and relationships, plus the constraints that govern the problem domain</li> </ul> <p><b>Diagram (2m)</b></p> <p><b>(ii).Describe the concepts of Relaxed layer coupling. (6m) BTL1</b></p> <p><b>Answer:</b> pg.no:199 in Craig Larman book</p> <p><b>Concept coupling(4m)</b></p> <ul style="list-style-type: none"> <li>• There are two general approaches to layering: strict layering and relaxed layering.</li> <li>• A relaxed layered application loosens the constraints such that a component can interact with components from any lower layer.</li> <li>• Using relaxed layering can improve efficiency because the system does not have to forward simple calls from one layer to the next.</li> </ul> <p><b>Diagram(2m)</b></p>
5	<p><b>Draw a neat sketch of logical layered architecture of Next Gen application and Discuss the components in detail. (13m) (Nov/Dec 2016) BTL2</b></p> <p><b>Answer:</b> pg.no:199 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(3m)</b></p>

	<ul style="list-style-type: none"> <li>• In a strictly layered model, each layer only calls the services of the layer below it</li> <li>• For information services, the layered model is usually considered relaxed</li> <li>• For example, the GUI may utilize logging, or a form may directly access a database for a query</li> <li>• We will primarily concentrate on the middle layer, the Domain or Application Logic layer</li> <li>• For UI, we will primarily be concerned with how it interacts with the middle layer</li> </ul>
6	<p><b>What are the system sequence diagram? Differentiate the relationship between SSDs and use cases? Explain with an Example. (13m) (Nov/Dec 2016) BTL2</b></p> <p><b>Answer:</b> pg.no:176,222 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>Sequence Diagram models the collaboration of objects based on a time sequence. It shows how the objects interact with others, in a particular, scenario of a use case.</p> <p><b>Explanation(8m)</b></p> <p>For example: Visual Paradigm can automate this process by generating a flow of events of a use case to a sequence diagram</p> <p><b>Diagram(3m)</b></p>
7	<p><b>Describe the UML notation for class diagram with an example. Explain the concept of Link, Association and Inheritance. (13m) (May/June 2016) BTL2</b></p> <p><b>Answer:</b> pg.no:133,249 in Craig Larman book</p> <p><b>Explanation(8m)</b></p> <p><b>Link (2m)</b></p> <p>A link represents a connection through which an object collaborates with other objects. Rumbaugh has defined it as “a physical or conceptual connection between objects”. Through a link, one object may invoke the methods or navigate through another object. A link depicts the relationship between two or more objects.</p> <p><b>Association (3m)</b></p> <p>Association is a group of links having common structure and common behavior. Association depicts the relationship between objects of one or more classes. A link can be defined as an instance of an association.</p> <p><b>Inheritance(3m)</b></p> <p>Inheritance is the mechanism that permits new classes to be created out of existing classes by extending and refining its capabilities. The existing classes are called the base classes/parent classes/super-classes, and the new classes are called the derived classes/child classes/subclasses.</p> <p><b>Diagram(5m)</b></p>
8	<p><b>Apply Interactive modeling for a Payroll system in UML. (13m) (Nov/Dec 2016) BTL3</b></p> <p><b>Answer:</b> pg.no:221-226 in Craig Larman book</p> <p><b>Definition (2m)</b></p> <p>The term interaction diagram, is a generalization of two more specialized UML diagram types both can be used to express similar message interactions:</p> <p><b>Explanation(6m)</b></p> <ul style="list-style-type: none"> <li>• collaboration diagrams <ul style="list-style-type: none"> <li>- illustrate object interactions in a graph or network format, in which objects can be placed anywhere on the diagram</li> </ul> </li> <li>• sequence diagrams</li> </ul> <p><b>Diagram(5m)</b></p>

<b>PART C</b>	
1.	<p><b>For the Course Registration system design the following UML diagrams. (15m)</b> (i).Conceptual Class Diagram (Over all system). (ii).Sequence and collaboration diagram (Login process, maintaining the course details.) <b>BTL6</b></p> <p><b>Conceptual Diagram(7m)</b>  <b>Sequence Diagram(8m)</b>  <b>Answer:</b> pg.no:15,Refer notes</p>
2.	<p><b>Design the logical layer architecture for Next Generation application. (15m) (Nov/Dec 2016)</b>  <b>BTL6</b></p> <p><b>Diagram(5m)</b>  <b>Answer:</b> pg.no: 144, refer notes  <b>Explanation(10m)</b></p> <ul style="list-style-type: none"> <li>• To achieve a layered architecture:</li> <li>• Organize the large-scale logical structure of a system into discrete layers of distinct, related responsibilities, with a clean, cohesive separation of concerns such that the "lower" layers are low-level and general services, and the higher layers are more application specific.</li> <li>• Collaboration and coupling is from higher to lower layers; lower-to-higher layer coupling must be avoided.</li> </ul>
3.	<p><b>Explain in detail about the relationship between interaction diagram and class Diagram. (15m) BTL5</b></p> <p><b>Answer:</b> pg.no:133,221 in Craig Larman book  <b>Definition(2m)</b> Interaction diagrams are models that describe how group of objects collaborate to realize some behavior.  <b>Explanation(8m)</b>  A <b>class diagram</b> describes the static structure of a system. It shows how a system is structured rather than how it behaves.<b>Diagram(3m)</b></p>
4.	<p><b>Write a problem statement for Quiz System. Design the UML Use Case diagram, Activity diagram, Class diagram, Sequence diagram, State chart diagram, Package diagram, and Component and Deployment diagram (15m) BTL6</b></p> <p><b>Answer:</b> pg.no:11,477,478,133,249-250 in Craig Larman book  <b>Explanation(10m)</b>  <b>Diagram(5m)</b>  <b>PROBLEM STATEMENT:</b>  Developing a quiz system which includes both the user and the administrator wherein the administrator is privileged to prepare the quiz questions for the users based on the selected category. The competency of the user is evaluated at the end by displaying the score obtained by the user in the quiz that he undertook. The quiz system can be used to evaluate the competency of the person taking the quiz</p>
4.	<p><b>Comparison of sequence and communication diagram by using the Ticket Reservation system. (15m) BTL4</b></p> <p><b>Answer:</b> pg.no:223,refer notes  <b>Definition(2m)</b> sequence diagram  Participants are mostly arranged along the top of page, unless the drop-box participant creation notation is used. It is easy to gather the participants involved in particular interactions  <b>Explanation(8m)</b>  <b>Communication diagram</b> Participants as well as links are the focus, so they are shown clearly as rectangles  <b>Diagram(3m)</b></p>

<b>UNIT 4- DESIGN PATTERNS</b>	
<b>GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling –High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural –Strategy – observer –Applying GoF design patterns – Mapping design to code</b>	
<b>PART A</b>	
1	<b>Define DesignPatterns. (Nov/Dec 2016) BTL1</b> <ul style="list-style-type: none"> <li>Pattern (or design pattern) is a written document that describes a general solution to a design problem that recurs repeatedly in many projects.</li> <li>Software designers adapt the pattern solution to their specific project</li> </ul>
2	<b>What is Elaboration? BTL1</b> <p>Elaboration is the initial series of iterations during which the team does serious investigation, implements (programs and tests) the core architecture, clarifies most requirements, and tackles the high-risk issues. In the UP, "risk" includes business value. Therefore, early work may include implementing scenarios that are deemed important, but are not especially technically risky.</p>
3	<b>Define responsibility. What are the various types of responsibilities? BTL1</b> <p><b>Responsibility-driven design</b> is essentially assigning responsibilities to collaborating objects. It is an iterative approach.</p> <p><b>Two basic types of responsibility:</b> <i>Doing</i> and <i>Knowing</i></p> <p><b>Doing:</b> doing something, creating an object, doing a calculation, initiate some action in another object, control activity between objects. Generate some activity</p> <p><b>Knowing:</b> knowing about private encapsulated data, related objects, or things that can be derived or calculated</p>
4	<b>What are the steps for mapping design to code? (Nov/Dec 2015,April/May 2017) BTL1</b> <p>The design model can be more or less close to the implementation model depending on how you map its classes to classes or similar constructs in the implementation language</p>
5	<b>List out the categories of Design patterns. State the use of design pattern. BTL1</b> <p>Design patterns are divided into three fundamental groups:</p> <ul style="list-style-type: none"> <li>Behavioral,</li> <li>Creational, and</li> <li>Structural</li> </ul> <p><b>USES</b></p> <p>A design pattern provides a general reusable solution to a common design problem</p> <p>They are used for solving common software design problems that occur again and again.</p>
6	<b>Define GRASP. BTL1</b> <p><b>GRASP :</b> General responsibility assignment software patterns (or principles), which consist of guidelines for assigning responsibility to classes and objects in object-oriented design</p>
7	<b>When a pattern is said to be a good pattern? BTL1</b> <p>There is a set of properties that a pattern must fulfill in order to be a good one. A pattern encapsulating: a solution (but not obvious), a proven concept, relationships, and human component</p>
8	<b>Define modular design. (May/June 2016, April/May 2017) BTL2</b> <p>Modular design is a design approach that creates things out of independent parts with standard interfaces</p>
9	<b>Interpret the need of Information Expert. BTL2</b> <ul style="list-style-type: none"> <li>To fulfill the responsibility of knowing and answering the sale's total, three responsibilities were</li> </ul>

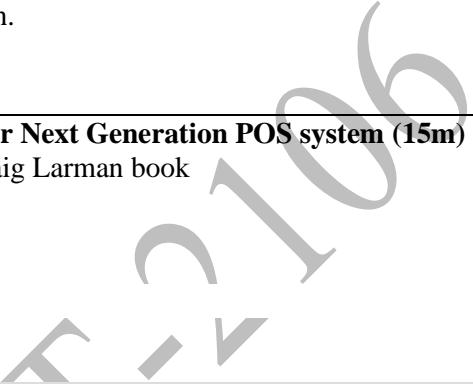
	<p>assigned to three design classes.</p> <ul style="list-style-type: none"> <li>The fulfillment of a responsibility often requires information that is spread across different classes of objects. This implies that there are many “partial experts” who will collaborate in the task</li> </ul>
10	<p><b>Distinguish between coupling and cohesion. (Nov/Dec 2015,2016,April/May 2017) BTL2</b></p> <p><b>Coupling</b> is the indication of the relationships between modules.</p> <p><b>Coupling</b> shows the relative independence among the modules.</p> <p><b>Cohesion</b> is the indication of the relationship within module <b>Cohesion</b> is a degree (quality) to which a component / module focuses on the single thing</p>
11	<p><b>Express the benefits of low coupling. BTL4</b></p> <p>Benefits of low coupling are</p> <ul style="list-style-type: none"> <li>maintainability – changes are confined in a single module</li> <li>testability – modules involved in unit testing can be limited to a minimum</li> <li>readability – classes that need to be analyzed are kept at a minimum</li> </ul>
12	<p><b>Analyze the meaning of coupling and also analyze its types. BTL5</b></p> <p>Coupling is basically a connectivity between various modules. There are two modules, one is the 'calling' module that sends some data to the module connected to it i.e. the 'called' module. Coupling is the interaction of various modules to each other</p> <ul style="list-style-type: none"> <li>Highly Coupled</li> <li>Loosely Coupled</li> <li>No Direct Coupling</li> <li>Data Coupling</li> <li>Stamp Coupling</li> <li>Content Coupling</li> <li>Common Coupling</li> </ul>
13	<p><b>“A system must be loosely coupled and highly cohesive”-Justify. BTL6</b></p> <p>High cohesion within modules and low coupling between modules are often regarded as related to high quality in OO programming languages.</p>
14	<p><b>Compose your views on High Cohesion. BTL3</b></p> <p>It is a measure of the strength of relationship between the methods and data of a class and some unifying purpose or concept served by that class</p>
15	<p><b>Examine the benefits of controller. BTL2</b></p> <p>The controller pattern assigns the responsibility of dealing with system events to a non-UI class that represents the overall system or a use case scenario</p>
16	<p><b>Summarize the list of structural patterns used during design phase of software development. BTL5</b></p> <p>Adapter Pattern. Adapting an interface into another according to client expectation.</p> <p>Bridge Pattern. Separating abstraction (interface) from implementation.</p> <p>Composite Pattern</p> <p>Decorator Pattern</p> <p>Facade Pattern</p> <p>Flyweight Pattern</p> <p>proxy Pattern</p>
17	<p><b>Analyze the situation to use Factory method pattern and its advantages. BTL4</b></p>

	<ul style="list-style-type: none"> <li>The Intent to use Factory method is to define an interface for creating an object, but let subclasses decide which class to instantiate.</li> <li>Factory Method lets a class defer instantiation to subclasses.</li> </ul> <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>It hides implementation of an application seam (the core interfaces that make up the application)</li> <li>It easily test the seam of an application (that is to mock/stub) certain parts of your application so you can build and test the other parts</li> <li>Allows to change the design of your application more readily, this is known as loose coupling</li> </ul>
18	<p><b>Discover the Limitations of Factory Pattern BTL3</b></p> <ul style="list-style-type: none"> <li>Makes code more difficult to read as all of your code is behind an abstraction that may in turn hide abstractions.</li> <li>Can be classed as an anti-pattern when it is incorrectly used,</li> <li>Example some people use it to wire up a whole application when using an IOC container, instead use Dependency Injection.</li> </ul>
19	<p><b>Illustrate the benefits of bridge pattern. BTL3</b></p> <ul style="list-style-type: none"> <li>Decoupling of the interface and implementation</li> <li>Improved extensibility</li> <li>Hiding of the implementation details from clients</li> </ul>
20	<p><b>Generalize your view on creator. BTL6</b></p> <ul style="list-style-type: none"> <li>Creational design patterns are design patterns that deal with object creation mechanisms.</li> <li>The basic form of object creation could result in design problems or in added complexity to the design.</li> <li>Creational design patterns solve this problem by somehow controlling this object creation.</li> </ul>
21	<p><b>Point out the interface and domain layer responsibilities. (May/June 2016) BTL4</b></p> <ul style="list-style-type: none"> <li>A UI object retrieves the domain object from a well-known source, such as a factory object that is responsible for creating domain objects.</li> <li>The UI layer should not have any domain logic responsibilities.</li> <li>It should only be responsible for userinterface tasks, such as updating widgets</li> </ul>
22	<p><b>Analyse: How to Choose the Initial Domain Object? BTL4</b></p> <ul style="list-style-type: none"> <li>Choose as an initial domain object a class at or near the root of the containment or aggregation hierarchy of domain objects.</li> <li>This may be a facade controller, such as Register, or some other object considered to contain all or most other objects, such as a Store.</li> </ul>
23	<p><b>Define Responsibilities and Methods. BTL1</b></p> <ul style="list-style-type: none"> <li>The UML defines a responsibility as "a contract or obligation of a classifier".</li> <li>Responsibilities are related to the obligations of an object in terms of its behavior.</li> <li>Basically, these responsibilities are of the following two types: - knowing –doing</li> </ul>
24	<p><b>List out some scenarios that illustrate varying degrees of functional cohesion. BTL1</b></p> <ul style="list-style-type: none"> <li>Very low cohesion</li> <li>low cohesion</li> <li>High cohesion</li> <li>Moderate cohesion</li> </ul>
25	<p><b>Discuss on Fine-Grained Classes? BTL2</b></p> <ul style="list-style-type: none"> <li>Consider the creation of the Credit Card, Drivers License, and Check software objects.</li> <li>Our first impulse might be to record the data they hold simply in their related payment classes, and eliminate such fine grained classes.</li> <li>However, it is usually a more profitable strategy to use them they often end up providing useful</li> </ul>

	<p>behavior and being reusable.</p> <ul style="list-style-type: none"> <li>• <b>For example</b>, the Credit Card is a natural Expert on telling you its credit company type (Visa, MasterCard, and so on). This behavior will turn out to be necessary for our application.</li> </ul>
26	<p><b>What is a Metaphor? BTL1</b> It is an analogy that relates two unrelated things by using one to denote the other.</p>
<b>PART B</b>	
1	<p><b>Explain the design principles in object modeling. Explain in detail the GRASP method for designing objects with example. (13m) (Nov/Dec 2016) BTL4</b></p> <p><b>Answer:</b> pg.no: 271,277,321 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>The GRASP patterns are a learning aid to help one understand essential object design, and apply design reasoning in a methodical, rational, explainable way. This approach to understanding and using design principles is based on patterns of assigning responsibilities.</p> <p><b>Explanation(8m)</b></p> <ul style="list-style-type: none"> <li>• The UML defines a responsibility as "a contract or obligation of a classifier"</li> <li>• Basically, these responsibilities are of the following two types: <ul style="list-style-type: none"> <li>• knowing</li> <li>• i doing</li> </ul> </li> </ul> <p>Example: SalesLineItem</p> <p><b>Diagram(3m)</b></p>
2	<p><b>Explain in detail about mapping design to code concepts in detail. (13m) (Nov/Dec 2015) BTL4</b></p> <p><b>Answer:</b> pg.no:371 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>The design model can be more or less close to the implementation model depending on how you map its classes to classes or similar constructs in the implementation language</p> <p><b>Explanation(8m)</b></p> <ul style="list-style-type: none"> <li>• Programming and the Development Process</li> <li>• Mapping Designs to Code</li> <li>• Creating Class Definitions from DCDs</li> <li>• Creating Methods from Interaction Diagrams</li> <li>• Container/Collection Classes in Code</li> <li>• Exceptions and Error Handling</li> <li>• Defining the SalemakeLineItem Method</li> </ul> <p><b>Diagram(3m)</b></p>
3	<p><b>What is GRASP? Describe the design patterns and principles used in it. (13m) BTL1</b></p> <p><b>Answer:</b> pg.no: 271 in Craig Larman book</p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(5m)</b></p> <ul style="list-style-type: none"> <li>• General responsibility assignment software patterns (or principles), abbreviated GRASP, consist of guidelines for assigning responsibility to classes and objects in object-oriented design</li> <li>• The different patterns and principles used in GRASP are controller, creator, indirection, information expert, high cohesion, low coupling, polymorphism, protected variations, and pure fabrication.</li> </ul>

4	<p><b>Examine the following GRASP patterns: (i)Creator,(ii).Information Expert, (iii)Low coupling, (iv).High cohesion. (13m) (April/May 2017,May/June 2016) BTL1</b></p> <p><b>Answer:</b> pg.no:281,290,285,283 in Craig Larman book</p> <p><b>Explanation(8m)</b></p> <p><b>Solution</b> Assign class B the responsibility to create an instance of class A</p> <p>if one or more of the following is true:</p> <p>B aggregates an object. .</p> <p>B contains an object. .</p> <p>B records instances of objects. .</p> <p>B closely uses objects. .</p> <p>B has the initializing data that will be passed to A when it is created (thus B is an Expert with respect to creating A).</p> <p>B is a creator of an object.</p> <p>If more than one option applies, prefer a class B which aggregates or contains class A</p> <p><b>Diagram(5m)</b></p>
5	<p><b>(i).Explain about Creator and controller design patterns with example. (13m) (Nov/Dec 2016) BTL4</b></p> <p><b>Answer:</b> pg.no:281,302 in Craig Larman book</p> <p><b>Explanation(8m)</b></p> <p><b>Diagram(5m)</b></p> <p><b>Solution</b></p> <p>Assign class B the responsibility to create an instance of class A if one or more of the following is true: .</p> <p>B aggregates an object. .</p> <p>B contains an object. .</p> <p>B records instances of objects. .</p> <p>B closely uses objects. .</p> <p>B has the initializing data that will be passed to A when it is created (thus B is an Expert with respect to creating A).</p> <p>B is a creator of an object. If more than one option applies, prefer a class B which aggregates or contains class A</p>
6	<p><b>(i).Compare cohesion and coupling (Nov/Dec 2018) with suitable example. (8m) (Nov/Dec 2015) BTL5</b></p> <p><b>Answer:</b> pg.no: 285,290 in Craig Larman book</p> <ul style="list-style-type: none"> <li>• <b>Coupling (4m)</b> is a measure of how strongly one element is connected to, has knowledge of, or relies on other elements.</li> <li>• An element with low (or weak) coupling is not dependent on too many other elements; "too many" is context-dependent, but will be examined. These elements include classes, subsystems, systems, and so on.</li> <li>• <b>Cohesion(4m)</b> (or more specifically, functional cohesion) is a measure of how strongly related and focused the responsibilities of an element are.</li> <li>• An element with highly related responsibilities, and which does not do a tremendous amount of work, has high cohesion. These elements include classes, subsystems, and so on.</li> </ul> <p><b>(ii).Summarize and state the role and patterns while developing system design. (5m) (Nov/Dec 2015) BTL5</b></p> <p><b>Answer:</b> pg.no:153,278 in Craig Larman book</p> <p><b>Explanation(5m)</b></p>

	A pattern is a named problem/solution pair that can be applied in new context, with advice on how to apply it in novel situations and discussion of its trade-offs.
7	<p><b>(i).Generalize your idea on Controller pattern with example (7m) BTL6</b></p> <p><b>Answer:</b> pg.no:302 in Craig Larman book</p> <p><b>Explanation(5m)</b></p> <ul style="list-style-type: none"> <li>• Assign the responsibility for receiving or handling a system event message to a class representing one of the following choices: - Represents the overall system, device, or subsystem (facade controller).</li> <li>• Represents a use case scenario within which the system event occurs, often named Handler, Coordinator, or Session (use-case or session controller).</li> <li>• Use the same controller class for all system events in the same use case scenario.</li> <li>• Informally, a session is an instance of a conversation with an actor.</li> <li>• Sessions can be of any length, but are often organized in terms of use cases (use case sessions).</li> </ul> <p><b>Diagram(2m)</b></p> <p><b>(ii).Generalize the concepts of Façade, session and bloated controller. (6m)</b></p> <p>Answer: pg.no:461,308 in Craig Larman book</p> <p><b>Façade(2m):</b></p> <ul style="list-style-type: none"> <li>• The first category of controller is a facade controller representing the overall system, device, or a subsystem</li> <li>• The facade could be an abstraction of the overall physical unit, such as a Register; a class representing the entire software system, such as POSSystem</li> </ul> <p><b>Session(2m):</b></p> <ul style="list-style-type: none"> <li>• A session is an instance of a conversation with an actor.</li> <li>• Sessions can be of any length but are often organized in terms of use cases (use case sessions).</li> </ul> <p><b>Bloated(2m):</b></p> <ul style="list-style-type: none"> <li>• Bloated Controllers: has low cohesion unfocused and handling too many areas of responsibility</li> <li>• The controller performs many of the tasks to fulfill the system event, without delegating the work.</li> </ul>
8	<p><b>Describe about the implementation model (Mapping design to code) and give the NextGen POS program solution. (13m) BTL1</b></p> <p><b>Answer:</b> pg.no:371 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>The design model can be more or less close to the implementation model depending on how you map its classes to classes or similar constructs in the implementation language</p> <p><b>Explanation(8m)</b></p> <p>Mapping design to code for NextGen POS program</p> <p><b>Diagram(3m)</b></p>

<b>PART C</b>	
1	<p><b>Create the observer pattern by using your own application and explain the sections of the design pattern. (15m) BTL6</b></p> <p><b>Answer:</b> pg.no: 463 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <ul style="list-style-type: none"> <li>• Observer pattern is used when there is one-to-many relationship between objects such as if one object is modified, its dependent objects are to be notified automatically.</li> </ul> <p><b>Explanation(10m)</b></p> <ul style="list-style-type: none"> <li>• Observer pattern falls under behavioral pattern category.</li> <li>• Observer pattern uses three actor classes.</li> <li>• Subject, Observer and Client.</li> <li>• Subject is an object having methods to attach and detach observers to a client object.</li> <li>• We have created an abstract class Observer and a concrete class Subject that is extending class Observer.</li> <li>• ObserverPatternDemo, our demo class, will use Subject and concrete class object to show observer pattern in action.</li> </ul> <p><b>Diagram(3m)</b></p>
2	<p><b>Develop the foundation code for Next Generation POS system (15m) BTL6</b></p> <p><b>Answer:</b> pg.no: refer notes in Craig Larman book</p> <p><b>Explanation(6m)</b></p> <p><b>Coding(6m)</b></p> <p><b>Diagram(3m)</b></p> <p>Class Payment</p>  <pre> package com.foo.nextgen.domain;  public class Payment  {     private Money amount;      public Payment( Money cashTendered ){ amount = cashTendered; }      public Money getAmount() { return amount; }  } </pre>
3	<p><b>Generalize the design issues in implementation of Singleton pattern. (15m) BTL6</b></p> <p><b>Answer:</b> pg.no: 442 in Craig Larman book</p> <p><b>Explanation(10m)</b></p> <p><b>Diagram(5m)</b></p>

	<ul style="list-style-type: none"> <li>• They deviate from the Single Responsibility Principle</li> <li>• Singleton classes cannot be sub classed.</li> <li>• Singletons can hide dependencies.</li> <li>• Programmers often resort to the idea of Dependency Injection to overcome this problem. When dependency Injection is used, Singleton instance is not retrieved inside the class but is passed through the constructor or a property</li> </ul>
4	<p><b>Explain the GRASP pattern(Creator,Information Expert, Low coupling) by using Monopoly game. (15m) (April/May 2017,May/June 2016) BTL5</b></p> <p><b>Answer:</b> pg.no:271,277 in Craig Larman book</p> <p><b>Explanation(12m)</b></p> <p><b>The Creator pattern</b></p> <p>Name: Creator</p> <p>Problem: Who creates an object A?</p> <p>Solution: Assign class B the responsibility to create an instance of class A if one of these is true</p> <p><b>Information Expert pattern</b></p> <p>Name: Information Expert</p> <p>Problem: What is a basic principle by which to assign responsibilities to an object</p> <p>Solution: Assign a responsibility to the class that has the information needed to respond to it.</p> <p><b>Low Coupling</b></p> <p>Name: Low Coupling</p> <p>Problem: How to reduce the impact of change?</p> <p>Solution: Assign responsibilities so that (unnecessary) coupling remains low. Use this principle to evaluate alternatives.</p> <p><b>Diagram(3m)</b></p>
5	<p><b>Analyze and categories of Design pattern. Analyze the creational pattern by using with Maze game. (15m) BTL4</b></p> <p><b>Answer:</b> pg.no:45,Refer notes</p> <p><b>Diagram(5m)</b></p> <p><b>Explanation(10m)</b></p> <p><b>The Creator pattern</b></p> <p>Name: Creator</p> <p>Problem: Who creates an object A?</p> <p>Solution: Assign class B the responsibility to create an instance of class A if one of these is true</p>

<b>UNIT 5- TESTING</b>	
<b>Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans</b>	
<b>PART A</b>	
1	<b>Define Software Quality Assurance. BTL1</b> <ul style="list-style-type: none"> <li>• (SQA) is a set of activities for ensuring quality in software engineering processes. It ensures that developed software meets and complies with the defined or standardized quality specifications.</li> <li>• SQA is an ongoing process within the Software Development Life Cycle (SDLC) that routinely checks the developed software to ensure it meets the desired quality measures.</li> </ul>
2	<b>What is TDD? BTL1</b> <ul style="list-style-type: none"> <li>• Test-driven development starts with developing test for each one of the features. The test might fail as the tests are developed even before the development.</li> <li>• Development team then develops and refactors the code to pass the test.</li> </ul>
3	<b>Give the advantages of test driven development. BTL2</b> <ul style="list-style-type: none"> <li>• Writing the tests first requires you to really consider what do you want from the code</li> <li>• Fast feedback</li> <li>• Creates a detailed specification</li> <li>• Reduces time spent on rework</li> <li>• Less time spent in the debugger</li> <li>• Identify the error/problem quickly</li> </ul>
4	<b>Define refactoring. Nov/Dec 2016 BTL1</b> <b>Refactoring</b> is changing a software system by improving its internal structure without changing its external behavior, i.e. it is a technique to restructure the code in a disciplined way
5	<b>List the activities and goals of refactoring. BTL1</b> <ul style="list-style-type: none"> <li>• remove duplicate code</li> <li>• improve clarity</li> <li>• make long methods shorter</li> <li>• remove the use of hard - coded literal constants</li> </ul>
6	<b>Summarize the issues in OO testing. (Nov/Dec 2015) BTL2</b> <ul style="list-style-type: none"> <li>• Basic unit of unit testing</li> <li>• Implication of Encapsulation</li> <li>• Implication of Inheritance</li> <li>• Implication of Genericity</li> <li>• Implications of Polymorphism</li> <li>• Implications for testing processes</li> </ul>
7	<b>Summarize class testing. (Nov/Dec 2018) BTL5</b> <ul style="list-style-type: none"> <li>• <b>Class testing</b> is the base of object-oriented software testing.</li> <li>• It involves three aspects: testing each method, testing the relations among class methods and testing the inheriting relation between class and subclass</li> </ul>
8	<b>Conclude on the need of Integration testing. BTL5</b> <ul style="list-style-type: none"> <li>• <b>Integration Testing</b> is a level of software testing where individual units are combined and tested as a group.</li> <li>• The <b>purpose</b> of this level of testing is to expose faults in the interaction between integrated units. Test drivers and teststubs are used to assist in Integration Testing.</li> </ul>
9	<b>Generalize the need of GUI testing. BTL6 Apr/May 2019</b> <ul style="list-style-type: none"> <li>• <b>GUI testing</b> is the process of testing the system's Graphical User Interface of the Application UnderTest.</li> </ul>

	<ul style="list-style-type: none"> <li>• GUI testing involves checking the screens with the controls like menus, buttons, icons, and all types of bars - toolbar, menu bar, dialog boxes and windows</li> </ul>
10	<p><b>Analyze the need for OO system testing. (Nov/Dec 2018) BTL4</b></p> <ul style="list-style-type: none"> <li>• The aim of System Testing is to ensure that the System will function correctly and properly when all functions/features are bundled as a whole.</li> </ul>
11	<p><b>Differentiate OO integration testing and OO system testing. May/June 2016 BTL2</b></p> <ul style="list-style-type: none"> <li>• <b>System Testing</b> is testing of the software application as a whole to check if the system is complaint with the user requirements.</li> <li>• <b>Integration testing</b> tests the interface between modules of the software application</li> </ul>
12	<p><b>Point out the meaning of unit testing. BTL4</b></p> <ul style="list-style-type: none"> <li>• <b>Unit Testing</b> is a level of software testing where individual units/ components of a software are tested.</li> <li>• The purpose is to validate that each unit of the software performs as designed</li> </ul>
13	<p><b>List the 2 levels of Integration testing. BTL1</b></p> <ul style="list-style-type: none"> <li>• component integration testing</li> <li>• system integration testing</li> </ul>
14	<p><b>Examine on static view on classes. BTL3</b></p> <p>The static view describes the structure of business objects that are sent as message arguments from the sender to the receiver of the message</p>
15	<p><b>Illustrate about Unit testing. BTL3</b></p> <ul style="list-style-type: none"> <li>• Unit Testing is a level of software testing where individual units/ components of a software are tested.</li> <li>• The purpose is to validate that each unit of the software performs as designed.</li> <li>• A unit is the smallest testable part of any software.</li> <li>• It usually has one or a few inputs and usually a single output.</li> </ul>
16	<p><b>Point out the use of atomic system function (ASF). BTL4</b></p> <p><b>Atomic System Function (ASF):</b> is an action that is observable at the system level in terms of port input and output events.</p> <p>It begins with a port input event, traverses one or more MM-Paths, and terminates with a port output event</p>
17	<p><b>Interpret the method/message path (MM-path). BTL2</b></p> <p>An MM-Path in object-oriented software is a sequence of method executions linked by messages.</p>
18	<p><b>Design the 4 controls commonly used in GUI design. BTL6</b></p> <ul style="list-style-type: none"> <li>• Input Controls</li> <li>• Navigational Components</li> <li>• Informational Components</li> <li>• Containers</li> </ul>
19	<p><b>List the types of system modeling BTL1</b></p> <ul style="list-style-type: none"> <li>• Functional modeling</li> <li>• Systems architecture</li> <li>• Business process modeling</li> <li>• Enterprise modeling</li> </ul>
20	<p><b>Summarize about GUI testing BTL5</b></p> <ul style="list-style-type: none"> <li>• GUI testing is the process of ensuring proper functionality of the graphical user interface (GUI ) for a given application and making sure it conforms to its written specifications.</li> <li>• GUI testing processes can be either manual or automatic, and are often performed by third -</li> </ul>

	party companies, rather than developers or end users.
21	<b>Define unit. BTL1</b> <ul style="list-style-type: none"> <li>• A single, cohesive function</li> <li>• A function which, when coded, fits on one page <math>f</math></li> <li>• The smallest separately compilable segment of code</li> <li>• The amount of code that can be written in 4 to 40 hours</li> <li>• A task in a work breakdown structure</li> <li>• Code that is assigned to one person</li> </ul>
22	<b>Define ASF. BTL1</b> <ul style="list-style-type: none"> <li>• An Atomic System Function (ASF) is an input port event, followed by a set of MM-Paths, and terminated by an output port event.</li> <li>• An atomic system function is an elemental function visible at the system level.</li> </ul>
23	<b>Differentiate Internal and External event BTL4</b> <ul style="list-style-type: none"> <li>• <b>External event:</b> It is also known as a system event, is caused by something (for example, an actor) outside our system boundary. SSDs illustrate external events.</li> <li>• <b>Internal event:</b> It is caused by something inside our system boundary. In terms of software, an internal event arises when a method is invoked via a message or signal that was sent from another internal object.</li> </ul>
24	<b>Define temporal event. BTL1</b> Temporal event is caused by the occurrence of a specific date and time or passage of time. In terms of software, a temporal event is driven by a real time or simulated-time clock.
25	<b>List out the types of Events. BTL2</b> <ul style="list-style-type: none"> <li>• External event</li> <li>• Internal event</li> <li>• Temporal event</li> </ul>

### PART B

1	<b>Describe in detail about coding and testing in OOAD. (13m) BTL1</b> <b>Answer:</b> pg.no:376 in Craig Larman book <b>Explanation(10m)</b> <ul style="list-style-type: none"> <li>• Unit Testing for Object-Oriented Systems</li> <li>• Test all features of a class object</li> <li>• Units should be tested in isolation</li> <li>• Test sequences of methods</li> <li>• Inheritance presents problems in testing</li> <li>• Flattened classes</li> <li>• Units</li> <li>• The smallest chunk that can be compiled by itself</li> <li>• A single procedure/function</li> <li>• Something so small it would be developed by one person</li> <li>• Classes and Methods = Units?</li> </ul> <b>Diagram(3m)</b>
2	<b>(i).Discuss in detail about the different types of testing in OOAD. (8m) (May/June 2016) BTL2</b> <b>Answer:</b> pg.no:168, Refer notes

	<p>Four levels of testing</p> <ol style="list-style-type: none"> <li>1. Method/Operation testing</li> <li>2. Class Testing</li> <li>3. Integration testing</li> <li>4. System testing           <ul style="list-style-type: none"> <li>▪ <b>Functional Testing</b></li> <li>▪ <b>Performance Testing</b></li> <li>▪ <b>Acceptance Testing</b></li> <li>▪ <b>Deployment testing</b></li> </ul> </li> </ol> <p><b>Functional Testing (4m)</b></p> <p>Test methods as black boxes</p> <p>Tests based on specification</p> <p><b>Structural Testing (4m)</b></p> <p>'Set' and 'Get' methods for attributes</p> <p><b>(ii).Describe the two views of OO unit testing. (5m) BTL2</b></p> <p><b>Answer:</b> pg.no:386 in Craig Larman book</p> <ul style="list-style-type: none"> <li>• <b>UNIT TESTING (5m)</b> <ul style="list-style-type: none"> <li>Is a level of software testing where individual units/ components of a software are tested.</li> <li>The purpose is to validate that each unit of the software performs as designed.</li> <li>A unit is the smallest testable part of any software.</li> <li>It usually has one or a few inputs and usually a single output.</li> <li>In procedural programming, a unit may be an individual program, function, procedure, etc.</li> <li>In object-oriented programming, the smallest unit is a method, which may belong to a base/ super class, abstract class or derived/ child class. (Some treat a module of an application as a unit.</li> </ul> </li> </ul>
3	<p><b>(i)Discuss briefly about the issues in OO testing. (7m) (April/May 2017)(Nov/Dec 2018) BTL2</b></p> <p><b>Answer:</b> pg.no:385 in Craig Larman book,</p> <p><b>Issues(7m)</b></p> <ul style="list-style-type: none"> <li>• Many individual units within that module.</li> <li>• Unit testing frameworks, drivers, stubs, and mock/ fake objects are used to assist in unit testing.</li> </ul> <p><b>(ii).Describe the two levels of integration in OO integration testing. (6m) BTL2</b></p> <p><b>Answer:</b> pg.no:169, refer notes</p> <p><b>Integration Testing(6m)</b></p> <ul style="list-style-type: none"> <li>• It is a systematic technique for constructing the program structure while conducting tests to uncover errors associated with interfacing.</li> <li>• The object is to take unit tested modules and build a program structure that has been dictated by design.</li> <li>• Top-down testing,</li> <li>• Bottom-up testing,</li> </ul>
4	<p><b>(i).What is OO testing? (5m) (Nov/Dec 2015) BTL1</b></p> <p><b>Answer:</b> pg.no:385 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p><b>Explanation(3m)</b></p> <p>In object-oriented systems, testing encompasses three levels, namely, unit testing, subsystem testing, and system testing.</p> <p><b>(ii)Examine in detail about the concepts of OO testing in OOAD(8m)(Nov/Dec 2015)BTL1</b></p> <p><b>Answer:</b> pg.no:385 in Craig Larman book</p> <p><b>Definition(2m)</b></p> <p>The different types of test cases that can be designed for testing object-oriented programs are called</p>

	<p>grey box test cases. Some of the important types of grey box testing are –</p> <p><b>Explanation(6m)</b></p> <ul style="list-style-type: none"> <li>• <b>State model based testing</b> – This encompasses state coverage, state transition coverage, and state transition path coverage.</li> <li>• <b>Use case based testing</b> – Each scenario in each use case is tested.</li> <li>• <b>Class diagram based testing</b> – Each class, derived class, associations, and aggregations are tested.</li> <li>• <b>Sequence diagram based testing</b> – The methods in the messages in the sequence diagrams are tested.</li> </ul>
5	<p><b>(i).Briefly summarize about class testing. (7m) BTL5</b></p> <p><b>Answer:</b> pg.no:168,Refer notes</p> <p><b>Class Testing(7m)</b></p> <ul style="list-style-type: none"> <li>• In unit testing, the individual classes are tested. It is seen whether the class attributes are implemented as per design and whether the methods and the interfaces are error-free.</li> <li>• Unit testing is the responsibility of the application engineer who implements the structure.(Intra Unit testing- Class testing),(Inter Integration testing)</li> </ul> <p><b>(ii).Explain the implications of Encapsulation and polymorphism. (6m) BTL5</b></p> <p><b>Answer:</b> pg.no:414 in Craig Larman book</p> <p><b>Explanation (4)</b></p> <p><b>Encapsulation</b> is a development technique which includes creating new data types (classes) by combining both information (structure) and behaviors, and restricting access to implementation details.</p> <p><b>Polymorphism</b> is ability to apply different meaning (semantics, implementation) to the same symbol (message, operation) in different contexts.</p> <p><b>Diagram(2m)</b></p>
6	<p><b>Explain about various OO Methodologies in detail. (13m) BTL4</b></p> <p><b>Answer:</b> refer Notes</p> <p><b>Explanation(10)</b></p> <ul style="list-style-type: none"> <li>• Object modelling techniques(OMT)</li> <li>• Object Process Methodology(OPM)</li> <li>• Rational Unified Process(RUP)</li> </ul> <p><b>Diagram (3)</b></p>
	<b>PART C</b>
1	<p><b>Explain in detail about the implication of Composition and Encapsulation with the example of Winder shield wiper system. (15m) BTL5</b></p> <p><b>Answer:</b> pg.no:264 in Craig Larman book</p> <p><b>Explanation(6m)</b></p> <p>Check attributes get set correctly I Initialised to the right value, eg: sizeIndex = [ 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 30 ]</p> <p>Find errors in calculation + instead of *</p> <p>Wrong method calls year.increment() instead of month.increment()</p> <p><b>Calculation(6m)</b></p> <p>Redundant code</p> <p>Incorrect boundary values I for (int i = 0; i ≤ 5; i++) VS for (int i = 0; i &lt; 5; i++)</p> <p>Error Messages</p> <p>Program efficiency is not so important</p> <p><b>Diagram(3m)</b></p>
2	<p><b>Explain in detail about (i) Software Quality Assurance (8m) BTL1</b></p>

	<p><b>Explanation (8m)</b>  <b>Answer:</b> U-5 Refer Notes pageno.5  <b>(ii) Develop Test cases &amp; Test Plans (7m) BTL2</b>  <b>Explanation (7m)</b></p>
3	<p><b>Analyze the Unit, Integration, and system testing for currency converter application. (15m) BTL4</b>  <b>Answer:</b> pg.no:385 in Craig Larman book  <b>Explanation(10m)</b></p> <p>The currency converter has the following requirements:</p> <ul style="list-style-type: none"> <li>• The user can input an amount into an input box</li> <li>• The user can select the currency to convert to</li> <li>• When selecting a currency, a flag is displayed for that currency</li> <li>• Clicking a ‘compute’ button outputs the equivalent amount into an output box</li> <li>• There is no limit on the number of conversions that can be performed</li> </ul> <p><b>Diagram(5m)</b></p>
4	<p><b>Develop the foundation code for Next Generation POS system (15m) BTL6</b>  <b>Answer:</b> pg.no:refer notes in Craig Larman book  <b>Explanation(6m)</b>  <b>Coding(6m)</b>  <b>Diagram(3m)</b>  Class Payment</p> <p>package com.foo.nextgen.domain;</p> <pre> public class Payment  {     private Money amount;      public Payment( Money cashTendered ){ amount = cashTendered; }      public Money getAmount() { return amount; }  } </pre>

IT8602

**MOBILE COMMUNICATION****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

**UNIT I - INTRODUCTION**

9

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA

**UNIT II - MOBILE TELECOMMUNICATION SYSTEM**

9

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture

**UNIT III – WIRELESS NETWORKS**

9

Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi – WiMAX

**UNIT IV - MOBILE NETWORK LAYER**

9

Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing- Vehicular Ad Hoc networks ( VANET ) –MANET Vs VANET – Security

**UNIT V - MOBILE TRANSPORT AND APPLICATIONS LAYER**

9

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**TOTAL: 45 PERIODS**

**OUTCOMES:****At the end of the course, the student should be able to:**

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

**TEXT BOOK:**

1.Jochen Schiller, —Mobile Communications‖, PHI, Second Edition, 2003.

2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012

**REFERENCES:**

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition ,2006.
4. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
5. Android Developers : <http://developer.android.com/index.html>
6. Apple Developer : <https://developer.apple.com/>
7. Windows Phone Dev Center : <http://developer.windowsphone.com>
8. BlackBerry Developer : <http://developer.blackberry.com/>

**Subject Code: IT8602**  
**Subject Name: Mobile Computing**

**Year / Sem : III / 6**  
**Subject Handler: Mr.S.Neelakandan**

### **UNIT I INTRODUCTION**

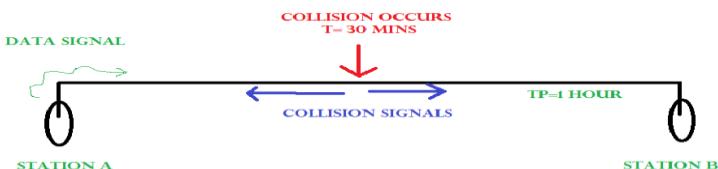
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA

#### **PART \* A**

<b>Q.No</b>	<b>Questions</b>
1	<p><b>Define mobile computing.</b> BTL 1  It is defined as the capability to change location while communicating to invoke computing services at some remote computers. It is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.</p>
2	<p><b>List the advantage of mobile computing.</b> BTL 1 <b>(May/June 2016)</b></p> <ul style="list-style-type: none"> <li>• Increase in Productivity</li> <li>• Entertainment</li> <li>• Portability</li> <li>• Cloud Computing</li> </ul>
3	<p><b>Give the properties of MAC protocols.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• It should help maximize the utilization of channels</li> <li>• Channel allocation needs to be fair. No node should be discriminated against at any time and made to wait for an unduly long time for transmission.</li> </ul>
4	<p><b>Give some mobile computing applications.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• Emergency services</li> <li>• Vehicles.</li> <li>• CDPD – Cellular Digital Packet Data</li> </ul>
5	<p><b>What is Mobility?</b> BTL 1</p> <p>A person who moves</p> <ul style="list-style-type: none"> <li>• Between different geographical locations</li> <li>• Between different networks</li> <li>• Between different communication devices</li> <li>• Between different applications</li> </ul> <p>A device that moves</p> <ul style="list-style-type: none"> <li>• Between different geographical locations</li> <li>• Between different networks</li> </ul>
6	<p><b>What is wireless communication?</b> BTL 1</p> <p>Wireless communication is the transfer of information over a distance without the use of electrical conductors or wires. The distance involved may be short or long lines.</p>
7	<p><b>List the characteristics of mobile computing.</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Ubiquity</li> </ul>

	<ul style="list-style-type: none"> <li>• Location awareness</li> <li>• Adaptation</li> <li>• Broadcast</li> <li>• Personalization</li> </ul>										
8	<p><b>How MAC protocols are classified? BTL 3</b></p> <p>They are classified into</p> <ul style="list-style-type: none"> <li>• Fixed assignment schemes</li> <li>• Random assignments schemes</li> <li>• Demand – based schemes</li> </ul>										
9	<p><b>Differentiate between wired network and mobile. BTL 2 (APR/MAY 2017)</b></p> <table border="1"> <thead> <tr> <th>Wired network</th> <th>Mobile network</th> </tr> </thead> <tbody> <tr> <td>1. High bandwidth</td> <td>1. Low Bandwidth</td> </tr> <tr> <td>2. High power machines</td> <td>2. Low power machines</td> </tr> <tr> <td>3. Can listen on wire</td> <td>3. Hidden terminal problem</td> </tr> <tr> <td>4. Connected operation</td> <td>5. Disconnected operation</td> </tr> </tbody> </table>	Wired network	Mobile network	1. High bandwidth	1. Low Bandwidth	2. High power machines	2. Low power machines	3. Can listen on wire	3. Hidden terminal problem	4. Connected operation	5. Disconnected operation
Wired network	Mobile network										
1. High bandwidth	1. Low Bandwidth										
2. High power machines	2. Low power machines										
3. Can listen on wire	3. Hidden terminal problem										
4. Connected operation	5. Disconnected operation										
10	<p><b>What are the functions of mobile computing? BTL 1</b></p> <ul style="list-style-type: none"> <li>• Session mobility</li> <li>• Device mobility</li> <li>• Service mobility</li> <li>• Host mobility</li> </ul>										
11	<p><b>State the issues of wireless MAC protocols. BTL 1</b></p> <ul style="list-style-type: none"> <li>• Hidden terminal problem</li> <li>• Exposed</li> <li>• Near &amp; Far</li> </ul>										
12	<p><b>Give some examples for fixed assignment and random Assignment schemes. BTL 1</b></p> <p>FAS- FDMA, TDMA, CDMA RAS – Aloha and CSMA.</p>										
13	<p><b>What is the advantage of TDMA? BTL 1</b></p> <ul style="list-style-type: none"> <li>• Flexible bit rate</li> <li>• No frequency guard band required</li> <li>• Extended battery life</li> <li>• Easy for mobile or base stations to initiate and execute hand off</li> </ul>										
14	<p><b>What is the disadvantage of using FDMA? BTL 1</b></p> <ul style="list-style-type: none"> <li>• The presence of guard signals.</li> <li>• Maximum bit rate per channel is fixed.</li> <li>• Requires right RF filtering to minimize adjacent channel interference.</li> </ul>										
15	<p><b>List various Random Assignment schemes in MAC. BTL 1 (Nov/dec2016)</b></p>										

	<ul style="list-style-type: none"> <li>• ALOHA</li> <li>• Slotted ALOHA</li> <li>• CSMA</li> <li>• CSMA/CD</li> <li>• CSMA/CA</li> </ul>
16	<p><b>What are the limitations of Mobile Computing?</b> BTL 1 (Nov/dec2016)</p> <p><b>Wireless Medium</b></p> <ul style="list-style-type: none"> <li>• Cost of Networks</li> <li>• Quantity and reliability of bandwidth</li> <li>• Environment obstacles</li> </ul> <p><b>Portability -Mobile Restrictions</b></p> <ul style="list-style-type: none"> <li>• Low Resources</li> <li>• Battery Constraint</li> </ul>
17	<p><b>Why do Hidden and Exposed terminal problem arise.</b> BTL 1 (May/June 2016)</p> <p>Hidden terminal problem is due to the fact that a node (say A) transmitting to another node (say B) cannot hear transmissions from another node C, which might also be transmitting to B, and might interfere with the A-to-B transmissions.</p> <p>Exposed node problem occurs when a node is prevented from sending packets to other nodes because of a neighboring transmitter.</p>
18	<p><b>Show that Barker code has good auto correlation.</b> BTL 3</p> <p>When the receiver attempts to correlate the received coded symbols with respect to any of the codes which it internally generates, it is not able to correlate even when it uses exactly the same code as the one used for transmission.</p> <ul style="list-style-type: none"> <li>• Reasons for no correlation</li> <li>• Propagation delay</li> <li>• Inappropriate code</li> </ul>
19	<p><b>Give the difference between 1G, 2G, 2.5G, 3G mobile network communications.</b> BTL 1</p> <p>1G –Voice -only communication.</p> <p>2G –Communicate voice as well as data signals.</p> <p>2.5G–Enhancements of the second generation and support data rates up to 100 kpbs.</p> <p>3G –Mobile devices communicate at even higher data rates and support voice, data, and multimedia streams. High data rates in 3G devices enable transfer of video clips and faster multimedia communication.</p>
20	<p><b>What are the basic services provided by the MAC layer?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Asynchronous data service (mandatory)</li> <li>• Time-bounded service (optional)</li> </ul>

21	<b>Define Mobile Binding.</b> BTL 1 A binding created for providing mobility to a mobile node after registration at a foreign network.
22	<b>What is MAC?</b> BTL 1 Message authentication codes (MAC) are used to authenticate messages during transmission. MAC of a message is created using a cryptographic MAC function which is similar to the hash function but has different security requirements.
23	<b>Define MACA Protocol.</b> BTL 1 Multiple Access with Collision Avoidance (MACA) is a slotted media access control protocol used in wireless LAN data transmission to avoid collisions caused by the hidden station problem and to simplify exposed station problem.
24	<b>Define Collision Detection based protocol for wireless networks.</b> BTL 1 CSMA/CD (Carrier Sense Multiple Access/ Collision Detection) is a media-access control method widely used in Ethernet technology/LANs. 
25	<b>Compose a role which is played by Radio/Infrared signals play in Mobile Computing.</b> BTL 6 <ul style="list-style-type: none"> <li>• Radio transmission uses radio-wave frequencies to send data directly between transmitters and receivers.</li> <li>• Infrared light -red light that is not commonly visible to human eyes. Red lights are used in remote controls.</li> </ul>
<b>PART * B</b>	
<b>Q.No</b>	<b>Questions</b>
1	<b>Describe in detail about characteristics of mobile computing.</b> (13M) (Nov/Dec2016) BTL 4  <b>Answer:</b> Page:28-31 - Prasant Kumar Pattnaik <b>Definition:</b> (2M) A computing environment is said to be mobile, when either the sender or the receiver of information can be on the move while transmitting or receiving information. <b>Explanation</b> (10M) <b>Ubiquity:</b> (2M) Ability of a user - perform computations from anywhere - at any time. <b>Location awareness:</b> (2M) Hand held device equipped with global positioning system (GPS) - transparently provide information - current location of a user - tracking system.

	<p><b>Adaptation:</b> (2M) Ability of a system - adjust to bandwidth fluctuation - without inconveniencing user.</p> <p><b>Broadcast:</b> (2M) Broadcast nature - underlying communication network - mobile computing environment, efficient delivery of data - made simultaneously to hundreds of mobile users.</p> <p><b>Personalization:</b> (2M) Services in mobile environment - easily personalized - user's profile</p>
2	<p><b>Explain different layers of structure of mobile computing Application. (13M)</b> <b>(May/June 2016) BTL 1</b></p> <p><b>Answer: Page: 88- 110 - Prasant Kumar Pattnaik</b></p> <p><b>Definition:</b> (2M)</p> <p>A mobile computing application is usually structured in terms of the functionalities implemented.</p> <p><b>Explanation: (6M)</b> Presentationtier, Application tier Data tier.</p> <p><b>Diagram(5M)</b></p>
3	<p><b>Write a short on the concepts of</b></p> <p><b>FDMA</b> (3M)</p> <p><b>TDMA</b> (2M)</p> <p><b>CDMA.</b> (2M)</p> <p><b>SDMA.</b> (2M) <b>BTL 2 (APR/MAY 2017)</b></p> <p><b>Answer: Page: 56 -59 - Prasant Kumar Pattnaik</b></p> <p><b>Explanation (9M)</b></p> <p><b>Fixed Assignment Schemes:</b> Important categories of fixed assignment MAC protocols:</p> <ul style="list-style-type: none"> <li>• Frequency Division Multiple Access(FDMA)</li> </ul>

- Time Division Multiple Access(TDMA)
- Code Division Multiple Access(CDMA)
- Spatial division multiple access (SDMA)

**FDMA:**

In FDMA - available bandwidth (frequency range) - divided into many narrower frequency bands called channels.

**TIME DIVISION MULTIPLE ACCESS (TDMA):**

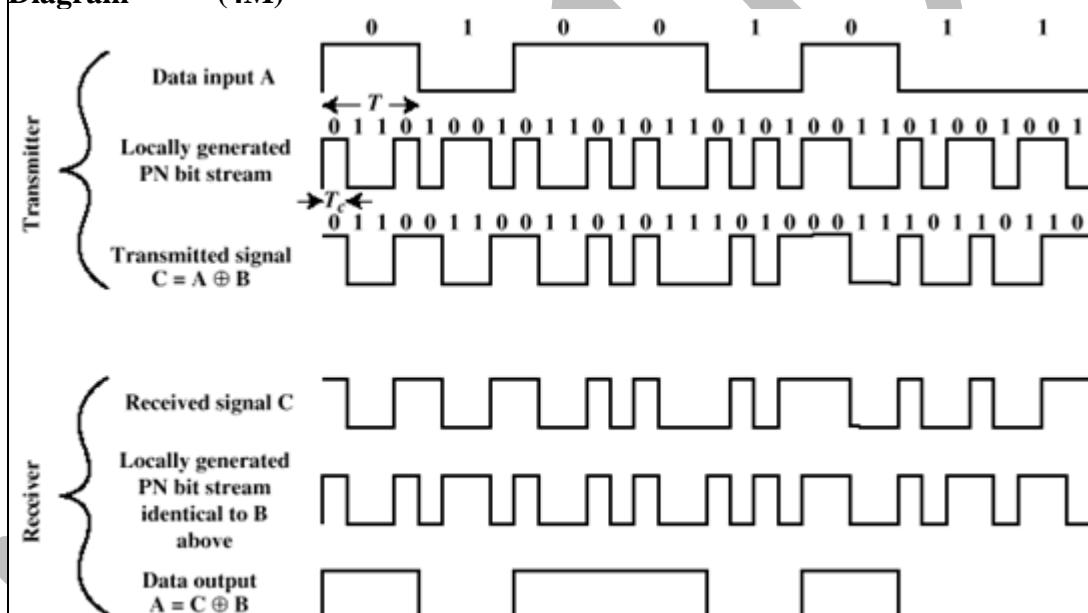
TDMA - access method - multiple nodes - allotted different time slots - access the same physical channel - timeline divided into fixed time slots - divided among multiple nodes that can transmit.

**CDMA:**

In CDMA - multiple users are allotted different codes - consist of sequences of 0 and 1 to access the same channel.

**SDMA:**

Spatial division multiple access (SDMA) - channel access method - mobile communication systems - reuses the same set of cell phone frequencies - given service area

**Diagram (4M)**

- 4 Discuss in detail about Random assignment scheme and Reservation based schemes. (13M) BTL 2

**Answer: Page: 59-61 - Prasant Kumar Pattnaik**

**Random Assignment Schemes: (7M)**

ALOHA

Slotted ALOHA

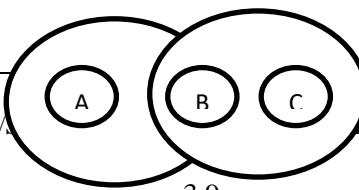
CSMA

CSMA/CD

CSMA/CA

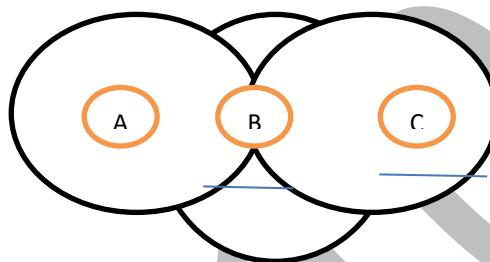
**ALOHA Scheme:**

	<p>Simple communication scheme - developed at the University of Hawai - (also called pure) ALOHA scheme, is a simple protocol.</p> <p><b>Slotted ALOHA:</b> slotted ALOHA scheme - chances of collisions are attempted - reduced by enforcing restrictions</p> <p><b>CSMA</b> a node senses - medium before starting to transmit - senses that some transmission -already underway - it defers its transmission.</p> <p><b>Reservation- based schemes: (6M)</b> A basic form of the reservation scheme is the RTS/CTS scheme. In an RTS/CTS scheme, a sender transmits an RTS (Ready to Send) packet to the receiver before the actual data transmission.</p> <p><b>MACA</b> MACA - Multiple Access Collision Avoidance. MACA solves - hidden/exposed terminal regulating - transmitter power.</p>
5	<p><b>Describe in detail about MAC protocols issues.</b> (13M) BTL 4 (APR/MAY 2017)</p> <p><b>Answer:</b> Page:207 -209 - Prasant Kumar Pattnaik</p> <p><b>Explanation:</b> (8M)</p> <p><b>Hidden and exposed terminal problems in infrastructure less Network:</b> (4M)</p> <ul style="list-style-type: none"> <li>Consider three mobile phones A,B, C. The transmission range of A reaches B, but not C (the detection range does not reach C either). The transmission range of C reaches B, but not A. Finally, the transmission range of B reaches A and C, i.e., A cannot detect C and vice versa.</li> <li>A starts sending to B, C does not receive this transmission.</li> <li>C also wants to send something to B and senses the medium. The medium appears to be free, the carrier sense fails. C also starts sending causing a collision at B.</li> <li>But A cannot detect this collision at B and continues with its transmission. A is <b>hidden</b> for C and vice versa.</li> <li>While hidden terminals may cause collisions, the next effect only causes unnecessary delay. Now consider the situation that B sends something to A and wants to transmit data to some other mobile phone outside the interference ranges of A and B. C senses the carrier and detects that the carrier is busy (B's signal).</li> <li>C postpones its transmission until it detects the medium as being idle again. But as A is outside the interference range of C, waiting is not necessary. Causing a 'collision' at B does not matter because the collision is too weak to propagate to A.</li> <li>In this situation, C is <b>exposed</b> to B.</li> </ul>



**Near and Far terminals:** (4m)

- A and B are both sending with the same transmission power. As the signal strength decreases proportionally to the square of the distance, B's signal drowns out A's signal. As a result, C cannot receive A's transmission.
- C as being an arbiter for sending rights (e.g., C acts as a base station coordinating media access). In this case, terminal B would already drown out terminal A on the physical layer. C in return would have no chance of applying a fair scheme as it would only hear B.



- The **near/far effect** is a severe problem of wireless networks using CDM. All signals should arrive at the receiver with more or less the same strength.
- Even if the senders were separated by code, the closest one would simply drown out the others.
- Precise power control is needed to receive all senders with the same strength at a receiver. For example, the UMTS system adapts power 1,500 times per second.

**Diagram** (5M)

**6 Differentiate between FDMA, TDMA, and CDMA. (13M) BTL 2**

**Answer: Page: 56-59 - Prasant Kumar Pattnaik**

**Explanation(13M)**

FDMA	TDMA	CDMA
Frequency Division Multiple Access or FDMA is an access technology that is used by radio systems to share the radio spectrum. The terminology “multiple access” implies the sharing of the resource amongst users, and the “frequency division” describes how the sharing is done: by allocating users with different carrier frequencies of the radio spectrum.	Time division multiple access (TDMA) is a channel access method for shared medium (usually radio) networks.	CDMA is a form of “spread-spectrum” signaling, since the modulated coded signal has a much higher bandwidth than the data being communicated.
Frequency limited	Is Bandlimited system	Power limited system

	Single frequency is used for single call	Multiple frequencies are used for multiple calls	Single frequency is used for multiple calls
	Filtering in the frequency domain.		Synchronization in time domain
	Cell Capacity is limited.		No absolute limit on channel capacity but it is an interference limited system
	Simple, established, robust		Established fully digital, flexible
	Inflexible, frequencies are scarce resources.		Guard space needed (multipath propagation) Synchronization needed.
	Transmission scheme is Continuous	Transmission scheme is Discontinuous	Transmission scheme is Discontinuous

**PART \* C**

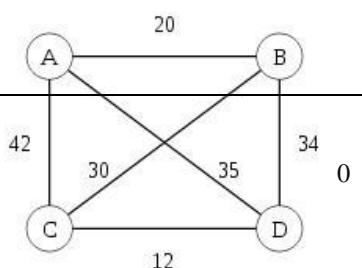
- 1 Explain the distinguishing features of various wireless network generations. (15M) (NOV/DEC 2016)** BTL 2

**Answer: Page: 17-19- Prasant Kumar Pattnaik  
Explanation (15M)**

Generation	Period of commercial use	Features	Standards	Data speed
1G	70s to 90s	Analog transmissions, primarily usage restricted to voice communication	NMT, AMPS, TACS	No direct Support
2g	90s to 2000	Digital transmissions, improved performance by letting multiple users share a single channel	GSM	9.6Kps
2.5G	2001-2005	Enhanced multimedia and streaming video, web browsing	GPRS	28kps or higher
3G	2005-2015	Enhanced multimedia and streaming video capabilities	UMTS, HSPA, EDGE, W-CDMA	384 kps or higher
4G	2010- present	Support interactive multimedia, voice, video, wireless internet and other broadband services	LTE, WIMAX	100 mbps or higher

- 2 Classify the different categories of MAC protocols. Identify the situations under which protocols from one category would be preferable over the other categories. Explain the working of a reservation-based MAC protocols. (15M) (MAY/JUNE 2016)** BTL 4

**Answer: Page: 61-63- Prasant Kumar Pattnaik  
Explanation (10M)**



	<p>They are classified into</p> <ul style="list-style-type: none"> <li>• Fixed assignment schemes</li> <li>• Random assignments schemes</li> <li>• Demand – based schemes</li> </ul> <p><b>Random Assignment Schemes: (5M)</b></p> <p>ALOHA Slotted ALOHA CSMA CSMA/CD CSMA/CA</p> <p><b>Reservation- based schemes: (5M)</b></p> <p>A basic form of the reservation scheme is the RTS/CTS scheme. In an RTS/CTS scheme, a sender transmits an RTS (Ready to Send) packet to the receiver before the actual data transmission.</p> <p><b>MACA</b> MACA - Multiple Access Collision Avoidance. MACA solves - hidden/exposed terminal regulating - transmitter power.</p> <p><b>Diagram (5M)</b></p>
3	<p><b>Differentiate infrastructure-based networks and infrastructure-less networks with the help of suitable schematic diagrams. (15M)</b> <span style="float: right;">BTL 4</span></p> <p><b>Answer:</b> Page: 63-65 - Prasant Kumar Pattnaik</p> <p><b>Explanation :</b> (10M)</p> <p>Infrastructure less wireless network - network of mobile nodes without having any central controller.</p> <p>Compared to ad-hoc wireless networks - infrastructure offers advantage of scale, centralized security management, and improved reach.</p> <p>Wireless devices can connect to resources on a wired LAN - which is common business settings - more access points can be added - improve congestion and broaden the reach of the network.</p> <p><b>Diagram (5M)</b></p>

## **UNIT II MOBILE TELECOMMUNICATION SYSTEM**

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture

### **PART \* A**

1	<p><b>List the features of Mobile IP.</b></p> <ul style="list-style-type: none"> <li>• Transparency</li> <li>• Compatibility</li> <li>• Security</li> <li>• Efficiency and scalability</li> </ul>	BTL 1
2	<p><b>What are the four types of handover available in GSM? BTL 1</b></p> <ul style="list-style-type: none"> <li>• Intra cell Handover</li> <li>• Inter cell Intra BSC Handover</li> <li>• Inter BSC Intra MSC handover</li> <li>• Inter MSC Handover</li> </ul>	
3	<p><b>How do I - TCP isolate problems on the wireless link? BTL 3</b></p> <p><b>I -TCP isolate problems on the wireless link:</b></p> <ul style="list-style-type: none"> <li>• I. TCP splits the connection into two parts .a wired / fixed and a wireless / mobile part.</li> <li>• I - TCP isolate problems on the wireless link from the fixed networks.</li> </ul>	
4	<p><b>List advantages of mobile TCP. BTL 1</b></p> <ul style="list-style-type: none"> <li>• It maintains the TCP end .to .end semantics. The SH does not sent any ACK itself but forwards the ACKs from the MH.</li> <li>• If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0.</li> <li>• Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH. Lost packets will be automatically retransmitted to the new SH.</li> </ul>	
5	<p><b>List disadvantages of mobile TCP. BTL 1</b></p> <p>As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption. A modified TCP on the wireless link not only requires modification to the MH protocol software but also now new network elements like the bandwidth manager.</p>	
6	<p><b>Define fast retransmit. BTL 1</b></p>	

	The gap in the packet stream is not due to severe congestion, but a simple packet loss due to a transmission error. The sender can now retransmit the missing packet before the timer expires. This behaviour is called fast retransmit.
7	<b>Define COA.</b> BTL 1 (NOV/DEC 2016) Care –of address is the address of the current tunnel end point for the Mobile node. It gives us the actual location of the MN from an IP point of view. Can be chosen e.g via DHCP.
8	<b>What are the types of COA?</b> BTL 1 <ul style="list-style-type: none"> <li>• Foreign agent COA</li> <li>• Collacated COA</li> </ul>
9	<b>What are the four messages transmitted in optimized mobile IP?</b> BTL 1 <ul style="list-style-type: none"> <li>• Binding request</li> <li>• Binding acknowledgement</li> <li>• Binding update</li> <li>• Binding warning</li> </ul>
10	<b>What are the features of mobile IP?</b> BTL 1 <ul style="list-style-type: none"> <li>• Transparency</li> <li>• Compatibility</li> <li>• Security</li> <li>• Efficiency and scalability</li> </ul>
11	<b>What are the key mechanisms used in Mobile IP?</b> BTL 1 <ul style="list-style-type: none"> <li>• Discovering the care-of- address</li> <li>• Registering the care-of- address</li> <li>• Tunneling the care-of- address</li> </ul>
12	<b>List the use route optimization.</b> BTL 1 (APR/MAY 2017) <ul style="list-style-type: none"> <li>• Enable direct notification of the corresponding host</li> <li>• Direct tunneling from the corresponding host to the mobile host</li> <li>• Binding cache maintained at the corresponding host</li> </ul>
13	<b>Illustrate the mechanisms used by DHCP for IP address allocation.</b> BTL 3

	<ul style="list-style-type: none"> <li>• Automatic allocation</li> <li>• Dynamic allocation</li> <li>• Manual allocation</li> </ul>
14	<p><b>Define GPRS.</b> BTL 1 The General Packet Radio Service provides packet mode transfer for applications that exhibit traffic patterns such as frequent transmission of small volumes.</p>
15	<p><b>List out the service of GSM.</b> BTL 1 (NOV/DEC 2016) The key advantages of GSM systems to consumers have been higher voice quality and low cost alternatives to making calls, such as the Short Message Service. The advantages for network operator have been the ease of deploying equipments from any vendors that implement the standard. Like other cellular standards, GSM allows network operators to offer roaming services so that subscribers can use their phones on GSM networks all over the world</p>
16	<p><b>Why routing in multi hop adhoc networks are complicated?</b> BTL 1 (APR/MAY 2017) Routing is complicated because of frequent topology changes, different capabilities of the nodes, varying propagation characteristics. Further, no control instance can support routing.</p>
17	<p><b>What is the basic purpose of DHCP?</b> BTL 1 (MAY/JUNE 2016)</p> <ul style="list-style-type: none"> <li>• DHCP is mainly used to simplify the installation and maintenance of networked computer</li> <li>• DHCP is a mechanism for configuring nodes, parameters acquired via DHCP are eg., IP address, default gateway, DNS server, subnet mask, etc.</li> </ul>
18	<p><b>Define Tunneling and Encapsulation.</b> BTL 1 (MAY/JUNE 2016)</p> <ul style="list-style-type: none"> <li>• Encapsulation: is the mechanism of taking a packet consisting of packet header and data and putting it into the data part of a new packet.</li> <li>• Tunnel: establishes a virtual pipe for data packet between a tunnel entry and a tunnel endpoint.</li> </ul>
19	<p><b>What are the three types of encapsulation?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• IP - in - IP Encapsulation</li> <li>• Minimal Encapsulation</li> <li>• Generic Routing Encapsulation</li> </ul>
20	<p><b>State the use of BOOTP Protocol.</b> BTL 3 (NOV/DEC 2016) The Bootstrap Protocol (BOOTP) is a computer networking protocol used in Internet Protocol networks to automatically assign an IP address to network devices from a configuration server. The BOOTP was originally defined in RFC 951.</p>
21	<p><b>What is the need for encapsulation?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• To hide the original header information</li> </ul>

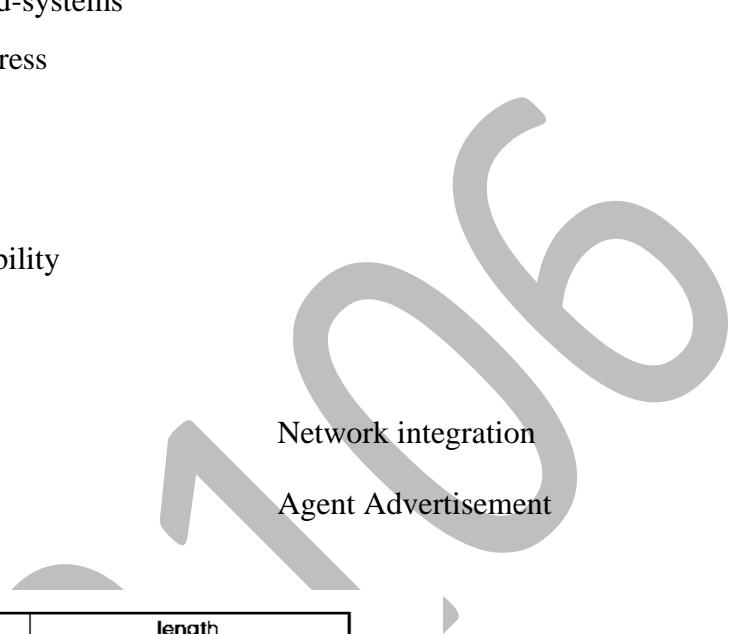
	<ul style="list-style-type: none"> <li>• To provide data independence</li> </ul>
22	<p><b>State the IP datagram structure.</b> BTL 2</p> <p>The IP datagram structure. An IP datagram consists of a header part and text part. The header has a 20 bytes fixed part and a variable length optional part. It is transmitted in big endian order.</p>
23	<p><b>Define congestion avoidance.</b> BTL 1</p> <p>Transmission Control Protocol (TCP) uses a network congestion-avoidance algorithm that includes various aspects of an additive increase/multiplicative decrease (AIMD) scheme, with other schemes such as slow start and congestion window to achieve congestion avoidance.</p>
24	<p><b>What is Care of address?</b> BTL 1</p> <p>Used in Internet routing, a care-of address (usually referred to as CoA) is a temporary IP address for a mobile device. This allows a home agent to forward messages to the mobile device.</p>
25	<p><b>What are the ways to reduce the congestion in a mobile network?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Network monitoring</li> <li>• Network Segmentation</li> <li>• <i>Use a Content Delivery Network</i></li> <li>• <i>Reconfigure TCP/IP Setting.</i></li> </ul>

**PART \* B**

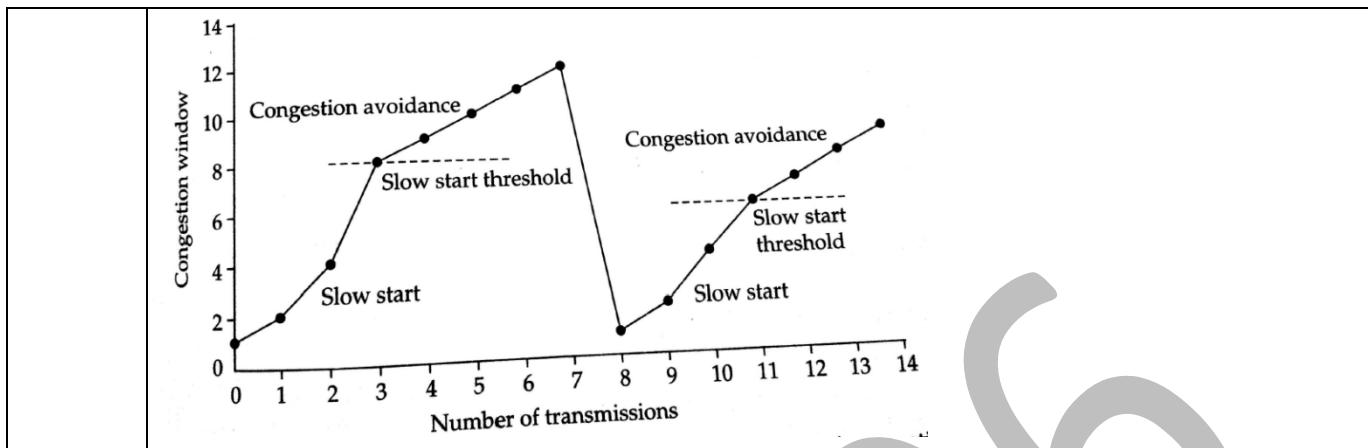
1	<p><b>(i) Discuss improvement in TCP for traditional networks.</b> (6M) BTL 2</p> <p><b>Answer:</b> Page:88-91 - Prasant Kumar Pattnaik</p> <p><b>Explanation (4M)</b></p> <p><b>Traditional Networks:</b></p> <ul style="list-style-type: none"> <li>• In the wired networks - packet losses are primarily attributable to congestions - built-up the networks - reduce congestion - TCP invokes congestion control mechanisms.</li> <li>• Congestion control - primarily achieved by reducing transmission window - which in turn results in slower data transfer.</li> </ul> <p><b>Diagram (2M)</b></p> <p><b>(ii) Describe Mechanism for TCP Improvement.</b> (7M) (MAY/JUNE 2016)</p> <p>BTL 2</p> <p><b>Explanation (4M)</b></p> <p><b>Slow Start:</b></p> <ul style="list-style-type: none"> <li>• TCP session is started - starting transmission at a fixed transmission window size- transmission is started at the lowest window size - then doubled after each successful transmission.</li> </ul> <p><b>Congestion avoidance:</b></p> <ul style="list-style-type: none"> <li>• It starts where slow start stops -once the congestion window reaches the congestion - threshold level.</li> </ul> <p><b>Fast retransmit/ fast recovery</b></p>
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	<ul style="list-style-type: none"> <li>A sender initiates a timer after transmitting a packet - sets timeout value (RTO) - RTO is calculated on RTT.</li> </ul> <p><b>Diagram (3M)</b></p>	
2	<p><b>Explain the GSM system architecture with a neat diagram. (13M) (Nov/dec 2011/2015) BTL 2</b></p> <p><b>Answer: Page: 40-43 - Prasant Kumar Pattnaik</b></p> <p><b>GSM ARCHITECTURE</b></p> <p>The architecture of GSM comes in hierarchy, consisting of many entities, interfaces and subsystems.</p> <p>The GSM system consist of three subsystems namely,</p> <ul style="list-style-type: none"> <li>The Radio Subsystems(RSS)</li> <li>Network and Switching Subsystems(NSS)</li> <li>Operation Subsystem(OSS)</li> </ul> <p><b>Diagram(5M)</b></p> <p><b>Explanation(8M)</b></p> <p><b>The components of RSS</b></p> <ul style="list-style-type: none"> <li>Mobile station</li> <li>Base Transceiver Station</li> <li>Base Station Subsystem</li> <li>Base Station Controller</li> </ul> <p><b>NETWORK AND SWITCHING SUBSYSTEM:</b></p> <p>Network And Switching Subsystem is the heart of GSM.</p> <p><b>Functions:</b></p>	(13M) (Nov/dec 2011/2015) BTL 2

	<ul style="list-style-type: none"> <li>• Connects wireless network with standard public network</li> <li>• Performs handover between different BSS</li> <li>• Localization (to locate the mobile station)</li> <li>• Charging, accounting and roaming of users.</li> </ul> <p><b>Functions</b></p> <ul style="list-style-type: none"> <li>• Traffic monitoring</li> <li>• Status reporting of network entities.</li> <li>• Security management</li> </ul>
3	<p><b>Describe the services provided by GSM with a neat diagram. (13M)</b>  <b>(Nov/Dec 2014, 2016) BTL 2</b></p> <p><b>Answer: Page: 40-42- Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b></p> <p><b>GSM: Mobile Services</b></p> <p>GSM offers several types of connections voice connections, data connections, short message service, multi-service options (combination of basic services).</p> <p><b>Explanation(6M)</b></p> <p><b>Three service domains</b></p> <ul style="list-style-type: none"> <li>• Bearer Services (2M)</li> <li>• Telematic Services (2M)</li> <li>• Supplementary Services (2M)</li> </ul> <p><b>Bearer Services</b> – interface to the physical medium (transparent for example in the case of voice or non transparent for data services)</p> <p><b>Telematic Services</b> – services provided by the system to the end user (e.g., voice, SMS, fax, etc.)</p> <p><b>Supplementary Services</b> – associated with the tele services: call forwarding, redirection, etc.</p> <p><b>Diagram(5M)</b></p> <pre> graph LR     MS[MS] --- TE1[TE]     MS --- MT[MT]     TE --- R[ ]     TE --- S[ ]     MT --- Um[U_m]     GSM[GSM-PLMN] --- GSM     GSM --- TN[transit network PSTN, ISDN]     TN --- SDN[source/destination network]     SDN --- U[ ]     SDN --- S2[ ]     SDN --- R2[ ]     U --- USR[U, S, R]     U --- TE2[TE]     subgraph tele_services [tele services]         TE1 --- MT         MT --- GSM         GSM --- TN         TN --- SDN         SDN --- TE2     end </pre>
4	<p><b>Explain in detail about Mobile IP with a neat sketch. (13M) BTL 1</b></p> <p><b>Answer: Page: 73-77 - Prasant Kumar Pattnaik</b></p> <p><b>Definition (2M)</b></p> <p>Mobile IP (or MIP) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address.</p>

	<p><b>Explanation (6M)</b></p> <ul style="list-style-type: none"> <li>• Routing</li> <li>• Specific routes to end-systems</li> <li>• Changing the IP-address</li> <li>• Transparency</li> <li>• Compatibility</li> <li>• Efficiency and scalability</li> <li>• Home Agent (HA)</li> <li>• Foreign Agent (FA)</li> <li>•</li> <li>•</li> </ul>  <p><b>Diagram (5M)</b></p> <table border="1"> <thead> <tr> <th>ver.</th> <th>IHL</th> <th>DS (TOS)</th> <th colspan="2">length</th> </tr> </thead> <tbody> <tr> <td colspan="2">IP identification</td> <td>flags</td> <td colspan="2">fragment offset</td> </tr> <tr> <td>TTL</td> <td colspan="2">IP-in-IP</td> <td colspan="2">IP checksum</td> </tr> <tr> <td colspan="5"><b>IP address of HA</b></td> </tr> <tr> <td colspan="5"><b>Care-of address of COA</b></td> </tr> <tr> <th>ver.</th> <th>IHL</th> <th>DS (TOS)</th> <th colspan="2">length</th> </tr> <tr> <td colspan="2">IP identification</td> <td>flags</td> <td colspan="2">fragment offset</td> </tr> <tr> <td>TTL</td> <td colspan="2">lay. 4 prot.</td> <td colspan="2">IP checksum</td> </tr> <tr> <td colspan="5"><b>IP address of CN</b></td> </tr> <tr> <td colspan="5"><b>IP address of MN</b></td> </tr> <tr> <td colspan="5">TCP/UDP/ ... payload</td> </tr> </tbody> </table>	ver.	IHL	DS (TOS)	length		IP identification		flags	fragment offset		TTL	IP-in-IP		IP checksum		<b>IP address of HA</b>					<b>Care-of address of COA</b>					ver.	IHL	DS (TOS)	length		IP identification		flags	fragment offset		TTL	lay. 4 prot.		IP checksum		<b>IP address of CN</b>					<b>IP address of MN</b>					TCP/UDP/ ... payload				
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5	<p><b>Elaborate TCP operation in detail. Construct the connection transfer of packets from source to destination with a neat diagram (13M) BTL 6</b></p> <p><b>Answer: Page: 92-95 - Prasant Kumar Pattnaik</b></p> <p><b>List (3M)</b></p> <p>A TCP Connection Connection Establishment Three-Way Handshaking: Data Transfer Connection Termination</p> <p><b>Diagram (10M)</b></p>																																																							

	<p>The diagram illustrates the TCP three-way handshake and connection establishment process between a Client and a Server.</p> <p><b>Initial Sequence Numbers:</b></p> <ul style="list-style-type: none"> <li><b>Client:</b> Initial sequence number (<math>x</math>) read from TCP's clock.</li> <li><b>Server:</b> Initial sequence number (<math>y</math>) read from TCP's clock.</li> </ul> <p><b>Sequence of Events:</b></p> <ol style="list-style-type: none"> <li><b>Client:</b> Sends a <b>CONNECT.req</b> message to the <b>Server</b>.</li> <li><b>Server:</b> Sends a <b>SYN(seq=x)</b> message back to the <b>Client</b>.</li> <li><b>Client:</b> Sends a <b>CONNECT.conf</b> message to the <b>Server</b>.</li> <li><b>Server:</b> Sends a <b>SYN+ACK(ack=x+1, seq=y)</b> message back to the <b>Client</b>.</li> <li><b>Client:</b> Sends an <b>ACK(seq=x+1, ack=y+1)</b> message to the <b>Server</b>.</li> <li><b>Server:</b> Sends a <b>CONNECT.ind</b> and <b>CONNECT.resp</b> messages to the <b>Client</b>.</li> </ol> <p><b>Established Connection:</b></p> <ul style="list-style-type: none"> <li><b>Client:</b> The sequence numbers of all segments A-&gt;B will start at <math>x+1</math>.</li> <li><b>Server:</b> The sequence numbers of all segments B-&gt;A will start at <math>y+1</math>.</li> </ul> <p><b>Application Content Request:</b></p> <ul style="list-style-type: none"> <li><b>Client:</b> Sends an <b>Application content request</b> to the <b>Server</b>.</li> <li><b>Server:</b> Sends an <b>ACK</b> message to the <b>Client</b>.</li> <li><b>Client:</b> Sends an <b>ACK</b> message to the <b>Server</b>.</li> </ul> <p><b>TCP Three-way handshake:</b></p> <p>(TCP payload size: 492 octets)</p>
6	<p><b>Explain in detail about TCP congestion control algorithms and a graphical representation of congestion and transmission. (13M) BTL 2</b></p> <p><b>Answer: Page: 101-104 - Prasant Kumar Pattnaik</b></p> <p><b>Explanation(8M)</b></p> <p><b>Algorithm List</b></p> <ol style="list-style-type: none"> <li>a. TCP Tahoe (2M)</li> <li>b. TCP new Reno (2M)</li> <li>c. TCP SACK (2M)</li> <li>d. TCP vegas. (2M)</li> </ol> <p><b>Diagram (5M)</b></p>

**PART-C**

- 1** Illustrate the comparison of various TCP advantages and disadvantages in Wireless Networking. (15M) (Nov/Dec 2016) BTL 2

**Answer:** Page: 99-110 - Prasant Kumar Patnaik

**Comparison( 15M)**

TCP approach	Mechanism Used	Merits	Demerits
Indirect TCP(I-TCP)	Segments the TCP connection into two	- Simple - Isolation of wire and wireless links is possible	- Loss of the TCP semantics - Security Problem
Snooping TCP(S-TCP)	Snooping of data and acknowledgements	- Transparency - MCA interaction	- Inadequate isolation of the wireless links - Security problem
Mobile TCP	The segmented TCP connection can choke the sender through window sizes	- End-to-end segment maintained - Handles frequent disconnections	- poor isolation - Wireless links. - Security problem
Fast retransmission Fast recovery	It avoids slow-start after any roaming	- Simple - More efficient	- Not transparent - Mixed Layers
Freeze- TCP	It freezes the TCP, later it resumes the TCP after reconnection.	- Works even when there are long interruptions	- Changes in TCP. - MAC dependent

- 2** Explain the architecture of GPRS and transmission Protocol of GPRS (13M) (NOV/DEC 2014) BTL 2

**Answer:** Page:44-45 - Prasant Kumar Patnaik

**Definition(2M)**

GPRS stands for General Packet Radio Services. This mechanism is flexible and powerful. This method provides packet mode for data transfer for small volumes of data, to increase the data transfer.

**Explanation(8M)**

	<p><b>Expectations:</b></p> <ul style="list-style-type: none"> <li>• Should use the existing network resources efficiently.</li> <li>• Should provide the selection of QoS parameters.</li> <li>• Should provide unicast, broadcast, multicast services.</li> </ul> <p><b>Types of packet transfer services.</b></p> <ul style="list-style-type: none"> <li>• Point to point packet transfer services.</li> <li>• Point to multipoint services.</li> </ul> <p><b>Diagram(3M)</b></p>
3	<p><b>Explain System Architecture of UMTS with a neat sketch. (15M) (NOV/DEC 2016)</b></p> <p>BTL 1</p> <p><b>Explanation (10M)</b></p> <p><b>Answer: Page: 46-48 - Prasant Kumar Pattnaik</b></p> <p>The UTRA network (UTRAN) handles cell level mobility and comprises several radio network subsystems (RNS).</p> <p><b>Diagram (5M)</b></p> <p><b>UMTS Logical and physical channels:</b></p> <ul style="list-style-type: none"> <li>Dedicated physical data channel (DPDCH)</li> <li>Dedicated physical control channel (DPCCH)</li> <li>Dedicated physical channel (DPCH)</li> </ul>

**Subject Code: IT8602**  
**Subject Name: Mobile Computing**

**Year / Sem : III / 6**  
**Subject Handler: Mr.S.Neelakandan**

### **UNIT III WIRELESS NETWORKS**

Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi – WiMAX

#### **PART \* A**

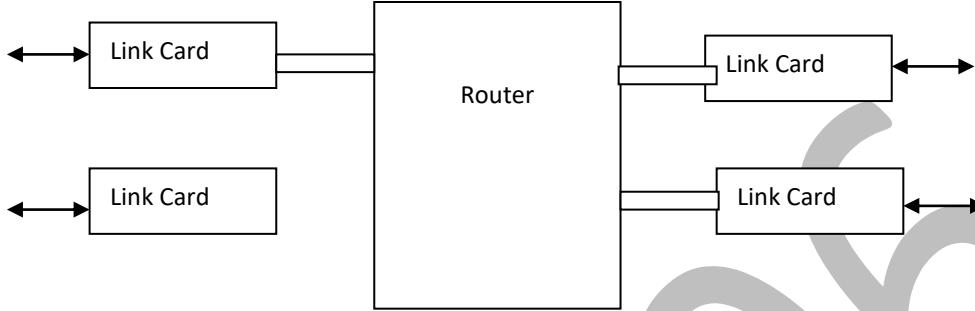
<b>1</b>	<b>Define Adhoc network.</b> BTL 1  It is a local area network (LAN) that is built spontaneously as device connects. Instead of relying on a base station to co ordinate the flow of messages to each node in the network, the individual network nodes forward packet to and from each other.
<b>2</b>	<b>Define MANET.</b> BTL 1  Mobile Adhoc network without the support of any form of fixed infrastructure such as a base station or an access point. They are set up among the hand held devices of mobile users.
<b>3</b>	<b>Define VANET.</b> BTL 1  The Vehicular Ad-Hoc Network, or <b>VANET</b> , is a technology that uses moves cars as nodes in a network to create a mobile network. <b>VANET</b> turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range
<b>4</b>	<b>Which DSDV adds two components to the distance vector algorithm?</b> BTL 1 Sequence Number and Damping
<b>5</b>	<b>Which DSR adds two components to the distance vector algorithm?</b> BTL 1 <ul style="list-style-type: none"> <li>• Route Discovery</li> <li>• Route Maintenance</li> </ul>
<b>6</b>	<b>Distinguish between MANET and VANET (NOV/DEC 2016)</b> BTL 2  The main difference between VANET and MANET network is production cost, the VANET production cost is costly when we compare with MANET. The network topology of VANET is frequent, fast, mobility is high because of speed of cars, and other hand the MANET is sluggish and slow. The bandwidth in VANET is higher compare to Mobile Ad-hoc networks. The nodes are moving randomly in MANET but in VANET the nodes are moving regularly.
<b>7</b>	<b>What is the key difference between MANET and other wireless networks?</b> BTL 1 <ul style="list-style-type: none"> <li>• No Fixed Routing/Forwarding Infrastructure</li> <li>• Untrusted environment</li> <li>• No PKI and Online security mechanism.</li> </ul>

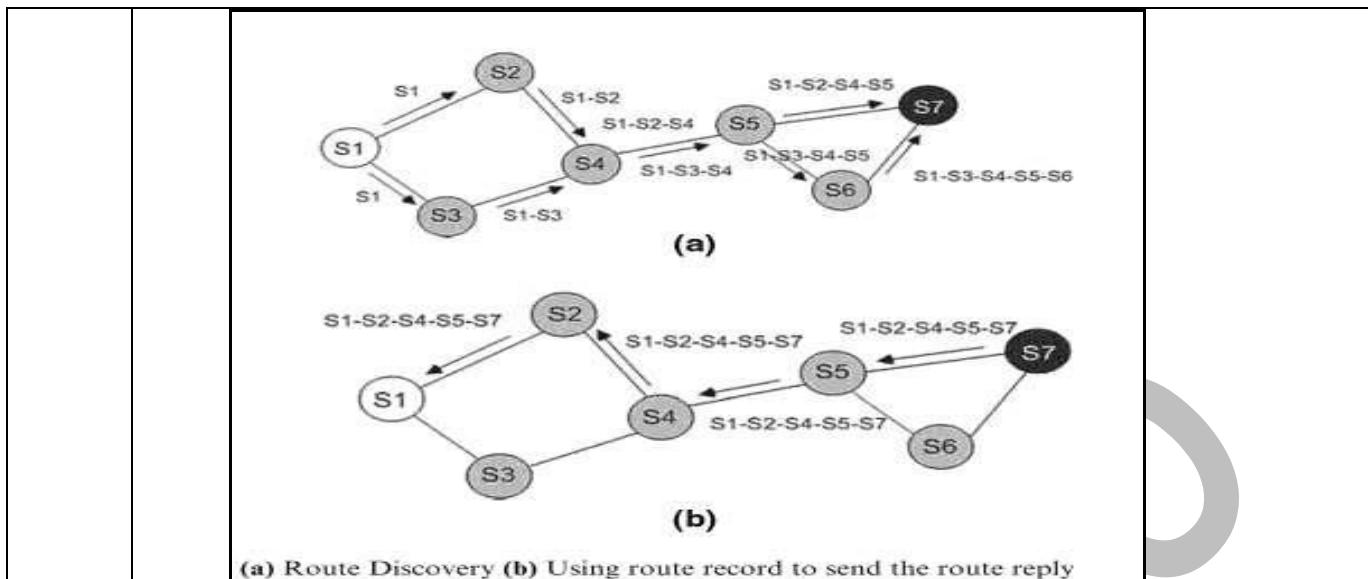
8	<p><b>List the characteristics of MANETs.</b> (MAY/JUNE 2016) BTL 2</p> <ul style="list-style-type: none"> <li>• Lack of fixed infrastructure</li> <li>• Dynamic Topologies</li> <li>• Bandwidth constrained, variable capacity links</li> </ul>
9	<p><b>Why is Routing in MANET a complex task?</b> BTL 1</p> <p>It is difficult to have a global node identifier assigned to every node. In a nutshell, the topology of a network Change dynamically as nodes move way or fail.</p>
10	<p><b>What is mesh based protocol?</b> BTL 1</p> <p>It establishes a mesh of paths that connects the source and destinations. These are most resilient to link failures as well as to node mobility.</p>
11	<p><b>What are the characteristics of secure Ad hoc networks?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Availability</li> <li>• Confidentiality</li> <li>• Integrity</li> <li>• Authentication</li> </ul>
12	<p><b>What are the security vulnerabilities of using adhoc network?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Lack of physical boundary</li> <li>• Low power RF transmissions</li> <li>• Limited computational capabilities</li> <li>• Limited Power supply</li> </ul>
13	<p><b>What is the difference between AODV and standard distance vector algorithm?</b> BTL 1</p> <p>AODV is capable of both unicast and multicast routing. It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. Routers use distance vector based routing protocols to periodically advertise the routes in their routing tables. Routing information exchanged between typical distance vector based routers is unsynchronized and unacknowledged.</p>
14	<p><b>What are the features of MANET routing Protocol?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• Capable to identify network topology after changes due to mobility</li> <li>• Topology Maintenance</li> <li>• Scheduling of packet transmission and channel assignment</li> </ul>
15	<p><b>List example of ON – Demand routing protocol.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• Dynamic Source Routing (DSR)</li> </ul>

	<ul style="list-style-type: none"> <li>• Adhoc On-demand distance vector routing (AODV)</li> </ul>
16	<p><b>What are the types of communications in a network? BTL 1</b></p> <p>The types of communication are:</p> <ul style="list-style-type: none"> <li>• Unicast</li> <li>• Multicast</li> <li>• Broadcast</li> </ul>
17	<p><b>State the reason for topology changes. BTL 3</b></p> <ul style="list-style-type: none"> <li>• The failure of a mobile node due to battery exhaustion, normal failure, or failure due to adverse environmental condition.</li> <li>• Link disconnections may occur due to noise and changes in signal propagation conditions</li> </ul>
18	<p><b>Define DSR routing. BTL 1</b></p> <ul style="list-style-type: none"> <li>• The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes.</li> <li>• DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration.</li> <li>• It is a reactive protocol and all aspects of the protocol operate entirely on-demand basis.</li> <li>• It works on the concept of source routing.</li> </ul>
19	<p><b>Define ODMR. BTL 1</b></p> <p>On-Demand Multicast routing protocol is a mesh architecture protocol, i.e., it has multiple paths from the sender to the receivers and uses a forwarding group concept.</p> <p>It applies on-demand procedures to dynamically build route and maintain multicast group membership. By maintaining a mesh instead of a tree, the drawbacks of multicast trees in ad hoc networks like frequent tree reconfiguration and non-shortest path in a shared tree are avoided</p>
20	<p><b>What are the passive and active attacks in MANET? BTL 1</b></p> <p><b>Passive:</b> Snooping, eavesdropping, Traffic analysis, Monitoring</p> <p><b>Active:</b> Wormhole, black hole, resource consumption, routing attacks</p>
21	<p><b>Define the term ‘CGSR’. BTL 4</b></p> <p>Cluster-Head Gateway Switch Routing Protocol The Cluster-Head Gateway Switch Routing (CGSR) protocol is a table-driven routing protocol. In a clustering system, each predefined number of nodes are formed into a cluster controlled by a cluster head, which is assigned using a distributed clustering algorithm</p>
22	<p><b>What is the concept of RTT. BTL 3 (NOV/DEC 2016)</b></p> <p>RTT refers to technology that allows a user to receive data during the actual time that a physical process occurs, known as real time. Real time is measured in milliseconds or microseconds.</p>

23	<b>Distinguish proactive and reactive protocols.</b> BTL 2 (APR/MAY 2017) Reactive and Proactive Protocols are the routing protocols that are used in mobile Ad hoc networks to send data from the host to the destination. A packet data is sent from source to destination in an Ad hoc network through multiple nodes that are mobile.
24	<b>What is multicast routing protocol?</b> BTL 1  A multicast routing protocol is one type of service provider that functions as a client within the framework of the router architecture. A multicast routing protocol manages group membership and controls the path that multicast data takes over the network. Examples of multicast routing protocols include: Protocol Independent Multicast (PIM), Multicast Open Shortest Path First (MOSPF), and Distance Vector Multicast Routing Protocol (DVMRP).
25	<b>List the disadvantage of DSDV.</b> BTL 2 A limitation of DSDV is that it provides only one route for a source/destination pair.
<b>PART * B</b>	
<b>Q.No</b>	<b>Questions</b>
1	<p><b>(i)List the characteristics of Mobile Ad hoc Networks (MANETs) (8M)</b> BTL 2  <b>Answer: Page:130-133 - Prasant Kumar Pattnaik</b></p> <p><b>Explanation(8M)</b></p> <ul style="list-style-type: none"> <li>• Lack of fixed infrastructure</li> <li>• Dynamic Topologies</li> <li>• Bandwidth constrained, variable capacity links</li> <li>• Energy constrained Operation</li> <li>• Increased Vulnerability</li> </ul> <p><b>(ii)explain the design issues of MANET. (5M)</b> BTL 2</p> <p><b>Explanation(5M)</b></p> <ul style="list-style-type: none"> <li>• Network Size and node density</li> <li>• Connectivity</li> <li>• Network topology</li> <li>• User traffic</li> <li>• Operational environment</li> <li>• Energy Constraints</li> </ul>
2	<b>What is VANET? Explain its usage with a neat diagram</b> (13M) (APR/MAY 2017) BTL 2

	<p><b>Answer: Page: 152-153 - Prasant Kumar Patnaik</b></p> <p><b>Explanation(8M)</b></p> <ul style="list-style-type: none"> <li>• Vehicular ad hoc networks (VANET) - special type of MANET - moving automobiles form nodes of the network.</li> <li>• Introduced for vehicles of police - fire brigades and ambulances - safe travelling on road.</li> </ul> <p><b>Diagram(2M)</b></p> <p><b>Uses of VANET (3M)</b></p> <p>A VANET can help disseminate geographical information to driver as he continues to drive. <b>For example</b>, the driver would be notified of the nearby food malls or petrol refilling stations, map display.</p>
3	<p><b>Describe in detail about routing protocols for traditional networks. (13M) (NOV/DEC 2016) BTL 2</b></p> <p><b>Answer: Page:143-145 - Prasant Kumar Patnaik</b></p> <p><b>Explanation(10M)</b></p> <p><b>Link State Protocols (LSP)</b></p> <p>Link denotes the connection of one router to its neighboring router. A neighbor of a router is one with which it can directly communicate without taking a help from any of the intervening routers.</p> <p><b>Characteristics</b></p> <p><b>Router connection to other routers by network interfaces</b></p> <ul style="list-style-type: none"> <li>• The identity of the router originating the message.</li> <li>• The identities of all its neighbors</li> </ul>

	<ul style="list-style-type: none"> <li>The delay along various links to its neighbors.</li> <li>A unique sequence number, which is formed by increasing the count every time the router forms a new link state advertisement</li> </ul>  <p><b>Diagram(3M)</b></p>
4	<p><b>Describe in detail about Manet routing protocols.</b> (MAY/JUNE 2016) (13M) BTL 2 <b>Answer:</b> Page: 146-150 - Prasant Kumar Pattnaik</p> <p><b>Explanation(12M)</b></p> <p><b>Destination Sequenced Distance vector routing protocol (4M)</b></p> <ul style="list-style-type: none"> <li>Table –driven approach to packet routing - extends bellman- ford routing algorithm- improvement made here is avoidance of routing loops through - use of a number sequencing scheme.</li> </ul> <p><b>Steps in operation of DSDV (4M)</b></p> <ol style="list-style-type: none"> <li>Each router (node) in the network collects route information..</li> <li>After gathering information - node determines shortest path to destinations based on - gathered information.</li> <li>Based on gathered information - a new routing table is generated.</li> <li>Router broadcasts table to its neighbours- on receipt by neighbours - neighbors nodes recomputed - respective routing tables.</li> <li>Process continues - routing information becomes stable.</li> </ol> <p><b>Dynamic Source routing protocol (DSR) (4M)</b></p> <ul style="list-style-type: none"> <li>Dynamic Source Routing protocol (DSR) - simple and efficient routing protocol designed specifically - use in multi-hop wireless ad hoc networks of mobile nodes.</li> <li>DSR allows network - completely self-organizing and self-configuring</li> </ul>

**Diagram(1M)**

**5** What is Routing? State the difference between wired and wireless routing. (13M)  
**(Nov/Dec 2015) BTL1**

**Answer: Page:138-139 - Prasant Kumar Pattnaik**

**Definition(2M)**

- **Routing** is the means of discovering paths in computer networks along which information (split up into packets) can be sent.
- Circuit-based networks, such as the voice telephone network, also perform routing, to find paths for telephone calls through the network fabric.

**Explanation(6M)**

- Routing - directed by **routing tables**, which maintain a record - best routes to various network locations - keep up with packet arrival rate.
- Small networks may involve hand configuration.

**Routing Metrics(3M)**

- Hop-Count- It is related to the total number of hops between two nodes.
- Queuing delay- This corresponds to the load of the link ie. the traffic going on in the line.

**For wireless networks the metrics are**

- Hop-Count
- RTT(Round Trip Time)
- Packet Pair
- ETx (Expected Transmission Count)

**Hop-Count:****Advantages (2M)**

- Easy to evaluate
- Simple
- Little Overhead

**Shortcomings**

	<p>It does not consider</p> <ul style="list-style-type: none"> <li>• Transmit rate</li> <li>• Load</li> <li>• Interference</li> </ul> <p>Packet Loss Rate</p>
6	<p><b>What are reactive and proactive protocols? Specify its advantages and disadvantages. (13M)</b>  <b>(NOV/DEC 2016) BTL 1</b></p> <p><b>Answer: Page: 139-141- Prasant Kumar Patnaik</b></p> <p><b>Explanation(8M)</b></p> <p><b>Proactive (Table-driven) protocols:</b></p> <p><b>Table-driven</b> routing protocol - each node in routing table maintains information about routes - every other node in network.</p> <p>Tables are periodically updated in face of random network topology changes.</p> <p><b>Example</b> of Proactive - destination Sequenced Distance Vector (DSDV)</p> <p>Example of on-demand routing protocols are:</p> <ul style="list-style-type: none"> <li>• Dynamic source routing(DSR)</li> <li>• Adhoc on- demand distance vector routing (AODV)</li> </ul> <p><b>Diagram(5M)</b></p>
	<b>PART*C</b>
1	<p>i) Discuss the characteristics of MANET. (8M) (MAY/JUNE 2016) BTL 3  (ii) Summarize the applications of MANET. (7M) BTL 2</p> <p><b>Answer: Page: 151-153 - Prasant Kumar Patnaik</b></p> <p><b>Characteristics: (8M)</b></p> <ul style="list-style-type: none"> <li>• Lack of fixed infrastructure</li> <li>• Dynamic Topologies</li> <li>• Bandwidth constrained, variable capacity links</li> <li>• Energy constrained Operation</li> <li>• Increased Vulnerability</li> </ul> <p><b>Application: (7M)</b></p> <ul style="list-style-type: none"> <li>• Tree – based protocol (4M)</li> <li>• Mesh based Protocol: (3M)</li> </ul> <p>Example of this category protocol: On-demand Multicast routing protocol(ODMRP)</p>
2	<p><b>Explain the major types of security attacks in a mobile ad hoc network. (15M)</b></p> <p><b>Answer: Page: 129-131- Prasant Kumar Patnaik</b></p>

	<p><b>Explanation (15M)</b></p> <ul style="list-style-type: none"> <li>• DATA traffic attacks</li> <li>• CONTROL traffic attacks</li> <li>• Black-Hole</li> <li>• Cooperative Black-Hole</li> <li>• Gray-Hole</li> <li>• Worm-Hole</li> <li>• HELLO Flood</li> <li>• Bogus Registration</li> <li>• Jellyfish</li> <li>• Man in Middle</li> <li>• Rushing</li> <li>• Cache Poisoning</li> <li>• Blackmail</li> <li>• Cooperative Blackmail</li> <li>• Sybil</li> </ul>
3	<p><b>Explain Distance Vector (DV) protocols in detail with a neat diagram (15M) BTL 3</b></p> <p><b>Answer: Page: 141-143 - Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b></p> <p>Routers using distance vector protocol do not have knowledge of the entire path that a packet would take to reach its destination</p> <ul style="list-style-type: none"> <li>• Direction in which a packet should be forwarded.</li> <li>• Its own distance from the destination.</li> </ul> <p><b>Explanation(8M)</b></p> <p>The Two popular distance vector protocols are:</p> <p>(a) <b>RIP (Routing Information protocol)-</b> It uses hop count of the destination..It supports cross platform distance vector routing</p> <p>(b) <b>IGRP (Interior gateway Routing protocol)-</b> It takes into an account the other</p>

	<p>information such as node delay and available bandwidth. It supports Cisco Systems proprietary distance vector.</p> <p>(c) <b>Ciscos Enhanced IGRP (EIGRP)</b>, it doesn't require transmitting updates periodically. Further, the updates are not broadcast and do not contain the full route table.</p> <p><b>Diagram (5M)</b></p>
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**Subject Code: IT8602**  
**Subject Name: Mobile Computing**

**Year / Sem : III / 6**  
**Subject Handler: Mr.S.Neelakandan**

### **UNIT IV MOBILE NETWORK LAYER**

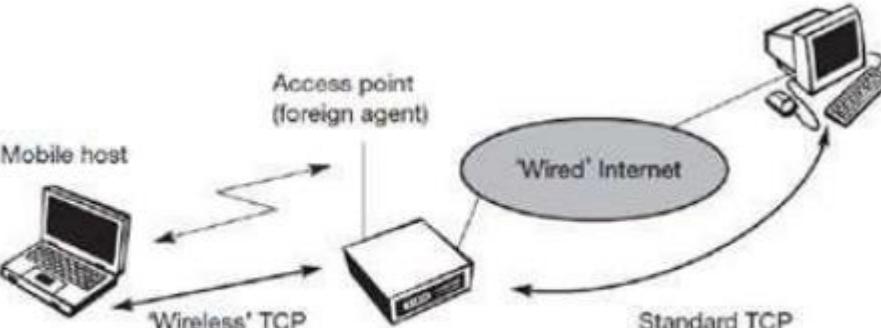
Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing- Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security

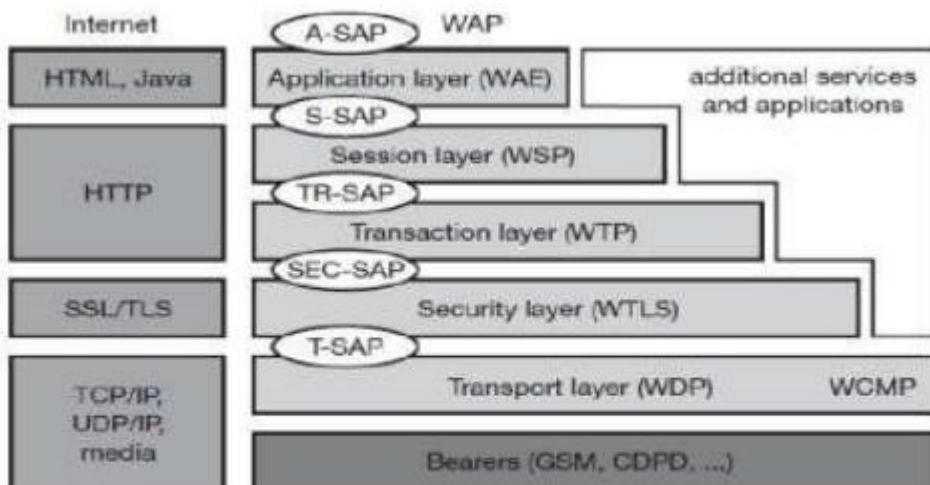
#### **PART \* A**

<b>1</b>	<b>Define Mobile TCP.</b>	BTL 1
	M-TCP (mobile TCP) approach has the same goals as I-TCP and snooping TCP: to prevent the sender window from shrinking if bit errors or disconnection but not congestion cause current problems.	
<b>2</b>	<b>List the advantages of Mobile TCP.</b>	BTL 1
	<ul style="list-style-type: none"> <li>➤ It maintains the TCP end-to-end semantics. The SH does not send any ACK itself but forwards the ACKs from the MH.</li> <li>➤ If the MH is disconnected, it avoids useless retransmissions, slow starts or breaking connections by simply shrinking the sender's window to 0. Since it does not buffer data in the SH as I-TCP does, it is not necessary to forward buffers to a new SH. Lost packets will be automatically retransmitted to the new SH.</li> </ul>	
<b>3</b>	<b>List the disadvantages of Mobile TCP.</b>	BTL 1
	<ul style="list-style-type: none"> <li>➤ As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption.</li> <li>➤ A modified TCP on the wireless link not only requires modifications to the MH protocol software but also new network elements like the bandwidth manager.</li> </ul>	
<b>4</b>	<b>Comment WAP transaction layer with its wireless transaction protocol.</b>	BTL 1
	The WAP transaction layer with its wireless transaction protocol (WTP) offers a lightweight transaction service at the transaction SAP (TR-SAP). This service efficiently provides reliable or unreliable requests and asynchronous transactions as explained in the above section. Tightly coupled to this layer is the next higher layer, if used for connection-oriented service	
<b>5</b>	<b>State Error code.</b>	BTL 1
	An error code (EC) is returned indicating the reason for the error to the higher layer. WDP is not allowed to use this primitive to indicate problems with the bearer service.	
<b>6</b>	<b>What is WTLS?</b>	BTL 1
	WTLS can provide different levels of security (for privacy, data integrity, and authentication) and has been optimized for low bandwidth, high-delay bearer networks.	
<b>7</b>	<b>How WTP achieves reliability?</b>	BTL 1
	WTP achieves reliability using duplicate removal, retransmission, acknowledgements and unique transaction identifiers. No WTP-class requires any connection set-up or tear-down phase. This avoids unnecessary overhead on the communication link.	
<b>8</b>	<b>What are the features of WTP?</b>	BTL 1

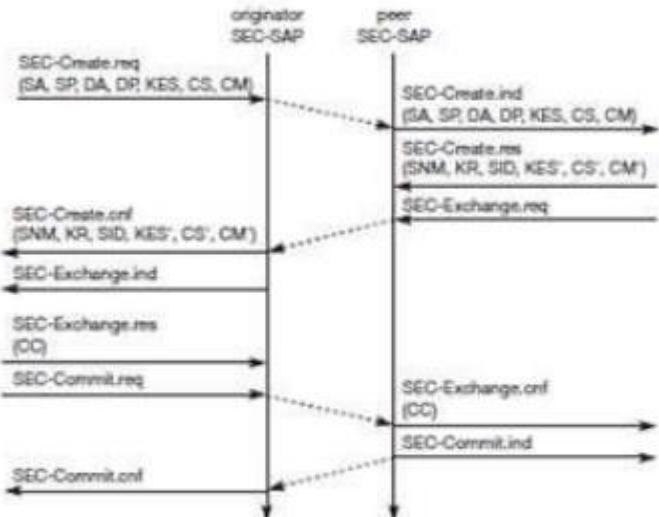
	A special feature of WTP is its ability to provide a user acknowledgement or, alternatively, an automatic acknowledgement by the WTP entity. If user acknowledgement is required, a WTP user has to confirm every message received by a WTP entity.
9	<b>State general features needed for content exchange between cooperating clients and servers.</b> BTL 1 <ul style="list-style-type: none"> <li>➤ Session management</li> <li>➤ Capability negotiation</li> <li>➤ Content encoding</li> </ul>
10	<b>What are the ideas of Wireless Application Environment?</b> BTL 1 <p>The main idea behind the wireless application environment (WAE) is to create a general-purpose application environment based mainly on existing technologies and philosophies of the world wide web. This environment should allow service providers, software manufacturers, or hardware vendors to integrate their applications so they can reach a wide variety of different wireless platforms in an efficient way.</p>
11	<b>Define WTA.</b> BTL 1 <p>WTA is a collection of telephony specific extensions for call and feature control mechanisms, merging data networks and voice networks.</p>
12	<b>List the basic features of WML.</b> BTL 2 <ul style="list-style-type: none"> <li>➤ Text and images</li> <li>➤ User interaction</li> <li>➤ Navigation</li> <li>➤ Context management</li> </ul>
13	<b>What is WAE?</b> BTL 1 <p>Wireless Application Environment, or WAE, provides an architecture for communication between wireless devices and Web servers. ... That Web server responds with an HTML page, which is also sent via HTTP. Because all browsers speak HTTP and both client and server speak the same protocol, they can communicate directly.</p>
14	<b>What are the capabilities not supported by WML?</b> BTL 1 <ul style="list-style-type: none"> <li>➤ WMLScript offers several capabilities not supported by WML:</li> <li>➤ Validity check of user input</li> <li>➤ Access to device facilities</li> <li>➤ Local user interaction</li> <li>➤ Extensions to the device software</li> </ul>
15	<b>What are the six libraries in WML Script?</b> BTL 1 <ul style="list-style-type: none"> <li>➤ Lang</li> <li>➤ Float</li> </ul>

	<ul style="list-style-type: none"> <li>➤ String</li> <li>➤ URL</li> </ul>
16	<p><b>What are the wide range of wireless devices?</b> BTL 1</p> <p>The forum is embracing and extending existing standards and technologies of the internet wherever possible and is creating a framework for the development of contents and applications that scale across a very wide range of wireless bearer networks and wireless device types.</p> <ul style="list-style-type: none"> <li>➤ Interoperable</li> <li>➤ Scalable</li> <li>➤ Efficient</li> </ul>
17	<p><b>State WML Script.</b> BTL 2</p> <p>WMLScript complements to WML and provides a general scripting capability in the WAP architecture (WAP Forum, 2000h). While all WML content is static (after loading on the client)</p>
18	<p><b>What is Validity Check?</b> BTL 1</p> <p>Validity check of user input, before user input is sent to a server, WMLScript can check the validity and save bandwidth and latency in case of an error. Otherwise, the server has to perform all the checks, which always includes at least one round-trip if problems occur.</p>
19	<p><b>List DHCP Features.</b> BTL 2</p> <ul style="list-style-type: none"> <li>➤ DHCP supporting the acquisition of care-of-address for mobile nodes</li> <li>➤ A DHCP server should located in the subnet of the access point of the mobile note.</li> <li>➤ DHCP relay should provide forwarding of the Messages.</li> <li>➤ RFC 3118 specifies authentication for DHCP messages which id needed to protect mobile nodes from malicious DHCP servers.</li> </ul>
20	<p><b>What is Mobile Adhoc Routing?</b> BTL 1</p> <ul style="list-style-type: none"> <li>➤ In wireless networks using an infrastructure cells have been defines. within a cell the base station can reach all mobile nodes.</li> <li>➤ In -hoc networks each node must be able to forward data for other nodes. At a certain time t1 the network topology consists of five nodes N1 to N5.</li> <li>➤ Nodes are connected depending upon the current transmission characteristics between them. In this network N4 can receive N1 over a good link.</li> </ul>
21	<p><b>Define Multicast Routing.</b> BTL 1</p> <p>Multicast IP Routing protocols are used to distribute data (for example, audio/video streaming broadcasts) to multiple recipients. Using multicast, a source can send a single copy of data to a single multicast address, which is then distributed to an entire group of recipients.</p>
22	<p><b>What is Multicast Group Membership Discovery?</b> BTL 1</p> <p>A protocol is used by receiving hosts to advertise their group membership to a local multicast router, enabling them to join and leave multicast groups. The main Multicast Group Membership Discovery protocols are Internet Group Management Protocol (IGMP) for IPv4</p>

	and Multicast Listener Discovery (MLD) for IPv6.
23	<b>State Slow Start.</b> BTL 2 TCP's reaction to a missing acknowledgement is quite drastic but it is necessary to get rid of congestion quickly. The behavior shown after the detection of congestion is called Slow start. The sender always calculates a Congestion window for a receiver.
24	<b>Comment Round Trip Time (RIT).</b> BTL 2 This scheme doubles the congestion window every time the acknowledgements come back which takes one Round Trip Time (RIT). This is called the exponential growth of the congestion window in the slow start mechanism.
25	<b>What is Congestion Threshold?</b> BTL 1 It is too dangerous to double the congestion window each time because the steps might become too large. The exponential growth stops at the Congestion Threshold. The congestion window reaches the congestion threshold further increase of the transmission rate is only linear by adding 1 to the congestion window each time the acknowledgements come back.
<b>PART * B</b>	
1	<b>What is Mobile TCP? Explain in detail about Mobile TCP. Mention its advantages. (13M)</b> BTL 3 <b>Answer: Page:170-173 - Prasant Kumar Pattnaik</b>  The M-TCP (mobile TCP) approach - same goals as I-TCP and snooping TCP: to prevent the sender window from shrinking - if bit errors or disconnection but not congestion cause current problems. M-TCP - improve overall throughput, to lower the delay, to maintain end-to-end semantics of TCP - provide a more efficient handover.   <b>Fig 4.1 Indirect TCP segments a TCP Connection into two parts</b>
	<b>Advantages:</b> 1. As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender. M-TCP assumes low bit error rates, which is not always a valid assumption.

	<p>2. A modified TCP on the wireless link not only requires modifications to the MH protocol software but also new network elements like the bandwidth manager.</p>
2	<p><b>Explain in detail about WAP Architecture with a neat sketch. (13M) BTL 3</b>  <b>Answer: Page:129-131 - Prasant Kumar Pattnaik</b></p> <p>WAP does not specify bearer services, but uses existing data services and will integrate further services. Examples are message services, such as short message service (SMS) of GSM, circuit-switched data, such as high-speed circuit switched data (HSCSD) in GSM, or packet switched data, such as general packet radio service (GPRS) in GSM.</p> <p>Many other bearers are supported, such as CDPD, IS-136, PHS. No special interface has been specified between the bearer service and the next higher layer, the transport layer with its wireless datagram protocol (WDP) and the additional wireless control message protocol (WCMP), because the adaptation of these protocols are bearer-specific.</p>  <pre> graph TD     subgraph Internet [Internet]         direction TB         I1[HTML, Java]         I2[HTTP]         I3[SSL/TLS]         I4[TCP/IP, UDP/IP, media]     end      subgraph WAP [WAP]         direction TB         A[A-SAP] --- AL[Application layer (WAF)]         AL --- S[S-SAP] --- SL[Session layer (WSP)]         SL --- TR[TR-SAP] --- TL[Transaction layer (WTP)]         TL --- SEC[SEC-SAP] --- SL[Security layer (WTLS)]         SL --- T[T-SAP] --- WC[Transport layer (WDP)]         WC --- WCMP[WCMP]         WC --- BE[Bearers (GSM, CDPD, ...)]     end </pre> <p><b>Fig 4.1 Components and Interface of WAP Architecture</b></p>

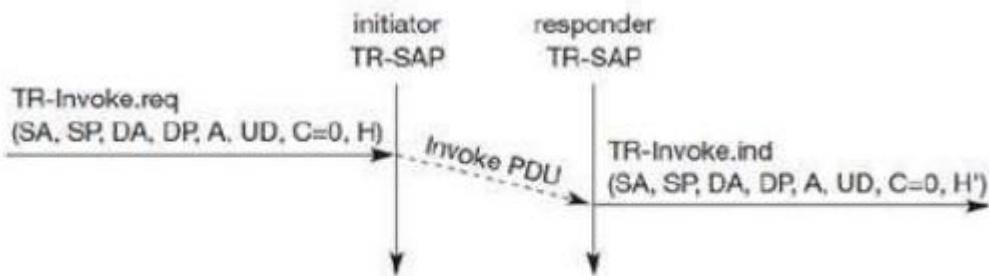
3	<p><b>Outline Wireless Datagram Protocol with a neat diagram. (13M) BTL 3</b></p> <p><b>Answer: Page:111-115 - Prasant Kumar Pattnaik</b></p> <p>The Wireless Datagram Protocol (WDP) operates on top of many different bearer services capable of carrying data. At the T-SAP WDP offers a consistent datagram transport service independent of the underlying bearer.</p> <p>To offer this consistent service, the adaptation needed in the transport layer can differ depending on the services of the bearer. The closer the bearer service is to IP, the smaller the adaptation can be. If the bearer already offers IP services, UDP is used as WDP. WDP offers more or less the same services as UDP.</p> <p>WDP offers source and destination port numbers used for multiplexing and demultiplexing of data respectively. The service primitive to send a datagram is TDUnitdata.req with the destination address (DA), destination port (DP), Source address (SA), source port (SP), and user data (UD) as mandatory parameters</p> <pre> sequenceDiagram     participant A as T-SAP     participant B as T-SAP     A-&gt;&gt;B: T-DUnitdata.req (DA, DP, SA, SP, UD)     A-&gt;&gt;B: T-DUnitdata.req (DA, DP, SA, SP, UD)     A-&gt;&gt;B: T-DUnitdata.req (DA, DP, SA, SP, UD)     B--&gt;A: T-DUnitdata.ind (SA, SP, UD)   </pre> <p><b>Fig 4.3 WAP Service Primitives</b></p>
4	<p><b>What is WLTS ? . Brief in detail about WLTS with a outline sketch. (13M) BTL 3</b></p> <p><b>Answer: Page:177-180 - Prasant Kumar Pattnaik</b></p> <p>If requested by an application, a security service, the wireless transport layer security (WTLS), can be integrated into the WAP architecture on top of WDP as specified in (WAP Forum, 2000c).</p> <p>WTLS can provide different levels of security (for privacy, data integrity, and authentication) and has been optimized for low bandwidth, high-delay bearer networks.</p>

**Fig 4.4 WTLS establishing a Secure Session**

- 5** **Describe in detail about Wireless Transaction Protocol. Give a neat sketch. (13M) BTL 3**  
**Answer: Page:189-193 - Prasant Kumar Pattnaik**

WTP has been designed to run on very thin clients, such as mobile phones.

WTP offers several advantages to higher layers, including an improved reliability over datagram services, improved efficiency over connection-oriented services, and support for transaction-oriented services such as web browsing.

**Fig 4.6 Basic Transaction , WTP Class 0**

WTP class 1 Class 1 offers a reliable transaction service but without a result message. Again, the initiator sends an invoke PDU after a TR-Invoke.req from a higher layer.

- 6** **List the features of Wireless Session Protocol. Explain in detail. (13M) BTL 3**  
**Answer: Page:182-183 - Prasant Kumar Pattnaik**

#### **Session management:**

WSP introduces sessions that can be established from a client to a server and may be long lived. Sessions can also be released in an orderly manner.

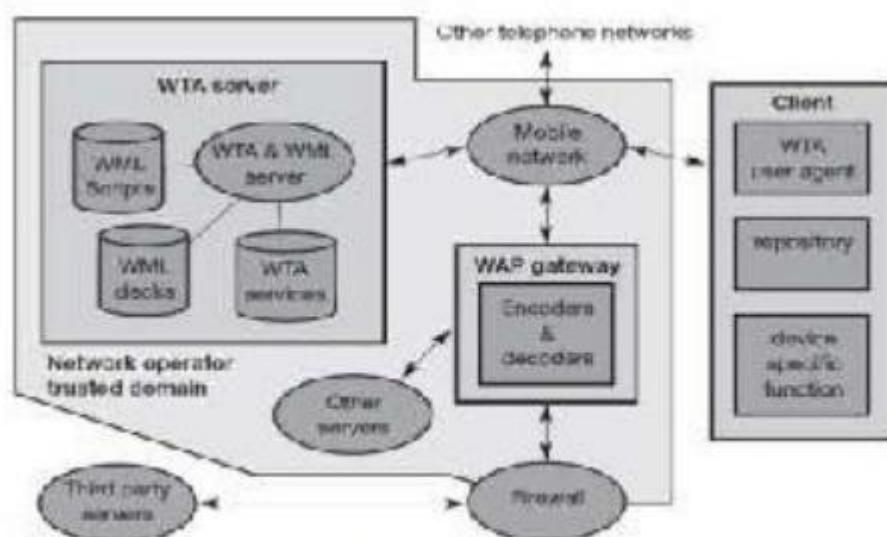
#### **Capability negotiation:**

	<p>Clients and servers can agree upon a common level of protocol functionality during session establishment.</p> <p><b>Content encoding:</b> WSP also defines the efficient binary encoding for the content it transfers. WSP offers content typing and composite objects, as explained for web browsing.</p> <p><b>HTTP/1.1 functionality:</b> WSP/B supports the functions HTTP/1.1 offers, such as extensible request/reply methods, composite objects, and content type negotiation.</p> <p><b>Exchange of session headers:</b> Client and server can exchange request/reply headers that remain constant over the lifetime of the session.</p> <p><b>Push and pull data transfer:</b> Pulling data from a server is the traditional mechanism of the web. This is also supported by WSP/B using the request/response mechanism from HTTP/1.1.</p> <p><b>Asynchronous requests:</b> Optionally, WSP/B supports a client that can send multiple requests to a server simultaneously.</p>
	<b>PART-C</b>
1	<p><b>Describe the main idea behind the Wireless Application Environment(WAE). (13M) BTL 3</b></p> <p><b>Answer: Page:212-215 - Prasant Kumar Pattnaik</b></p> <p>The main idea behind the wireless application environment (WAE) is to create a general-purpose application environment based mainly on existing technologies and philosophies of the world wide web.</p> <p>This environment should allow service providers, software manufacturers, or hardware vendors to integrate their applications so they can reach a wide variety of different wireless platforms in an efficient way.</p> <p>HTML, JavaScript, and the handheld device markup language HDML form the basis of the wireless markup language (WML) and the scripting language WML script.</p> <pre> graph LR     subgraph OS [Origin servers]         WS[Web server]         OCS[Other content servers]     end     G[Gateway]     C[Client]          WS -- Request --&gt; G     G -- "Flat response with content" --&gt; WS     G -- "Encoded response with content" --&gt; C     C -- "Encoded push content" --&gt; G     C -- "Encoded request" --&gt; G          subgraph C_content         WTA[WTA user agent]         WML[WML user agent]         OWU[Other WAE user agents]     end </pre> <p><b>Fig 4.10 WAE Logical Model</b></p> <p><b>2 Draw a neat sketch and explain the WTA Architecture. (13M) BTL 3</b></p> <p><b>Answer: Page:200-205 - Prasant Kumar Pattnaik</b></p> <p>The WTA framework integrates advanced telephony services using a consistent user interface</p>

(e.g., the WML browser) and allows network operators to increase accessibility for various special services in their network. A network operator can reach more end-devices using WTA because this is integrated in the wireless application environment (WAE) which handles device-specific characteristics and environments.

WTA extends the basic WAE application model in several ways:

- Content push
- Access to telephony functions
- Repository for event handlers
- Security model



**Fig 4.11 WTA Architecture**

3

**Outline the Wireless Markup Languages with sample code. (13M) BTL 3**  
**Answer: Page:232-233 - Prasant Kumar Pattnaik**

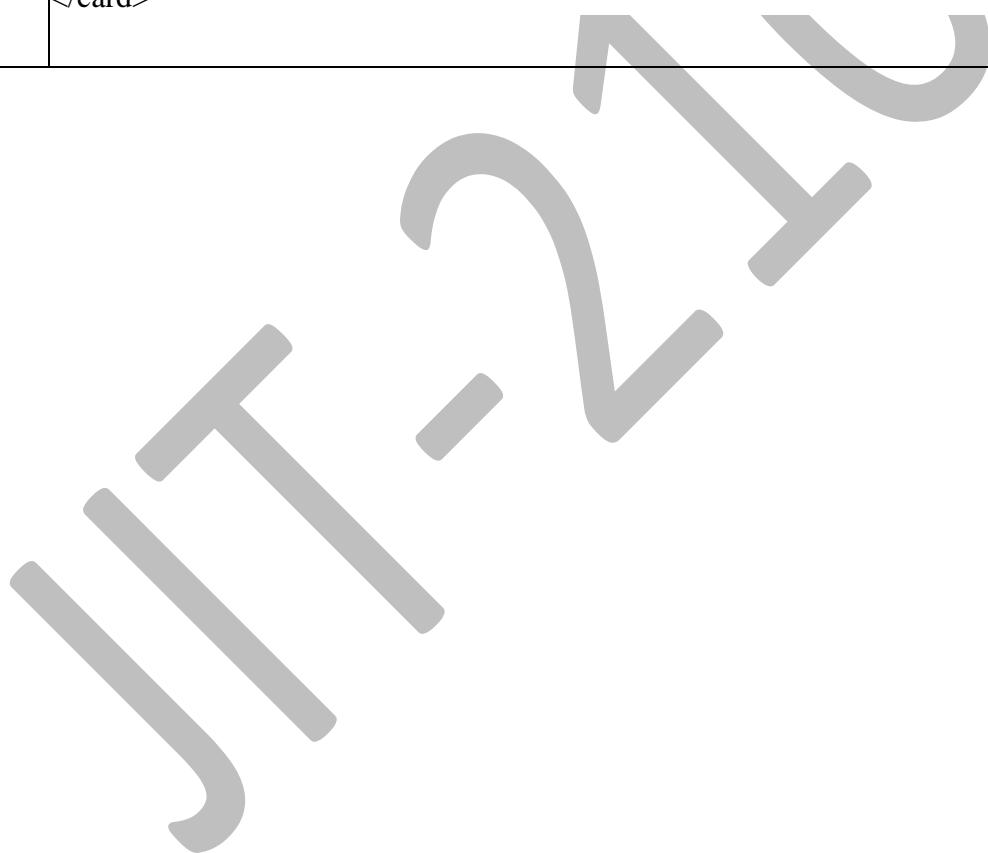
The wireless link will always have only a very limited capacity compared to a wire. Current handheld devices have small displays, limited user input facilities, limited memory, and only low performance computational resources. While the bandwidth argument will remain for many years, it currently seems that the gap between mobile and fixed devices regarding processing power is getting narrower.

<?xml version="1.0"?>

```

<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
  
```

	<pre>&lt;wml&gt;  &lt;card id="card_one" title="Simple example"&gt;&lt;do type="accept"&gt;  &lt;go href="#card_two"/&gt; &lt;/do&gt;  &lt;p&gt;  This is a simple first card! &lt;br/&gt; On the next one you can choose ...  &lt;/p&gt; &lt;/card&gt;</pre>
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**Subject Code: IT8602**  
**Subject Name: Mobile Computing**

**Year / Sem : III / 6**  
**Subject Handler: Mr.S.Neelakandan**

<b>UNIT V MOBILE TRANSPORT AND APPLICATION LAYER</b> Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.	
<b>PART * A</b>	
<b>1</b>	<b>What are the two main responsibilities of OS in a mobile handset? BTL 1</b> Managing Resources Providing different interfaces.
<b>2</b>	<b>What is the advantage of using Microkernel design approach? BTL 1</b> It minimizes the size of the kernel code. It is easier to port, extend, and maintain operating system code.
<b>3</b>	<b>List the Special constraints of mobile OS. (MAY/JUNE 2016) BTL 2</b> <ul style="list-style-type: none"> <li>• Limited memory</li> <li>• Limited Screen Size</li> <li>• Miniature keyboard</li> <li>• Limited processing power</li> </ul>
<b>4</b>	<b>List the Special service requirements of mobile OS. BTL 2</b> <ul style="list-style-type: none"> <li>• Support for specific communication protocols</li> <li>• Support for variety of input mechanisms</li> <li>• Support for IDE</li> <li>• Extensive library support</li> </ul>
<b>5</b>	<b>What is the advantage of E-commerce? BTL 1</b> <ul style="list-style-type: none"> <li>• The benefits of using M-Commerce include customer convenience, cost savings and new business opportunities.</li> <li>• From the customer's perspective, M-Commerce provides the flexibility of anytime, anywhere shopping using just a light weighted device.</li> </ul>
<b>6</b>	<b>What is the Disadvantage of E-commerce? BTL 1</b> <ul style="list-style-type: none"> <li>• Mobile devices do not generally offer graphics or processing power of PC. The users is therefore constrained to use small screen and keyboard and low resolution pictures and videos. It may be difficult to perceive the look and feel of many products from online pictures and videos.</li> <li>• The small screens of mobile devices limit the complexity of applications. For</li> </ul>

	<p>example, the menu choice, and txt typing capability are severely constrained.</p> <ul style="list-style-type: none"> <li>• No Security.</li> </ul>
7	<p><b>Define mobile payment system.</b> BTL 1 A mobile payment may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service.”</p>
8	<p><b>What are the features of SDK?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• They can run the application on the actual android device or a software emulator on the host machine.</li> <li>• This is achieved by using the android Debug Bridge (ADB) available with SDK</li> </ul>
9	<p><b>List out Android application components.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• Activity</li> <li>• Content Providers</li> <li>• Service</li> <li>• Broadcast receivers.</li> </ul>
10	<p><b>What is the advantage of Android?</b> BTL 1</p> <ul style="list-style-type: none"> <li>• It is an Open platform and can be ported on all cell phone.</li> <li>• The android SDK to develop applications is possible on every operating system.</li> <li>• They support robust libraries for media access, communication and data transfer.</li> </ul>
11	<p><b>What is radio frequency identification?</b> BTL 1 RFID tag can be attached to a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from distance that may be several meters away from the reader and beyond the sight of the reader.</p>
12	<p><b>List the operating system that is available for sensor nodes.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• Tiny OS</li> <li>• Contiki</li> <li>• Lite OS</li> <li>• Mantis</li> </ul>
13	<p><b>Give some applications of M-commerce.</b> BTL 2</p> <ul style="list-style-type: none"> <li>• Advertising</li> </ul>

	<ul style="list-style-type: none"> <li>• Mobile ticketing</li> <li>• Loyalty and payment services</li> <li>• Interactive advertisements.</li> </ul>				
14	<b>What are the two popular types of M-payment schemes? BTL 1</b> <ul style="list-style-type: none"> <li>• Bank account Based</li> <li>• Credit card based</li> <li>• Micro Payment</li> </ul>				
15	<b>What are the features required by a mobile device to enable mobile e commerce? BTL 1</b> <ul style="list-style-type: none"> <li>• Good Internet Connectivity</li> <li>• Ability to display rich content such as images</li> <li>• Ability to scan bar codes</li> <li>• Ability to read RFID tags</li> </ul>				
16	<b>Define POS. (NOV/DEC 2016) BTL 1</b> A point of sale (POS) is the place where sales are made. On a macro level, a POS may be a mall, a market or a city. On a micro level, retailers consider a POS to be the area where a customer completes a transaction, such as a checkout counter. It is also known as a point of purchase.				
17	<b>Differentiate E- Commerce and M-Commerce. (NOV/DEC 2016) BTL 2</b> <table border="1"> <tr> <td>E-Commerce 1. Any kind of commercial transaction that is concluded, over the internet using electronic system is known as e-commerce.</td><td>M-Commerce M-commerce refers to the commercial activities which are transacted with the help of wireless computing devices such as cell phone or laptops.</td></tr> <tr> <td>2. Use of internet is compulsory</td><td>2. Use of internet is not mandatory</td></tr> </table>	E-Commerce 1. Any kind of commercial transaction that is concluded, over the internet using electronic system is known as e-commerce.	M-Commerce M-commerce refers to the commercial activities which are transacted with the help of wireless computing devices such as cell phone or laptops.	2. Use of internet is compulsory	2. Use of internet is not mandatory
E-Commerce 1. Any kind of commercial transaction that is concluded, over the internet using electronic system is known as e-commerce.	M-Commerce M-commerce refers to the commercial activities which are transacted with the help of wireless computing devices such as cell phone or laptops.				
2. Use of internet is compulsory	2. Use of internet is not mandatory				
18	<b>What is Mobile Wallet? BTL 1</b> A user may have a number of ATM card or credit card. The mobile wallet helps to keep these under the umbrella of a single wallet and can make payments whenever necessary. A few example of mobile wallet are paypal, google wallet, Paytm,etc.				
19	<b>What is mChek? BTL 1</b> It is a new payment system that links a debit or credit card, or a bank account, to a mobile phone, allowing one to make payments from the mobile phone.				
20	<b>List the disadvantage of M-Commerce? (APR/MAY 2017) BTL 2</b>				

	Mobile device do not generally offer graphics or processing power of a PC. The small screens of mobile devices limit the complexity of applications. Security.
21	<b>What is microkernel operating system? BTL 1</b> A microkernel is a piece of software or even code that contains the near-minimum amount of functions and features required to implement an operating system.
22	<b>Analyze the features of windows iPhone. BTL 3</b> <ul style="list-style-type: none"> <li>• Supports iOS 2, iOS 3, iOS 4 and iOS 5 devices</li> <li>• Multi-platform (Java based) product, supported on Linux, Windows and Mac</li> <li>• Fast, powerful search across device including regular expressions</li> <li>• Integrated mapping supports visualisation of geo-tagged information, including google maps searches, photos, and cell-sites and wifi locations observed by the device (the infamous "locationd" data)</li> </ul>
23	<b>Describe UIQ interface. BTL 3</b> An interface is a set of commands or menus through which a user communicates with a program. A command-driven interface is one in which you enter commands. A menu-driven interface is one in which you select command choices from various menus displayed on the screen.
24	<b>What are the elements of Android software stack? (APR/MAY 2017) BTL 1</b> <ul style="list-style-type: none"> <li>• linux kernel</li> <li>• native libraries (middleware),</li> <li>• Android Runtime</li> <li>• Application Framework</li> <li>• Applications</li> </ul>
25	<b>State the drawbacks of Symbian OS. BTL 2</b> The reason for problems could have been in the software architecture. The basic Symbian OS was pretty well optimized to run on even pretty low power CPUs (uses less processing power than Linux or iOS for the same tasks), but to accomplish this Symbian went its own way with just about everything.
<b>PART * B</b>	
1	i) <b>What are the advantages of M commerce?</b> (7M) BTL 2 <b>Answer: Page: 223-224 - Prasant Kumar Pattnaik</b>  <b>Advantages:</b> <ul style="list-style-type: none"> <li>• For business organization- benefits of using M-Commerce - include customer convenience - cost savings - new business opportunities.</li> <li>• customer's perspective - M-Commerce provides - flexibility of anytime, anywhere shopping - light weighted device- customer can save substantial time compared to</li> </ul>

	<p>visiting several stores - identifying - right product at the lowest price.</p> <ul style="list-style-type: none"> <li>Mobile devices - highly personalized - providing an additional level of convenience to customers. For example - a repeat order for some items - placed just at touch of a button. Application software downloaded for specific m-commerce vendor - store many customer specific information - help to effortlessly place orders.</li> </ul> <p><b>ii) What are the disadvantages of M commerce?</b> <span style="float: right;">(6M) BTL 2</span></p> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Mobile devices - generally offer graphics or processing power of a PC- users are constrained to use small screen - keyboard and low resolution pictures videos - difficult to perceive - look and feel of many products from online pictures and videos.</li> <li>Small screens of mobile devices limit - complexity of applications. For example- menu choice- text typing capability- severely constrained.</li> <li>Network impose several types of restrictions -for example, the available bandwidth is severely restricted - international calls - SMS be prohibitively expensive.</li> <li>disadvantage is security -unless a customer is extremely careful- may fall prey to various types of frauds - may get billed for items he did not purchase.</li> </ul>
2	<p><b>Explain in detail the structure of Mobile Commerce.</b> <span style="float: right;">(13M) BTL 2</span></p> <p><b>Answer: Page: 223-226 - Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b></p> <ul style="list-style-type: none"> <li>In mobile commerce, a content provider implements an application by providing two sets of programs: Client side and server-side.</li> <li>The client side programs run on the micro browsers installed on the users mobile devices.</li> <li>These server side programs, performing database access and computations, reside on the host computer (servers).</li> </ul> <p><b>Explanation(6M)</b></p> <ul style="list-style-type: none"> <li>Mobile Devices</li> <li>Network</li> <li>Host Computers</li> </ul> <p>Major components:</p>

	<ul style="list-style-type: none"> <li>• Web servers.</li> <li>• Database servers</li> <li>• Application Program</li> </ul> <p><b>Diagram(5M)</b></p>
3	<p><b>What are the special constraints of Mobile O/S? Illustrate with examples. (13 M) (NOV/DEC 2016) BTL 3</b></p> <p><b>Answer: Page:230-231 - Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b></p> <p>The operating system for a mobile device needs to function in the presence of many times of constraints which are not present in the traditional computer.</p> <p>As an example of such a constraint, consider the fact that a mobile device is powered by severely limited energy stored in a tiny battery.</p> <p><b>Explanation(6M)</b></p> <ul style="list-style-type: none"> <li>• Limited Memory</li> <li>• Limited Screen Size</li> <li>• Miniature Keyboard</li> <li>• Limited Processing Power</li> <li>• Limited Battery Power</li> <li>• Limited and fluctuating bandwidth of the wireless medium</li> <li>• Real Time data streaming</li> </ul> <p><b>Diagram(5M)</b></p>
4	<p><b>Describe in detail about Mobile payment systems. (13M) BTL 3</b></p> <p><b>Answer: Page: 231-232 - Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b></p> <p><b>Mobile Payment Systems</b></p> <p>“Mobile payments are a natural evolution of E-payment schemes. A mobile payment may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service.”</p> <p><b>Explanation(10M)</b></p> <p><b>Mobile Payment Schemes</b></p> <ul style="list-style-type: none"> <li>• Bank account based</li> <li>• Credit card based</li> </ul>

	<ul style="list-style-type: none"> <li>• Micropayment</li> </ul> <p><b>Desirable properties of a Mobile Payment System:</b></p> <ul style="list-style-type: none"> <li>• Easy to use:</li> <li>• The M-payment request must be easy for the customer to use</li> </ul> <p><b>Mobile Payment solution:</b></p> <ul style="list-style-type: none"> <li>• SMS based payment:</li> <li>• POS based payment</li> <li>• Bar code based payment</li> <li>• Mobile Wallet</li> </ul> <p><b>Process of Mobile Payment</b></p> <p><b>Diagram(1M)</b></p>
5	<p><b>Describe in detail about Commercial Mobile operating systems in detail. (13M) (APR/MAY 2017) BTL 3</b></p> <p><b>Answer: Page:232-233 - Prasant Kumar Pattnaik</b></p> <p><b>Explanation(8M)</b></p> <ul style="list-style-type: none"> <li>• The Graphic / Window / Event manager (GWE) component handles all input and output</li> <li>• Previous a virtual memory management</li> <li>• Supports security through provision of a cryptographic library.</li> <li>• Application development similar to that in Win32 environment. advantages since many programmers have knowledge of Win 32 based application development</li> </ul> <p><b>Android (5M)</b></p> <ul style="list-style-type: none"> <li>• Android software stack</li> <li>• Application layer</li> <li>• Application framework</li> <li>• Libraries and runtime</li> <li>• Kernel</li> </ul>
6	<p><b>Discuss the applications of M-Commerce with a neat sketch. (13M) (NOV/DEC 2016) BTL 3</b></p> <p><b>Answer: Page: 223-224- Prasant Kumar Pattnaik</b></p> <p><b>Explanation(8M)</b></p> <ul style="list-style-type: none"> <li>• Advertising</li> </ul>

	<ul style="list-style-type: none"> <li>• Comparison Shopping</li> <li>• Information about a product</li> <li>• Mobile ticketing</li> <li>• Catalogue Shopping</li> </ul> <p><b>Diagram(5M)</b></p>
	<p style="text-align: center;"><b>PART * C</b></p> <p><b>1</b> <b>What is RFID? Briefly explain the principle and its working. (15M) (MAY/JUNE 2016)</b> BTL 2 <b>Answer: Page:209-211 - Prasant Kumar Pattnaik</b></p> <p><b>Definition (2M)</b> Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. The tags contain electronically-stored information.</p> <p><b>Explanation(10M)</b></p> <pre> graph TD     Tag[RFID Tag] --&gt; Signals[ ]     Signals --&gt; Reader[RFID Reader]     Reader --&gt; Retrieval[Data Retrieval]     Retrieval --&gt; Computer[A computer picks up the data sent to it by the RFID reader.]     Computer --&gt; Uses[Uses]     </pre> <p>An RFID tag is an electronic device</p> <p>An RFID reader combines the functions of radio transmitter, receiver and data interface.</p> <p>A computer picks up the data sent to it by the RFID reader.</p> <p>Uses</p> <p>Many companies use RFID tags to track the flow of goods through warehousing, distribution and retail.</p> <p><b>Diagram(3M)</b></p>
<b>2</b>	<p><b>What do you understand by the mobile payment system? Briefly explain an application where mobile payment may be useful. (15M) (NOV/DEC 2016) BTL 2</b> <b>Answer: Page: 231-235- Prasant Kumar Pattnaik</b></p> <p><b>Definition(2M)</b> <b>Mobile Payment Systems:</b> “Mobile payments are a natural evolution of E-payment schemes. A mobile payment</p>

	<p>may be defined as any payment instrument where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return of goods and service.”</p> <p><b>Explanation(10M)</b></p> <p><b>Mobile Payment Schemes</b></p> <ul style="list-style-type: none"> <li>• Bank account based</li> <li>• Credit card based</li> <li>• Micropayment</li> </ul> <p><b>Desirable properties of a Mobile Payment System:</b></p> <ul style="list-style-type: none"> <li>• Easy to use:</li> <li>• The M-payment request must be easy for the customer to use</li> </ul> <p><b>Mobile Payment solution:</b></p> <p>SMS based payment:</p> <p>POS based payment</p> <p>Bar code based payment</p> <p>Mobile Wallet</p> <p><b>Process of Mobile Payment</b></p> <p><b>Diagram(3M)</b></p>
3	<p><b>Explain the different mobile payment schemes and security issues. (15M) (MAY/JUNE 2016) BTL 3</b></p> <p><b>Answer: Page:234-235 - Prasant Kumar Pattnaik</b></p> <p><b>Explanation(10M)</b></p> <p><b>Mobile Payment Schemes</b></p> <ul style="list-style-type: none"> <li>• Bank account based</li> <li>• Credit card based</li> <li>• Micropayment</li> </ul> <p>Step 1: Customer places order for goods with the trader.</p> <p>Step 2: The trader securely transfer the order to the selected payment service provider over the Internet.</p> <p>Step 3: The customer authenticates with the payment service provided.</p> <p>Step 4: The transaction detail appropriately and securely routes the transaction authorization request through its payment gateway to the selected customer's bank.</p> <p>Step 5: The merchant is informed of the payment status.</p> <p>Step 6: For Successful transaction, the customer's bank transfer the requested amount to the trader's bank account.</p> <p><b>Diagram(5M)</b></p>

<b>CS8091</b>	<b>BIG DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

**UNIT I INTRODUCTION TO BIGDATA** **9**

Evolution of Big data - Best Practices for Big data Analytics –Big data characteristics –Validating – The Promotion of the Value of Big Data –Big Data Use Cases-Characteristics of Big Data Applications – Perception and Quantification of Value –Understanding Big Data Storage – A General Overview of High- Performance Architecture –HDFS - MapReduce and YARN – Map Reduce Programming Model

**UNIT II CLUSTERING AND CLASSIFICATION** **9**

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.

**UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM** **9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity-

Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

**UNIT IV STREAM MEMORY** **9**

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: GraphAnalytics

**UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION** **9**

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding – Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

**TEXT BOOKS:**

1. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.

**REFERENCES:**

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers" CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

**TABLE OF CONTENT**

<b>CS8091      BIG DATA ANALYTICS</b>		
<b>Unit No</b>	<b>SYLLABUS</b>	<b>Page No.</b>
I	<b>INTRODUCTION TO BIGDATA</b>	4-14
II	<b>CLUSTERING AND CLASSIFICATION</b>	15-22
III	<b>ASSOCIATION AND RECOMMENDATION SYSTEM</b>	23-28
IV	<b>STREAMMEMORY</b>	29-32
V	<b>NO SQL DATA MANAGEMENT FOR BIG DATA ANDVISUALIZATION</b>	33-37

**Subject Code: CS8091**  
**Subject Name: Big Data Analytics**

**Year/Semester: III/06**  
**Subject Handler: Ms.S.Ancy**

### **UNIT I INTRODUCTION TO BIG DATA**

Evolution of Big data - Best Practices for Big data Analytics –Big data characteristics –Validating – The Promotion of the Value of Big Data –Big Data Use Cases-Characteristics of Big Data Applications – Perception and Quantification of Value –Understanding Big Data Storage – A General Overview of High-Performance Architecture –HDFS - MapReduce and YARN – Map Reduce Programming Model

#### **PART \* A**

<b>Q.No.</b>	<b>Questions</b>
1.	<p><b>What are the challenges of conventional system? BTL1</b>          There are existing algorithms, but they are heuristic and have not been implemented because the expected computational performance has not been met with conventional systems.</p>
2	<p><b>List the main characteristics of Big Data.BTL1</b></p> <ul style="list-style-type: none"> <li>✓ Volume</li> <li>✓ Variety</li> <li>✓ Velocity</li> <li>✓ Variability</li> </ul>
3	<p><b>Why you need to tame big data? BTL1</b></p> <ul style="list-style-type: none"> <li>✓ Increased data volumes being captured and stored</li> <li>✓ Rapid acceleration of data growth</li> <li>✓ Increased data volumes pushed into the network</li> <li>✓ Growing variation in types of data assets for analysis</li> <li>✓ Alternate and unsynchronized methods for facilitating data delivery</li> <li>✓ Rising demand for real-time integration of analytical results</li> </ul>
4	<p><b>Summarize the values of big data. BTL2</b></p> <ul style="list-style-type: none"> <li>✓ Optimized consumer spending as a result of improved targeted customer marketing;</li> <li>✓ Improvements to research and analytics within the manufacturing sectors to lead to new product development;</li> <li>✓ Improvements in strategizing and business planning leading to innovation and new start-up companies;</li> <li>✓ Predictive analytics for improving supply chain management to optimize stock management, replenishment, and forecasting;</li> <li>✓ Improving the scope and accuracy of fraud detection</li> </ul>
5	<p><b>What are the various characteristics of Big Data Applications? BTL2</b></p> <ul style="list-style-type: none"> <li>✓ Data throttling</li> <li>✓ Computation-restricted throttling:</li> <li>✓ Large data volumes</li> <li>✓ Significant data variety</li> <li>✓ Benefits from data parallelization</li> </ul>

6	<p><b>Discuss the types of data analytics.</b> BTL1</p> <ul style="list-style-type: none"> <li>✓ Structured data</li> <li>✓ Unstructured data</li> <li>✓ Semi structured data</li> </ul>
7	<p><b>What is the need of Map Reduce Model?</b> BTL1</p> <p>Map Reduce, can be used to develop applications to read, analyze, transform, and share massive amounts of data is not a database system but rather is a programming model introduced and described by Google researchers for parallel, distributed computation involving massive datasets (ranging from hundreds of terabytes to petabytes).</p>
8	<p><b>What is the limitations of MaPR?BTL2</b></p> <p>First, the programming paradigm is nicely suited to applications where there is locality between the processing and the data, but applications that demand data movement will rapidly become bogged down by network latency issues.</p> <p>Second, not all applications are easily mapped to the MapReduce model, yet applications developed using alternative programming methods would still need the MapReduce system for job management.</p> <p>Third, the allocation of processing nodes within the cluster is fixed through allocation of certain nodes as “map slots” versus “reduce slots.” When the computation is weighted toward one of the phases, the nodes assigned to the other phase are largely unused, resulting in processor under utilization.</p>
9	<p><b>Define HDFS.</b> BTL1</p> <p>HDFS attempts to enable the storage of large files, and does this by distributing the data among a pool of data nodes. A single Name Node runs in a cluster, associated with one or more data nodes, and provide the management of a typical hierarchical file organization and namespace. The name node effectively coordinates the interaction with the distributed data nodes. The creation of a file in HDFS appears to be a single file, even though it blocks “chunks” of the file into pieces that are stored on individual data nodes.</p>
10	<p><b>Describe how Map-reduce computation executes.</b> BTL2</p> <p>The MapReduce execution environment employs a master/slave execution model, in which one master node (called the JobTracker) manages a pool of slave computing resources (called TaskTrackers) that are called upon to do the actual work.</p>
11	<p><b>Illustrate Reduce Function.</b> BTL1</p> <p><b>Reduce</b>, in which the set of values associated with the intermediate key/value pairs output by the Map operation are combined to provide the results.</p> <ul style="list-style-type: none"> <li>• The total number of occurrences of each word in each document can be computed as the sum of the occurrences of each word in each paragraph. The total number of occurrences of each word in each paragraph can be computed as the sum of the occurrences of each word in each sentence.</li> </ul> <p>In this example, the determination of the right level of parallelism can be scaled in relation to the size of the “chunk” to be processed and the number of computing resources available in the pool. A single task might consist of counting the number of occurrences of each word in a single document, or a paragraph, or a sentence, depending on the level of granularity.</p> <p>Each time a processing node is assigned a set of tasks in processing different subsets of the data, it maintains interim results associated with each key. This will be done for all of the documents, and interim results for each word are created. Once all the interim results are completed, they can be redistributed so that all the interim results associated with a key can be assigned to a specific processing node that accumulates the results into a final result.</p>

12	<p><b>Classify the components of Hadoop Framework.</b> BTL1</p> <ul style="list-style-type: none"> <li>✓ Hadoop distributed file systems (HDFS) and MapReduce.</li> <li>✓ A new generation framework for job scheduling and cluster management is being developed under the name YARN</li> </ul>
13	<p><b>Justify why the partitions are shuffled in map reduce.</b> BTL2</p> <p><b>Sort/shuffle</b>, in which the interim results are sorted and redistributed so that all interim results for a specific key value are located at one single-processing node. To continue the analogy, this would be the process of delivering all the buckets for a specific key to a single delivery point.</p>
14	<p><b>What are the advantages of YARN?</b> BTL1</p> <p>The concept of an Application Master that is associated with each application that directly negotiates with the central Resource Manager for resources while taking over the responsibility for monitoring progress and tracking status. Pushing this responsibility to the application environment allows greater flexibility in the assignment of resources as well as be more effective in scheduling to improve node utilization.</p> <p>The YARN approach allows applications to be better aware of the data allocation across the topology of the resources within a cluster. This awareness allows for improved colocation of compute and data resources, reducing data motion, and consequently, reducing delays associated with data access latencies. The result should be increased scalability and performance.</p>

### **PART \* B**

1	<p><b>List the main characteristics of big data architecture with a neat schematic diagram.</b> (13M) BTL1</p> <p><b>Answer page :</b></p> <p><b>CHARACTERISTICS OF BIG DATA:</b></p> <p><b>(i)Volume</b> (3M)</p> <p>The name 'Big Data' itself is related to a size which is enormous. Size of data plays very crucial role in determining value out of data.</p> <p><b>(ii)Variety</b> (3M)</p> <p>Variety refers to heterogeneous sources and the nature of data, both structured and unstructured. During earlier days, spreadsheets and databases were the only sources of data considered by most of the applications</p> <p><b>(iii)Velocity</b> (3M)</p> <p>The term 'velocity' refers to the speed of generation of data. How fast the data is generated and processed to meet the demands, determines real potential in the data.</p> <p><b>(iv)Variability</b> (4M)</p> <p>This refers to the inconsistency which can be shown by the data at times, thus hampering the process of being able to handle and manage the data effectively.</p>
2	<p><b>Explain the use cases in Big Data.</b>(13M)BTL4</p> <p><b>Answer page :</b></p> <p>Introduction (3M)</p>

	<p>It consists of a methodology for elastically harnessing parallel computing resources and distributed storage, scalable performance management, along with data exchange via high-speed networks.</p> <p><b>A scan of the list allows us to group most of those applications into these categories:(10 M)</b></p> <ul style="list-style-type: none"> <li>✓ <b>Business intelligence, querying, reporting, searching</b></li> <li>✓ <b>Improved performance for common data management operations,</b></li> <li>✓ <b>Non-database applications,</b></li> <li>✓ <b>Data mining and analytical applications,</b></li> <li>✓ <b>Counting</b></li> <li>✓ <b>Scanning</b> functions that can be broken up into parallel threads, such as sorting, data transformations, semantic text analysis, pattern recognition, and searching.</li> <li>✓ <b>Modeling</b> capabilities for analysis and prediction.</li> <li>✓ <b>Storing</b> large datasets while providing relatively rapid access.</li> </ul>
3	<p><b>Explain the Characteristics of Big data applications. (13M)BTL1</b></p> <p><b>Answer page :</b></p> <p><b>Introduction (3M)</b></p> <p>The big data approach is mostly suited to addressing or solving business problems that are subject to one or more of the following criteria:</p> <p>Criterias (10M)</p> <ol style="list-style-type: none"> <li>1. <b>Data throttling:</b> The business challenge has an existing solution, but on traditional hardware, the performance of a solution is throttled as a result of data accessibility, data latency, data availability, or limits on bandwidth in relation to the size of inputs.</li> <li>2. <b>Computation-restricted throttling:</b> There are existing algorithms, but they are heuristic and have not been implemented because the expected computational performance has not been met with conventional systems.</li> <li>3. <b>Large data volumes:</b> The analytical application combines a multitude of existing large datasets and data streams with high rates of data creation and delivery.</li> <li>4. <b>Significant data variety:</b> The data in the different sources vary in structure and content, and some (or much) of the data is unstructured.</li> <li>5. <b>Benefits from data parallelization:</b> Because of the reduced data dependencies, the application's runtime can be improved through task or thread-level parallelization applied to independent data segments.</li> </ol>
4	<p><b>Perception and Quantification of Value. (13M)BTL3</b></p> <p><b>Answer page :</b></p> <p>Big data significantly contributes to adding value to the organization by:</p>

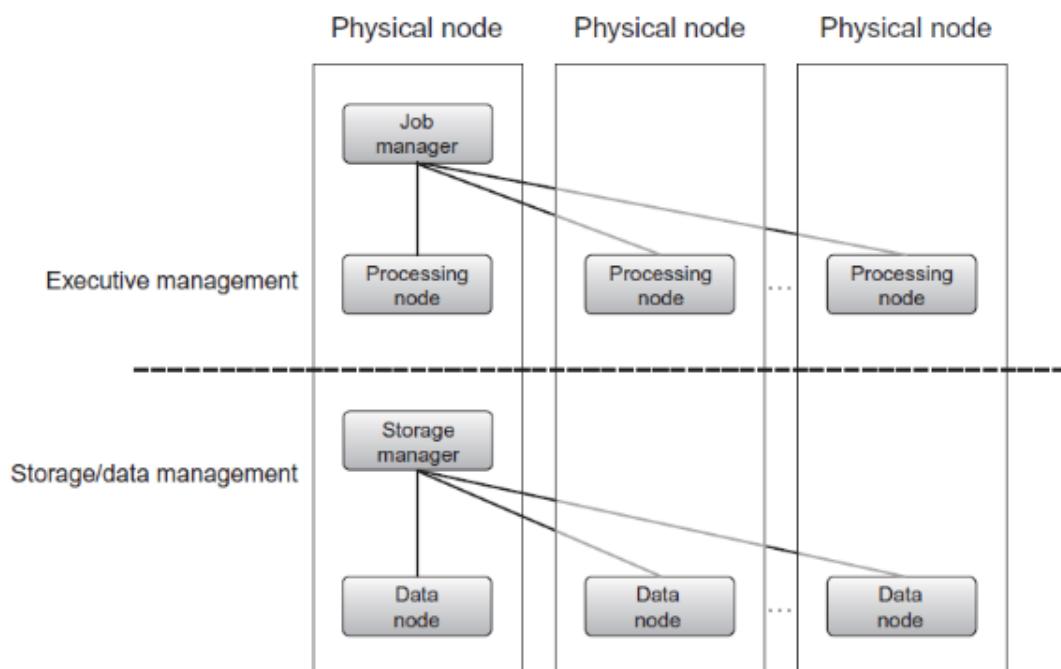
- **Increasing revenues:** As an example, an expectation of using a recommendation engine would be to increase same-customer sales by adding more items into the market basket. (3M)
- **Lowering costs:** As an example, using a big data platform built on commodity hardware for ETL would reduce or eliminate the need for more specialized servers used for data staging, thereby reducing the storage footprint and reducing operating costs. (3M)
- **Increasing productivity:** Increasing the speed for the pattern analysis and matching done for fraud analysis helps to identify more instances of suspicious behavior faster, allowing for actions to be taken more quickly and transform the organization from being focused on recovery of funds to proactive prevention of fraud. (3M)
- **Reducing risk:** Using a big data platform or collecting many thousands of streams of automated sensor data can provide full visibility into the current state of a power grid, in which unusual events could be rapidly investigated to determine if a risk of an imminent outage can be reduced. (4M)

**Write a general overview of high performance architecture. (13M)BTL3**

**Answer page :**

Most high-performance platforms are created by connecting multiple nodes together via a variety of network topologies.

The general architecture distinguishes the management of computing resources and the management of the data across the network of storage nodes, as is seen in Figure 1.1.



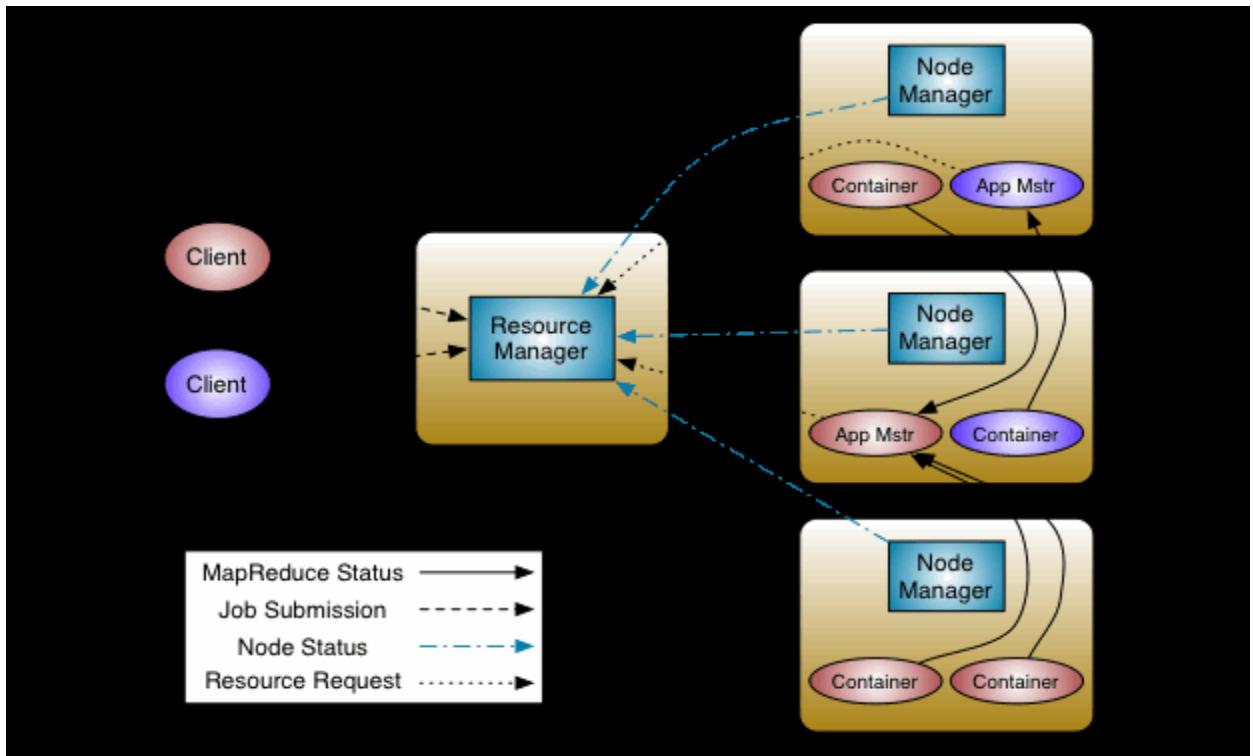
**Fig 1.2 Typical organization of resources in a big data platform**

In this configuration, a master job manager oversees the pool of processing nodes, assigns tasks, and monitors the activity. At the same time, a storage manager oversees the data storage pool

	<p>and distributes datasets across the collection of storage resources. (10M)</p> <p>Hadoop is a framework that allows to store Big Data in a distributed environment, so that, data's can be processed parallelly.</p> <p style="text-align: right;">(3M)</p>
6	<p><b>Explain in details HDFS (HADOOP DISTRIBUTED FILE SYSTEMS). (13M)BTL3</b></p> <p><b>Answer page :</b></p> <p>Introduction (5M)</p> <p>HDFS attempts to enable the storage of large files, and does this by distributing the data among a pool of data nodes. A single Name Node runs in a cluster, associated with one or more data nodes, and provide the management of a typical hierarchical file organization and namespace. The name node effectively coordinates the interaction with the distributed data nodes. The creation of a file in HDFS appears to be a single file, even though it blocks “chunks” of the file into pieces that are stored on individual data nodes.</p> <p>The diagram illustrates the HDFS architecture. It shows two separate clusters, each labeled "HDFS cluster". Each cluster contains a "Name node" (represented by a square box) and several "Data node" boxes, each containing a "Disk" icon. Within each cluster, the Name node is connected to the Data nodes, and the Data nodes are interconnected. Arrows indicate the bidirectional communication between the Name node and each Data node, and between the Data nodes themselves. The clusters are also interconnected via arrows pointing from the Name node of one cluster to the Name node of the other.</p> <p style="text-align: center;"><i>Figure 1.3. The HDFS architecture</i></p> <ul style="list-style-type: none"> <li>✓ Explanation (5 M).</li> <li>✓ Diagram (3M)</li> </ul> <p>Once a file is created, as data is written to the file, it is actually cached in a temporary file. When the amount of the data in that temporary file is enough to fill a block in an HDFS file, the name node is alerted to transition that temporary file into a block that is committed to a permanent data</p>

	<p>node, which is also then incorporated into the file management scheme.</p> <p style="text-align: right;">(3M)</p>
	<p><b>Explain in detail about the Data Replication. (13M)BTL3</b></p> <p><b>Answer page :</b></p> <p>Introduction (3M) HDFS provides a level of <b>fault tolerance</b> through <b>data replication</b>. An application can specify the degree of replication (i.e., the number of copies made) when a file is created.</p> <p>Criterias (8M)</p> <ul style="list-style-type: none"> <li>• <b>Monitoring:</b> There is a continuous “heartbeat” communication between the data nodes to the name node. If a data node’s heartbeat is not heard by the name node, the data node is considered to have failed and is no longer available. In this case, a replica is employed to replace the failed node, and a change is made to the replication scheme.</li> <li>• <b>Rebalancing:</b> This is a process of automatically migrating blocks of data from one data node to another when there is free space, when there is an increased demand for the data and moving it may improve performance or an increased need to replication in reaction to more frequent node failures.</li> <li>• <b>Managing integrity:</b> HDFS uses checksums, which are effectively “digital signatures” associated with the actual data stored in a file (often calculated as a numerical function of the values within the bits of the files) that can be used to verify that the data stored corresponds to the data shared or received. When the checksum calculated for a retrieved block does not equal the stored checksum of that block, it is considered an integrity error. In that case, the requested block will need to be retrieved from a replica instead.</li> <li>• <b>Metadata replication:</b> The metadata files are also subject to failure, and HDFS can be configured to maintain replicas of the corresponding metadata files to protect against corruption.</li> <li>• <b>Snapshots:</b> This is incremental copying of data to establish a point in time to which the system can be rolled back.</li> </ul> <p>These concepts map to specific internal protocols and services that HDFS uses to enable a large-scale data management file system that can run on commodity hardware components.</p> <p><b>Perspectives (2M)</b></p> <p>The ability to use HDFS solely as a means for creating a scalable and expandable file system for maintaining rapid access to large datasets provides a reasonable value proposition from an Information Technology perspective:</p> <ul style="list-style-type: none"> <li>• decreasing the cost of specialty large-scale storage systems;</li> <li>• providing the ability to rely on commodity components;</li> <li>• enabling the ability to deploy using cloud-based services;</li> <li>• reducing system management costs.</li> </ul> <p style="text-align: right;">(3M)</p>
8	<p><b>List Limitations within this existing MapReduce model. (13M)BTL4</b></p> <p><b>Answer page :</b></p>

	<p><b>Each heating 3 marks (13M)</b></p> <p>First, the programming paradigm is nicely suited to applications where there is locality between the processing and the data, but applications that demand data movement will rapidly become bogged down by network latency issues.</p> <p>Second, not all applications are easily mapped to the MapReduce model, yet applications developed using alternative programming methods would still need the MapReduce system for job management.</p> <p>Third, the allocation of processing nodes within the cluster is fixed through allocation of certain nodes as “map slots” versus “reduce slots.” When the computation is weighted toward one of the phases, the nodes assigned to the other phase are largely unused, resulting in processor under utilization.</p> <p>This is being addressed in future versions of Hadoop through the segregation of duties within a revision called YARN. In this approach, overall resource management has been centralized while management of resources at each node is now performed by a local Node Manager.</p>
9	<p><b>Explain in detail about the YARN with example.(13M)BTL2</b></p> <p><b>Answer page :</b></p> <p><b>Explanation (5M)</b></p> <p><b>Diagram (5M)</b></p> <p>The fundamental idea of YARN is to split up the functionalities of resource management and job scheduling/monitoring into separate daemons. The idea is to have a global ResourceManager (RM) and per-application ApplicationMaster (AM). An application is either a single job or a DAG of jobs.</p> <p>The ResourceManager and the NodeManager form the data-computation framework. The ResourceManager is the ultimate authority that arbitrates resources among all the applications in the system. The NodeManager is the per-machine framework agent who is responsible for containers, monitoring their resource usage (cpu, memory, disk, network) and reporting the same to the ResourceManager/Scheduler.</p> <p>The per-application ApplicationMaster is a framework specific library and is tasked with negotiating resources from the ResourceManager and working with the NodeManager(s) to execute and monitor the tasks.</p>



*Fig.1.4Yarn Architecture*

**The Resource Manager has two main components: Scheduler and Applications Manager.**

#### **Advantages of YARN(3M)**

The concept of an Application Master that is associated with each application that directly negotiates with the central Resource Manager for resources while taking over the responsibility for monitoring progress and tracking status. Pushing this responsibility to the application environment allows greater flexibility in the assignment of resources as well as be more effective in scheduling to improve node utilization.

#### **Write about the Map Reduce Programming Model with example. (13M)BTL2**

**Answer page :**

Explanation (5M)

Programming model (5M)

Diagram (3M)

10

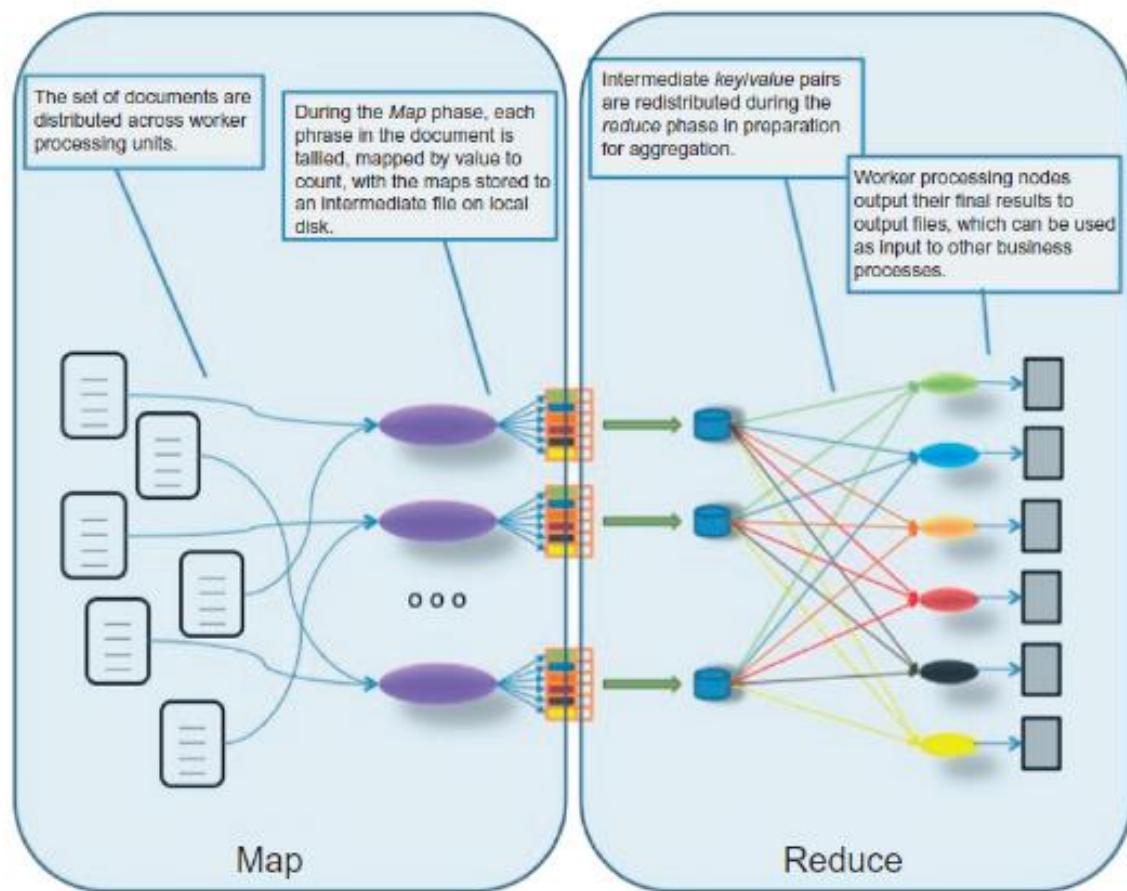
Map Reduce, can be used to develop applications to read, analyze, transform, and share massive amounts of data is not a database system but rather is a programming model introduced and described by Google researchers for parallel, distributed computation involving massive datasets (ranging from hundreds of terabytes to petabytes).

Application development in Map Reduce is a combination of the familiar procedural/imperative approaches used by Java or C++ programmers embedded within what is effectively a functional language programming model such as the one used within languages like Lisp

and APL.

Map Reduce's dependence on two basic operations that are applied to sets or lists of data value pairs:

1. **Map**, which describes the computation or analysis applied to a set of input key/value pairs to produce a set of intermediate key/value pairs.
2. **Reduce**, in which the set of values associated with the intermediate key/value pairs output by the Map operation are combined to provide the results.



**Fig.1.5 How Map and Reduce Work.**

Combining both data and computational independence means that both the data and the computations can be distributed across multiple storage and processing units and automatically parallelized. This parallelizability allows the programmer to exploit scalable massively parallel processing resources for increased processing speed and performance.

## PART – C

1	<p><b>Generalize how the data flow takes places in MapReduce framework (15) BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction of Mapreduce (5M)</li> <li>✓ Working of Mapreduce(5M)</li> <li>✓ Frame work in detail(5M)</li> </ul>
2	<p><b>State the significances of MapReduce and discuss about Hadoop distributed file system architecture with neat diagram (15) BTL5</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Features of Mapreduce (5M)</li> <li>✓ Working of Mapreduce(5M)</li> <li>✓ Frame work in detail(5M)</li> </ul>
3	<p><b>Consider a collection of literature survey made by a researcher in the form of a text document with respect to cloud and big data analytics. Using Hadoop and Map Reduce , write a program to count the occurrence of pre dominant key words (15) BTL5</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Features Map reduce and Hadoop (5M)</li> <li>✓ List of survey of text documents(5M)</li> <li>✓ Program to count the occurrence(5M)</li> </ul>
4	<p><b>Examine the Name Node recovery process. What will happen with a Name Node that doesn't have any data? (15) BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (5M)</li> <li>✓ Working of Name node(5M)</li> <li>✓ Recovery Process(5M)</li> </ul>

## UNIT II – CLUSTERING AND CLASSIFICATION

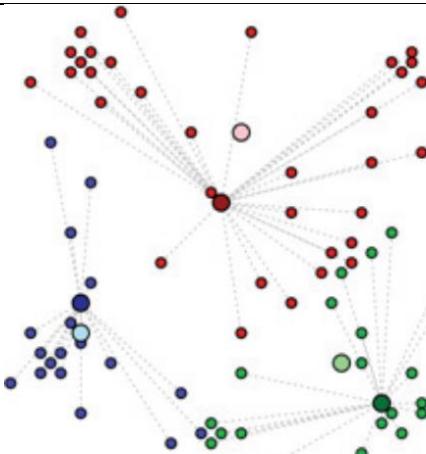
Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve BayesClassifier.

### PART \* A

Q.No.	Questions
1.	<b>Define Clustering BTL1</b> Clustering is the use of <b><i>unsupervised</i></b> techniques for grouping similar objects. Clustering is a method often used for exploratory analysis of the data.
2	<b>What are the problems faced if clustering exists in non- Euclidean.</b> <b>BTL2</b> <ul style="list-style-type: none"> <li>✓ Data Distribution. Large number of samples. The number of samples to be processed is very high. Algorithms have to be very conscious of scaling issues. ....</li> <li>✓ Application context. Legacy clusterings. Previous cluster analysis results are often available.</li> </ul>
3	<b>Compare and contrast the relationship between centroids and clustering. BTL4</b>  Increasing similarity in a series of HAC clustering steps contradicts the fundamental assumption that small clusters are more coherent than large clusters. An inversion in a dendrogram shows up as a horizontal merge line that is <i>lower</i> than the previous merge line. All merge lines in and <a href="#">17.5</a> are higher than their predecessors because single-link and complete-link clustering are monotonic clustering algorithms.  Despite its non-monotonicity, centroid clustering is often used because its similarity measure - the similarity of two centroids - is conceptually simpler than the average of all pairwise similarities in GAAC. It is all one needs to understand centroid clustering. There is no equally simple graph that would explain how GAAC works.
4	<b>Generalize the initialization of K-means algorithm? BTL6</b> The most important are listed below [4]: As many clustering methods, the -Means algorithm assumes that the number of clusters is already known by the users, which, unfortunately, usually is not true in practice. As an iterative technique, the -Means algorithm is especially sensitive to initial cluster centers. The -Means algorithm converges to a local minima.
5	<b>Define Bayes Theorem. BTL1</b> Bayes' theorem, named after 18th-century British mathematician Thomas Bayes, is a mathematical formula for determining conditional probability. The theorem provides a way to revise existing predictions or theories (update probabilities) given new or additional evidenceThere are several different ways to write the formula for Bayes' theorem. The most common form is: $P(A   B) = P(B   A)P(A) / P(B)$

	<p>where A and B are two events and <math>P(B) \neq 0</math>  <math>P(A   B)</math> is the conditional probability of event A occurring given that B is true.  <math>P(B   A)</math> is the conditional probability of event B occurring given that A is true.  <math>P(A)</math> and <math>P(B)</math> are the probabilities of A and B occurring independently of one another (the marginal probability).</p>
6	<p><b>Discuss the number of clusters. BTL2</b>  It would be good to know how much better or worse having k clusters versus <math>k - 1</math> or <math>k + 1</math> clusters would be in explaining the structure of the data.</p>
7	<p><b>What is diagnostics? BTL1</b>  <b>Diagnostics</b> is a method of testing a computer hardware device or software program to ensure it is working as it should be. This testing is performed before a computer or computer-related product is released to the public. Benchmark, <b>Diagnostics</b> program, Hardware terms, Preventive maintenance, Software terms, Test.</p>
8	<p><b>Examine the use of object attributes? BTL3</b>  In computing, an <b>attribute</b> is a specification that defines a property of an <b>object</b>, element, or file. ... However, in actual <b>usage</b>, the term <b>attribute</b> can and is often treated as ... checked="checked"&gt;&lt;label for="check1"&gt;Check me&lt;/label&gt; &lt;p&gt;&lt;/p&gt; ...</p>
9	<p><b>What is the unit of measure? BTL1</b>  A <b>unit of measurement</b> is a definite magnitude of a quantity, defined and adopted by convention or by law, that is used as a standard for <b>measurement</b> of the same kind of quantity.</p>
10	<p><b>Summarize about rescaling. BTL2</b>  In <b>statistics</b>, <b>scale</b> analysis is a set of methods to analyze survey data, in which responses to questions are combined to measure a latent variable. These items can be dichotomous (e.g. yes/no, agree/disagree, correct/incorrect) or polytomous (e.g. disagree strongly/disagree/neutral/agree/agree strongly). <b>Rescaling data</b> is multiplying each member of a <b>data</b> set by a constant k; that is to say, transforming each number x to f(X), where <math>f(x) = kx</math>, and k and x are both real numbers. <b>Rescaling</b> will change the spread of your <b>data</b> as well as the position of your <b>data</b> points.</p>
11	<p><b>What is metoids? BTL2</b>  <b>Metroid</b> is a science fiction action game franchise created by Nintendo. ... <b>Metroid</b> follows space-faring bounty hunter Samus Aran, who protects the galaxy from the Space Pirates and their attempts to harness the power of the parasitic <b>Metroid</b> creatures. <b>Metroid</b> combines the platforming of Super Mario Bros.</p>
12	<p><b>What is customer segmentation? BTL1</b>  <b>Customer segmentation</b> is the process of dividing <b>customers</b> into groups based on common characteristics so companies can market to each group effectively and appropriately. In business-to-business marketing, a company might <b>segment customers</b> according to a wide range of factors, including: Industry.</p>
13	<p><b>Describe the prediction trees? BTL2</b>  A prediction or decision tree is a tree-shaped diagram that shows statistical probability or determines a course of action. It shows the steps to take and why one choice may lead to another. Therefore, it is a suitable decision-making tool for research analysis or for planning the strategy to reach a goal</p>

14	<b>Analyze on internal nodes and leaf nodes. BTL4</b> An <b>internal node</b> or <b>inner node</b> is any <b>node</b> of a tree that has child <b>nodes</b> and is thus not a <b>leaf node</b> . An intermediate <b>node</b> between the root and the <b>leaf nodes</b> is called an <b>internal node</b> . An <b>internal node</b> (also known as an <b>inner node</b> , inode for short, or branch <b>node</b> ) is any <b>node</b> of a tree that has child <b>nodes</b> .
15	<b>What is purity of node? BTL1</b> A decision tree where the target variable takes a continuous value, usually numbers, are called Regression Trees. ... The decision to split at each <b>node</b> is made according to the metric called <b>purity</b> . A <b>node</b> is 100% impure when a <b>node</b> is split evenly 50/50 and 100% pure when all of its data belongs to a single class.
16	<b>Point out the CART. BTL 4</b> Introduction to Classification & Regression Trees ( <b>CART</b> ) Decision Trees are commonly used in <b>data mining</b> with the objective of creating a model that predicts the value of a target (or dependent variable) based on the values of several input (or independent variables).
17	<b>Illustrate Naïve Bayes. BTL3</b> In machine learning, <b>naïve Bayes</b> classifiers are a family of simple "probabilistic classifiers" based on applying <b>Bayes'</b> theorem with strong ( <b>naïve</b> ) independence assumptions between the features. They are among the simplest <b>Bayesian</b> network models. <b>Naïve Bayes</b> has been studied extensively since the 1960s.
	<b>PART – B</b>
1.	<b>Explain the K-means algorithm with an example. BTL2</b> <b>Answer page :</b> <ul style="list-style-type: none"><li>✓ Introduction to K means (2M)</li><li>✓ Initial starting points for the centroids (3M)</li><li>✓ Points are assigned to the closest centroid (3M)</li><li>✓ Compute the mean of each cluster (3M)</li><li>✓ Frame work in detail(2M)</li></ul>



**Figure2.4 Compute the mean of each cluster**

**Discuss in detail the K-Means Advantages and Disadvantages. BTL2**

**Answer page :**

- ✓ Introduction to K means (3M)

**Advantages of k-means (5M)**

- Relatively simple to implement.
- Scales to large data sets.
- Guarantees convergence.
- Can warm-start the positions of centroids.
- Easily adapts to new examples.
- Generalizes to clusters of different shapes and sizes, such as elliptical clusters.

**Disadvantages of k-means (5M)**

- Choosing k manually.
- Being dependent on initial values.
- Clustering data of varying sizes and density.
- Clustering outliers.
- Scaling with number of dimensions.

**Illustrate in detail about Decision Trees in R. BTL3**

**Answer page :**

- ✓ Introduction to Decision Tree (2M)
- ✓ Initial plotted using package (1 M)
- ✓ Points common steps for implementing Decision tree in R (8M)
- ✓ R Coding (2M)

	<p>In R programming, the decision trees can be plotted using package called rpart.plot. The common steps for implementing Decision tree in R are as follows.</p> <p>Step 1: Import the data      Step 2: Clean the dataset      Step 3: Create train/test set      Step 4: Build the model.      Step 5: Make prediction      Step 6: Measure Performance      Step 7: Tune the hyper – parameters.</p>
	<p><b>Illustrate in detail Bayes' theorem with an example. BTL3</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction to Bayes' theorem (2M)</li> <li>✓ Initial classifiers (3M)</li> <li>✓ Finding the attributes (3M)</li> <li>✓ Control Probabilities (3M)</li> <li>✓ Example(2M)</li> </ul> <p><b>Example I</b></p> <p>John flies frequently and likes to upgrade his seat to first class. He has determined that if he checks in for his flight at least two hours early, the probability that he will get an upgrade is 0.75; otherwise, the probability that he will get an upgrade is 0.35. With his busy schedule, he checks in at least two hours before his flight only 40% of the time. Suppose John did not receive an upgrade on his most recent attempt. What is the probability that he did not arrive two hours early?</p>
4	<p>Let <math>C = \{\text{John arrived at least two hours early}\}</math>, and  <math>A = \{\text{John received an upgrade}\}</math>, then  <math>\neg C = \{\text{John did not arrive two hours early}\}</math>, and  <math>\neg A = \{\text{John did not receive an upgrade}\}</math>.</p> <p>John checked in at least two hours early only 40% of the time, or <math>P(C) = 0.4</math>.</p> <p>Therefore, <math>P(\neg C) = 1 - P(C) = 0.6</math>.</p> <p>The probability that John received an upgrade given that he checked in early is 0.75, or <math>P(A C) = 0.75</math>.</p> <p>The probability that John received an upgrade given that he did not arrive two hours early is 0.35, or <math>P(A \neg C) = 0.35</math>.</p> <p>Therefore, <math>P(\neg A \neg C) = 0.65</math>.</p> <p>The probability that John received an upgrade <math>P(A)</math> can be computed as shown in Equation 7-8.</p>

	$  \begin{aligned}  P(A) &= P(A \cap C) + P(A \cap \neg C) \\  &= P(C) \cdot P(A C) + P(\neg C) \cdot P(A \neg C) \\  &= 0.4 \times 0.75 + 0.6 \times 0.35 \\  &= 0.51  \end{aligned}  \tag{7-8}  $ <p>Thus, the probability that John did not receive an upgrade <math>P(\neg A)=0.49</math>. Using Bayes' theorem, the probability that John did not arrive two hours early given that he did not receive his upgrade is shown in Equation 7-9.</p> $  \begin{aligned}  P(\neg C \neg A) &= \frac{P(\neg A \neg C) \cdot P(\neg C)}{P(\neg A)} \\  &= \frac{0.65 \times 0.6}{0.49} \approx 0.796  \end{aligned}  \tag{7-9}  $
5	<p><b>Describe the various hierarchical methods of cluster analysis. BTL2</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Initializing the clusters (4M)</li> <li>✓ Explanation for Hierarchical methods(5M)</li> <li>✓ Example (2M)</li> </ul>
6	<p><b>Explain in detail about the applications of clustering. BTL4</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Document clustering (3M)</li> <li>✓ Delivery store optimization (3M)</li> <li>✓ Identifying crime localities(3M)</li> <li>✓ Cyber Profiling Analysis (4M)</li> </ul>
7	<p><b>What are the main features of GRGPF algorithm and explain it? BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Initial features (4 M)</li> <li>✓ Working of the algorithm (4M)</li> <li>✓ Frame work in detail(3M)</li> </ul>
8	<p><b>Describe about Market- Based model. BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Definition of Frequent Itemsets (2M)</li> <li>✓ Applications of Frequent Itemsets (2M)</li> <li>✓ Association Rules (2M)</li> <li>✓ Finding Association Rules with High Confidence(2M)</li> <li>✓ Example(3M)</li> </ul> <p>The market-basket model of data is used to describe a common form of manymany relationships between two kinds of objects. On the one hand, we have items, and on the other we have baskets, sometimes called “transactions.”</p>

	Each basket consists of a set of items (an itemset), and usually we assume that the number of items in a basket is small – much smaller than the total number of items. The number of baskets is usually assumed to be very large, bigger than what can fit in main memory. The data is assumed to be represented in a file consisting of a sequence of baskets.
9	<p><b>Generalize about general algorithm and decision tree algorithm.BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction to Decision Tree (2M)</li> <li>✓ Initial plotted using package (1 M)</li> <li>✓ Points common steps for implementing Decision tree in R (8M)</li> <li>✓ R Coding (2M)</li> </ul> <p>In R programming, the decision trees can be plotted using package called rpart.plot. The common steps for implementing Decision tree in R are as follows.</p> <p>Step 1: Import the data      Step 2: Clean the dataset      Step 3: Create train/test set      Step 4: Build the model.      Step 5: Make prediction      Step 6: Measure Performance      Step 7: Tune the hyper – parameters.</p>
10	<p><b>Illustrate about the clustering? Explain it with proper example. BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Document clustering (3M)</li> <li>✓ Delivery store optimization (3M)</li> <li>✓ Identifying crime localities(3M)</li> <li>✓ Cyber Profiling Analysis (4M)</li> </ul>
	<b>PART * C</b>
1	<p><b>Explain in detail about evaluate the decision tree algorithm. BTL5</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction to Decision Tree (2M)</li> <li>✓ Initial plotted using package (3 M)</li> <li>✓ Points common steps for implementing Decision tree in R (8M)</li> <li>✓ R Coding (2M)</li> </ul> <p>In R programming, the decision trees can be plotted using package called rpart.plot. The common steps for implementing Decision tree in R are as follows.</p> <p>Step 1: Import the data      Step 2: Clean the dataset      Step 3: Create train/test set      Step 4: Build the model.      Step 5: Make prediction      Step 6: Measure Performance      Step 7: Tune the hyper – parameters.</p>
2	<p><b>Explain in detail about two methods of using the naïve bayes classifier in R with examples.</b></p>

**BTL6****Answer page :**

- ✓ Introduction to Bayes' theorem (2M)
- ✓ Initial classifiers (3M)
- ✓ Finding the attributes (3M)
- ✓ Control Probabilities (5M)
- ✓ Example(2M)

**Example I**

John flies frequently and likes to upgrade his seat to first class. He has determined that if he checks in for his flight at least two hours early, the probability that he will get an upgrade is 0.75; otherwise, the probability that he will get an upgrade is 0.35. With his busy schedule, he checks in at least two hours before his flight only 40% of the time. Suppose John did not receive an upgrade on his most recent attempt. What is the probability that he did not arrive two hours early?

Let  $C = \{\text{John arrived at least two hours early}\}$ , and

$A = \{\text{John received an upgrade}\}$ , then

$\neg C = \{\text{John did not arrive two hours early}\}$ , and

$\neg A = \{\text{John did not receive an upgrade}\}$ .

John checked in at least two hours early only 40% of the time, or  $P(C) = 0.4$ .

Therefore,  $P(\neg C) = 1 - P(C) = 0.6$ .

The probability that John received an upgrade given that he checked in early is 0.75, or  $P(A|C) = 0.75$ .

The probability that John received an upgrade given that he did not arrive two hours early is 0.35, or  $P(A|\neg C) = 0.35$ .

Therefore,  $P(\neg A|\neg C) = 0.65$ .

The probability that John received an upgrade  $P(A)$  can be computed as shown in Equation 7-8.

$$\begin{aligned}
 P(A) &= P(A \cap C) + P(A \cap \neg C) \\
 &= P(C) \cdot P(A|C) + P(\neg C) \cdot P(A|\neg C) \\
 &= 0.4 \times 0.75 + 0.6 \times 0.35 \\
 &= 0.51
 \end{aligned} \tag{7-8}$$

Thus, the probability that John did not receive an upgrade  $P(\neg A) = 0.49$ . Using Bayes' theorem, the probability that John did not arrive two hours early given that he did not receive his upgrade is shown in Equation 7-9.

$$\begin{aligned}
 P(\neg C|\neg A) &= \frac{P(\neg A|\neg C) \cdot P(\neg C)}{P(\neg A)} \\
 &= \frac{0.65 \times 0.6}{0.49} \approx 0.796
 \end{aligned} \tag{7-9}$$

	<b>Demonstrate about the two clustering techniques with suitable example. BTL3</b> <b>Answer page :</b> ✓ Introduction (2M) ✓ Types of clustering(3M) ✓ Type I clustering (4M) ✓ Type II clustering (4M) ✓ Frame work in detail(2M)
4	<b>Explain and list the different hierarchical clustering techniques and explain any one. BTL4</b> <b>Answer page :</b> ✓ Introduction (2M) ✓ Initializing the clusters (5 M) ✓ Explanation for Hierarchical methods(5M) ✓ Example (3 M)

### UNIT III – ASSOCIATION AND RECOMMENDATION SYSTEM

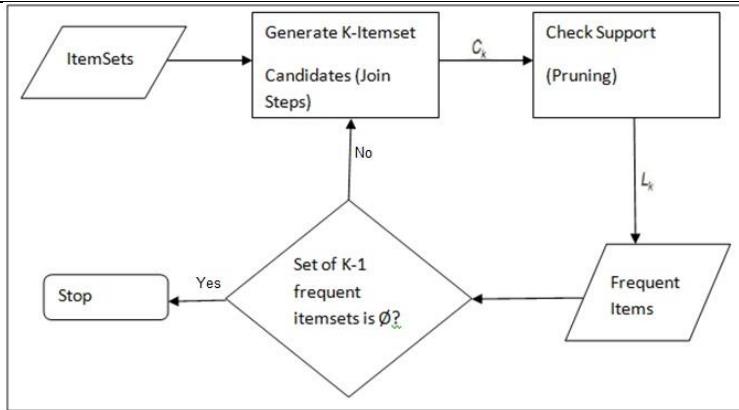
Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association & finding similarity- Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches

#### PART \* A

Q.No	Questions
1	<b>Define Apriori. BTL1</b> Apriori is an <b>algorithm</b> for frequent item set <b>mining</b> and association rule learning over relational databases. It proceeds by identifying the frequent individual items in the <b>database</b> and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the <b>database</b> .
2	<b>State the use of apriori algorithm in data mining.BTL1</b> Apriori algorithm is a classical <b>algorithm in data mining</b> . It is <b>used</b> for <b>mining</b> frequent itemsets and relevant association rules. It is devised to operate on a <b>database</b> containing a lot of transactions, for instance, items brought by customers in a store.
3	<b>State market basket analysis. BTL1</b> Market Basket Transaction or <b>Market Basket Analysis</b> is a <b>data mining</b> technique to derive association between two <b>data</b> sets. We have categorical <b>data</b> of transaction records as input to the <b>analysis</b> and the output of the <b>analysis</b> is association rules as a new knowledge directly from <b>data</b> .
4	<b>What is the logic behind association rule? BTL2</b> Association rules are if-then statements that help to show the probability of relationships between <b>data</b> items within large <b>data</b> sets in various types of databases. <b>Association rule</b>

	<b>mining</b> has a number of applications and is widely used to help discover sales correlations in transactional <b>data</b> or in medical <b>data</b> sets.
5	<b>What is Prune? BTL2</b> <b>Pruning</b> is a technique in machine learning and search algorithms that reduces the size of decision trees by removing sections of the tree that provide little power to classify instances. <b>Pruning</b> reduces the complexity of the final classifier, and hence improves predictive accuracy by the reduction of overfitting.
6	<b>Define Confidence. BTL1</b> <b>Confidence</b> indicates the number of times the if-then statements are found true. You may then identify itemsets with support values above this threshold as significant itemsets. Measure 2: <b>Confidence</b> . This says how likely item Y is purchased when item X is purchased, expressed as $\{X \rightarrow Y\}$ . This is measured by the proportion of transactions with item X, in which item Y also appears.
7	<b>What do you mean by lift? BTL2</b> In <b>data mining</b> and association rule learning, <b>lift</b> is a measure of the performance of a targeting model (association rule) at predicting or classifying cases as having an enhanced response (with respect to the population as a whole), measured against a random choice targeting model.
8	<b>Show the advantage of leverage. BTL3</b> <ul style="list-style-type: none"> <li>✓ Driving Profitability</li> <li>✓ Enhancing Strategic Focus</li> <li>✓ Improving Effectiveness of Marketing Efforts</li> <li>✓ Optimizing Pricing and Generating Efficiency</li> <li>✓ Analyzing Historical Case Information for Trends</li> <li>✓ Establishing Proof</li> </ul>
9	<b>What is frequent itemset generation? BTL1</b> A <b>frequent itemset</b> is an <b>itemset</b> whose support is greater than some user-specified minimum support (denoted $L_k$ , where k is the size of the <b>itemset</b> ) A candidate <b>itemset</b> is a potentially <b>frequent itemset</b> (denoted $C_k$ , where k is the size of the <b>itemset</b> )
10	<b>Analyse the validation and testing. BTL4</b> <b>Validation Dataset:</b> The sample of <b>data</b> used to provide an unbiased evaluation of a model fit on the training dataset while tuning model hyperparameters. ... <b>Test Dataset:</b> The sample of <b>data</b> used to provide an unbiased evaluation of a final model fit on the training dataset. <b>Validation</b> is the process of assessing how well your <b>mining</b> models perform against real <b>data</b> . It is important that you <b>validate</b> your <b>mining</b> models by understanding their quality and characteristics before you deploy them into a production environment.
11	<b>What is utility matrix? BTL4</b> A common tool used to summarize <b>utility</b> requirements is a <b>Utility Matrix</b> . The <b>data</b> used in a recommendation system is divided in two categories: the users and the items. Each user likes certain items, and the rating value $r_{ij}$ (from 1 to 5) is the <b>data</b> associated with each user i and item j and represents how much the user appreciates the item.

12	<p><b>Examine about data profiling. BTL1</b></p> <p>Data profiling is a process of examining data from an existing source and summarizing information about that data.</p>
13	<p><b>Give the content based recommendation system. BTL5</b></p> <p>In content-based recommendations, the recommendation systems check for similarity between the items based on their attributes or content and then propose those items to the end users. A Content-based recommendation system tries to recommend items to users based on their profile. The user's profile revolves around that user's preferences and tastes. It is shaped based on user ratings, including the number of times that user has clicked on different items or perhaps even liked those items.</p>
14	<p><b>Explain collaborative filtering system. BTL4</b></p> <p>Collaborative filtering (CF) is a technique used by recommender systems. In the more general sense, collaborative filtering is the process of filtering for information or patterns using techniques involving collaboration among multiple agents, viewpoints, data sources, etc.</p>
15	<p><b>Define knowledge based recommendation. BTL2</b></p> <p>Knowledge-based recommender systems (knowledge based recommenders) are a specific type of recommender system that are based on explicit knowledge about the item assortment, user preferences, and recommendation criteria (i.e., which item should be recommended in which context).</p>
16	<p><b>Give the definition Hybrid recommendation. BTL2</b></p> <p>Recommender systems are software tools used to generate and provide suggestions for items and other entities to the users by exploiting various strategies. Hybrid recommender systems combine two or more recommendation strategies in different ways to benefit from their complementary advantages.</p>
17.	<p><b>Define online recommendation system. BTL4</b></p> <p>A recommender system, or a recommendation system (sometimes replacing 'system' with a synonym such as platform or engine), is a subclass of information filtering system that seeks to predict the "rating" or "preference" a user would give to an item. They are primarily used in commercial applications.</p>
Part * B	
1	<p><b>Explain the apriori algorithm for mining frequent item sets with an example. BTL1</b></p> <p>Answer page :</p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Initial support count and confidence(3M)</li> <li>✓ Populating the table Ci and Li(8M)</li> </ul> <p>Apriori is an algorithm for discovering frequent itemsets in transaction databases. It was proposed by Agrawal &amp; Srikant (1993). ... It contains 5 transactions (t1, t2, ..., t5) and 5 items (1,2, 3, 4, 5). For example, the first transaction represents the set of items 1, 3 and 4.</p>

*Apriori Algorithm Steps*

Below are the apriori algorithm steps:

1. Scan the transaction data base to get the support ‘S’ each 1-itemset, compare ‘S’ with min\_sup, and get a support of 1-itemsets,
2. Use join to generate a set of candidate k-item set. Use apriori property to prune the unfrequented k-item sets from this set.
3. Scan the transaction database to get the support ‘S’ of each candidate k-item set in the given set, compare ‘S’ with min\_sup, and get a set of frequent k-item set
4. If the candidate set is NULL, for each frequent item set 1, generate all nonempty subsets of 1.
5. For every nonempty subsets of 1, output the rule “ $s \Rightarrow (1-s)$ ” if confidence C of the rule “ $s \Rightarrow (1-s)$ ”  $\geq$  min\_conf
6. If the candidate set is not NULL, go to step 2

### **Illustrate how will you find association rules with High confidence. BTL3**

**Answer page :**

- ✓ Introduction to(2M)

The **confidence** of an **association rule** is the support of  $(X \cup Y)$  divided by the support of X. Therefore, the **confidence** of the **association rule** is in this case the support of  $(2,5,3)$  divided by the support of  $(2,5)$ .

**Confidence** for this **rule will** also be **high** since {Milk} is such a frequent itemset and **would** be present in every other transaction. It does not matter what **you have** in the antecedent for such a frequent consequent. The **confidence** for an **association rule** having a very frequent consequent **will** always be **high**.

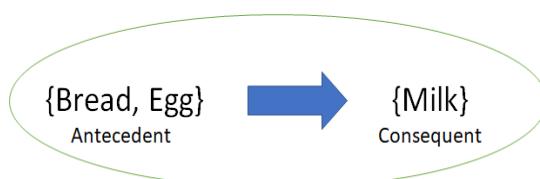
Lets now see what an association rule exactly looks like. It consists of an antecedent and a consequent, both of which are a list of items. Note that implication here is co-occurrence and not causality. For a given rule, **itemset** is the list of all the items in the antecedent and the consequent.

- ✓ Initial support count and confidence(3M)
- ✓ Populating the table Ci and Li(8M)

Application here is co-occurrence and not causality. For a given rule, **itemset** is the list of all the

2

items in the antecedent and the consequent.



**Itemset = {Bread, Egg, Milk}**

### 1. Support

This measure gives an idea of how frequent an *itemset* is in all the transactions. Consider  $itemset1 = \{\text{bread}\}$  and  $itemset2 = \{\text{shampoo}\}$ .

$$\text{Support}(\{X\} \rightarrow \{Y\}) = \frac{\text{Transactions containing both } X \text{ and } Y}{\text{Total number of transactions}}$$

### 2. Confidence

The conditional probability of occurrence of consequent given the antecedent.

$$\text{Confidence}(\{X\} \rightarrow \{Y\}) = \frac{\text{Transactions containing both } X \text{ and } Y}{\text{Transactions containing } X}$$

### 3. Lift

$$\text{Lift}(\{X\} \rightarrow \{Y\}) = \frac{(\text{Transactions containing both } X \text{ and } Y) / (\text{Transactions containing } X)}{\text{Fraction of transactions containing } Y}$$

**Describe the Recommendations systems? Clearly explain the two applications for Recommendations systems. BTL1**

**Answer page :**

- ✓ Introduction to **Recommendations systems** (2M)
- ✓ Two applications for recommendation system(8M)
- ✓ Examples(3M)

**Discuss in detail about any one Ranking algorithm used by Search Engines? BTL2**

**Answer page :**

- ✓ Introduction to Search engines (2M)
- ✓ Ranking algorithm working (8M)
- ✓ Frame work in detail(3M)

**5**

**Explain collaborative filtering based recommendation systems. BTL2**

	<b>Answer page :</b> ✓ Introduction to Recommendations systems (2M) ✓ working for filtering based recommendation system(8M) ✓ Examples(3M)
6	<b>Outline in detail about the application of association rule. BTL3</b> <b>Answer page :</b> ✓ Introduction (2M) ✓ Two applications (8M) ✓ Examples(3M)
7	<b>Explain in detail about discovering features of documents. BTL3</b> <b>Answer page :</b> ✓ Introduction(2M) ✓ types of features(4M) ✓ Methods to extract the features (4M) ✓ Working of the feature extraction in detail(3M)
8	<b>Generalize in detail about utility matrix and long tail. BTL6</b> <b>Answer page :</b> ✓ Introduction(2M) ✓ types of features(4M) ✓ Methods to extract the features (4M) ✓ Working in detail(3M)
9	<b>Explain in detail about evaluation of candidate rule. BTL1</b> <b>Answer page :</b> ✓ Introduction(2M) ✓ types of candidate rule(4M) ✓ Methods to extract the candidate rule (4M) ✓ Working in detail(3M)
	<b>PART * C</b>
1	<b>Narrate in detail about a model for Recommendation system. BTL5</b> <b>Answer page :</b> ✓ Introduction to <b>Recommendations systems</b> (3M) ✓ Two applications for recommendation system(8M) ✓ Examples(4M)
2	<b>Explain in detail about frequent item set generation and rule generation. BTL1</b> <b>Answer page :</b> ✓ Introduction(3M) ✓ types of features(4M) ✓ Methods to extract the features (4M) ✓ Working of the feature extraction in detail(4M)

3	<b>Explain recommendation based on User ratings using appropriate example. BTL1</b> <b>Answer page :</b> <ul style="list-style-type: none"><li>✓ Introduction(3M)</li><li>✓ types of features(4M)</li><li>✓ Methods to extract the features (4M)</li><li>✓ Working of the feature extraction in detail(4M)</li></ul>
4	<b>Explain in detail about Hybrid and Knowledge based recommendation. BTL4</b> <b>Answer page :</b> <ul style="list-style-type: none"><li>✓ Introduction to Recommendations systems (2M)</li><li>✓ working for Hybrid and knowledge based recommendation system(10M)</li><li>✓ Examples(3M)</li></ul>

<b>UNIT – IV – STREAM MEMORY</b>		
Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: GraphAnalytics		
<b>PART * A</b>		
<b>Differentiate between data stream mining and traditional data mining. BTL4</b>		
1	<b>Traditional</b>	<b>Stream</b>
	No. of passes	Multiple
	Processing time	Unlimited
	Memory usage	Unlimited
	Type of result	Accurate
	Concept	Static
2	Distributed	No
		Yes
<b>Illustrate examples can you find for stream sources? BTL3</b>		
Amazon Kinesis an other open-source Apache projects like Storm, Flink, Spark Streaming, and Samza are examples of big data streaming systems. Many other companies also provide streaming systems for big data that are frequently updated in response to the rapidly changing nature of these technologies.		
<b>How are moments estimated? BTL2</b>		
Consider a stream $S = \{a_1, a_2, \dots, a_m\}$ with elements from a domain $D = \{v_1, v_2, \dots, v_n\}$ . Let $m_i$ denote the frequency (also sometimes called multiplicity) of value $v_i \in D$ ; i.e., the number of times $v_i$ appears in $S$ . The $k$ th frequency moment of the stream is defined as: $F_k = \sum_{i=1}^n m_i^k$		
<b>List out the applications of data stream. BTL4</b>		
Most IoT data is well-suited to data streaming. Things like traffic sensors, health sensors, transaction logs, and activity logs are all good candidates for data streaming. This streamed data is often used for real-time aggregation and correlation, filtering, or sampling.		
<b>Compute the surprise number (second moment) for the stream 3, 1, 4, 1, 3, 4, 2, 1, 2. What is the third moment of this stream? BTL1</b>		

	1st moment = sum of the <b>numbers</b> of elements = length of the <b>stream</b> . Easy to <b>compute</b> . 2nd moment = <b>surprise number</b> = a measure of how uneven the distribution is. <b>Stream</b> of length 100; 11 values appear.
6	<b>Define decaying window. BTL1</b> The windows ensure that any property calculated from data contains measurements that are relevant to the current state of the structure. The two widely used weighting functions are exponentially decaying windows and sliding, rectangular windows. The exponentially decaying window is defined as. 1.
7	<b>Outline the need for sampling data in a stream. BTL5</b> Stream sampling is the process of collecting a representative sample of the elements of a data stream. The sample is usually much smaller than the entire stream, but can be designed to retain many important characteristics of the stream, and can be used to estimate many important aggregates on the stream.
8	<b>Analyze the term filtering a data stream. BTL3</b> Filtering condition of a stream item is independent of other items of the same stream or any other data stream. The most common example of such filtering is stream sampling, when each item is filtered out with a certain probability and the remaining items form the desired sample.
9	<b>What is real time analysis? BTL1</b> Speed of new data creation and growth: Big Data can describe high velocity data, with rapid data ingestion and near real time analysis.
10	<b>Give the advantages of the algorithm used in estimating moments. BTL1</b> In statistics, the method of moments is a method of estimation of population parameters. It starts by expressing the population moments (i.e., the expected values of powers of the random variable under consideration) as functions of the parameters of interest. Those expressions are then set equal to the sample moments.
11	<b>Why stream data systems? BTL2</b> Stream processing unifies applications and analytics. This simplifies the overall infrastructure, because many systems can be built on a common architecture, and also allows a developer to build applications that use analytical results to respond to insights in the data—to take action—directly.
12	<b>Why do you think data stream management is relevant in data mining? BTL2</b> Value stream management is a lean business practice that helps determine the value of software development and delivery efforts and resources. It also helps to improve the flow of value to the organization, while managing and monitoring the software delivery life cycle from end-to-end.
13	<b>How oneness is counted in window. BTL5</b> In a <b>decaying window</b> algorithm, you assign more weight to newer elements. Multiply the current sum/score by the value (1-c). In a <b>data</b> stream consisting of various elements, you maintain a separate sum for each distinct element.
14	<b>What would result if the cost of exact counts doesn't match? BTL3</b> <b>Operations Count</b> Method: One way to estimate the time complexity of a program or function is to select one or more <b>operations</b> , such as add, multiply, and compare, and to determine how many of each is done

	<b>Illustrate how would you show your understanding of Market-Basket Data? BTL3</b> Market Basket Analysis is a modelling technique based upon the theory that if you buy a certain group of items, you are more (or less) likely to buy another group of items. For example, if you are in an English pub and you buy a pint of beer and don't buy a bar meal, you are more likely to buy crisps
15	<b>What is sentiment analysis? BTL1</b> Sentiment analysis is the process of using text analytics to mine various sources of data for opinions. ... However, big data technology is made to handle the different sources and different formats of the structured and unstructured data.
16	<b>Compare and contrast RTAP (Real Time Analytics Platform) and RTSA (Real Time Sentiment Analysis)? BTL5</b> A real-time analytics platform enables organizations to make the most out of real-time data by helping them to extract the valuable information and trends from it. Such platforms help in measuring data from the business point of view in real time, further making the best use of data.
17	<b>Prove by induction on m that <math>1+3+5+\dots+(2m-1) = m^2</math>. BTL4</b> 1st moment = sum of the numbers of elements = length of the stream. Easy to compute. 2nd moment = surprise number = a measure of how uneven the distribution is. Stream of length 100; 11 values appear.
18	<b>List any 4 online tool to perform sentiment analysis. BTL1</b> HubSpot's ServiceHub. HubSpot's ServiceHub tools include a customer feedback tool that can break down qualitative survey responses and evaluate them for positive or negative intent. ... Quick Search. ... Reputate. ... Lexalytics. .
19	<b>Generalize information would you use to substitute the view of streams over databases? BTL6</b> Perforce streams are "branches with brains," a containerized approach to managing bodies of related files such as codelines. ... Most notably, streams are defined hierarchically using the mainline model, and Perforce generates the views for workspaces that are associated with a stream based on strictly inherited rules.
	<b>PART * B</b>
1	<b>What are streams? Explain stream data model with its architecture.(13) BTL2</b> Answer page : 11 – Patterson. <ul style="list-style-type: none"> <li>✓ Data Stream Management System (5M)</li> <li>✓ Data Streaming Architecture (3M)</li> <li>✓ Diagram (2M)</li> <li>✓ Issues in data Stream Query Processing(3M)</li> </ul>
2	<b>What is decaying window? briefly explain it with an example (13) BTL1</b>  Answer page : <ul style="list-style-type: none"> <li>✓ Definition explanation (5M)</li> <li>✓ Graph (3M)</li> <li>✓ Example (5M)</li> </ul>

	<b>Write a short note on sampling in Data Streams.(7) What are the applications of data stream.(6)</b> <b>BTL2</b>
3	<b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of Sampling (1M)</li> <li>✓ Reservoir Sampling (3M)</li> <li>✓ Biased Reservoir Sampling (3M)</li> <li>✓ Concise Sampling (3M)</li> </ul>
4	<b>Describe about Stream clustering and parallel clustering. (13) BTL1</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Algorithm(2M)</li> <li>✓ Diagram ( 3M)</li> <li>✓ Example (5M)</li> </ul>
5	<b>Discuss the concept of decaying window in detail.(13) BTL3</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Algorithm(2M)</li> <li>✓ Diagram ( 3M)</li> <li>✓ Example (5M)</li> </ul>
6	<b>i. Explain in detail about how data analysis used in Stock Market Predictions(13) BTL2</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Generalised Architecture(5M)</li> <li>✓ Explanation with Example (5M)</li> </ul>
7	<b>Explain the concept of Bloom Filter with an example.(13) BTL4</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Algorithm(5M)</li> <li>✓ Explanation with Example (5M)</li> </ul>
8	<b>Show how the mining concept used in real time sentiment analysis? (13) BTL3</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Architecture of Real Time Analytics Platform(5M)</li> <li>✓ Basic Building blocks of Real Time Analytics Platform(5M)</li> </ul>
9	<b>How is sentiment analysis playing a major role in data mining? (13) BTL4</b> <b>Answer page :</b> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of analysis (1M)</li> <li>✓ Data mining concepts (3M)</li> <li>✓ Role of Sentiment analysis (3M)</li> </ul>

	<ul style="list-style-type: none"> <li>✓ Example (3M)</li> </ul>
<b>PART * C</b>	
1	<p><b>How does the Big Data Stream Analytics Framework (BDSAF) works and explain with a neat architecture diagram. BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of Stream analytics (3M)</li> <li>✓ BDSAF (5M)</li> <li>✓ Architecture and Example(4M)</li> </ul>
<p><b>2 Explain in detail about Alon-Matias-Szegedy algorithm for second moments. BTL3</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types (2M)</li> <li>✓ <b>about Alon-Matias-Szegedy algorithm (10 M)</b></li> </ul>	
3	<p><b>Discuss in detail about characteristics of a social network as a graph. BTL3</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition (3M)</li> <li>✓ Types of networks (1M)</li> <li>✓ Characteristics (8M)</li> <li>✓ Example (3M)</li> </ul>
4	<p><b>(i) Classify approaches would you use to estimate the moments?</b>  <b>(ii) Examine is the function cost of exact counts? BTL5</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types (1M)</li> <li>✓ estimate the moments (4M)</li> <li>✓ function cost of exact counts (4M)</li> <li>✓ Example (3M)</li> </ul>

### UNIT-V NO SQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding -- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Q.N o	<b>PART * A</b>
1	<p><b>What is NoSQL database? BTL1</b></p> <p>NoSQL encompasses a wide variety of different database technologies that were developed in response to the demands presented in building modern applications: Developers are working with applications that create massive volumes of new, rapidly changing data types — structured, semi-structured, unstructured and polymorphic data.</p>

2	<b>What is Key Value data store? BTL1</b>
3	<b>Compare document store vs Key value store. BTL1</b> The difference lies in the way the data is processed; in a key-value store the data is considered to be inherently opaque to the database, whereas a document-oriented system relies on internal structure in the document in order to extract metadata that the database engine uses for further optimization.
4	<b>Provide your own definition of what big data means to your organization? BTL1</b>
5	<b>Outline the sharding? BTL5</b> It splits the database into unique pieces, each of which is hosted on a different server. For best performance, you want to keep data that are accessed together in the same shard (in other words, on the same physical machine).
6	<b>Identify three “big data” sources either within or external to your organization that would be relevant to your business. BTL2</b>
7	<b>Define Tabular store. BTL2</b>
8	<b>Summarize the features of Hive. BTL4</b>
	It stores schema in a database and processed data into HDFS.
	It is designed for OLAP.
	It provides SQL type language for querying called HiveQL or HQL.
	It is familiar, fast, scalable, and extensible
9	<b>What is Hive in Big data? BTL4</b>
	Hive is a data warehouse infrastructure tool to process structured data in Hadoop.
	It resides on top of Hadoop to summarize Big Data, and makes querying and analyzing easy.
	This is a brief tutorial that provides an introduction on how to use Apache Hive HiveQL with Hadoop Distributed File System.
10	<b>List out any three business challenges in an organization. BTL3</b>
	Uncertainty about the future. ...
	Financial management. ...
	Monitoring performance. ...
	Regulation and compliance. ...
	Competencies and recruiting the right talent. ...
	Technology. ...
	Exploding data. ...
	Customer service.
11	<b>Figure out the process of validating big data. BTL3</b>
	Step 1: Determine Data Sample. Determine the data to sample. ...
	Step 2: Validate the Database. Before you move your data, you need to ensure that all the required data is present in your existing database. ...
	Step 3: Validate the Data Format.

12	<p><b>Define object data stores. BTL1</b></p> <p>Object storage (also known as object-based storage) is a computer data storage architecture that manages data as objects, as opposed to other storage architectures like file systems which manages data as a file hierarchy, and block storage which manages data as blocks within sectors and tracks.</p>
13	<p><b>Justify how twitter data is useful for analyzing big data. BTL2</b></p> <p>Find out how to use Twitter's analytics dashboard to find the data you're looking for. Use Twitter's analytics dashboard to find the data you're looking for. Use Twitter Analytics to track monthly impressions. Find out which tweets did the best to find out what content your leads respond to.</p>
14	<p><b>Point out top data analytic tools. BTL5</b></p> <p>R Programming. R is the leading analytics tool in the industry and widely used for statistics and data modeling. .... Tableau Public: ... SAS: ... Apache Spark. ... Excel. ... RapidMiner:</p>
15	<p><b>Define R. BTL1</b></p> <p>Programming with Big Data in R (pbdR) is a series of R packages and an environment for statistical computing with big data by using high-performance statistical computation. ... R system mainly focuses on single multi-core machines for data analysis via an interactive mode such as GUI interface.</p>
<b>PART * B</b>	
1	<p><b>List the classification of NoSQL Databases and explain about Key Value Stores. (13) BTL3</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition and Introduction (3M)</li> <li>✓ Example table (3M)</li> <li>✓ Operations in Key value store(5M)</li> <li>✓ Diagram(2M)</li> </ul>
2	<p><b>Describe the system architecture and components of Hive and Hadoop(13) BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction to Grapg database (3M)</li> <li>✓ Data Fields in data store (1M)</li> <li>✓ Diagram(3M)</li> <li>✓ Hadoop explanation (3M)</li> <li>✓ Example (3M)</li> </ul>
3	<p><b>What is NoSQL? What are the advantages of NoSQL? Explain the types of NoSQL databases. (13) BTL1</b></p> <p><b>Answer page :</b></p>

	<ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of NoSQL databases (4 M)</li> <li>✓ Schema Less models (3M)</li> <li>✓ Example (3M)</li> </ul>
4	<p><b>Explain about Graph databases and descriptive Statistics(13) BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition (2M)</li> <li>✓ Introduction to Graph database (3M)</li> <li>✓ Data Fields in data store (5M)</li> <li>✓ Diagram(3M)</li> </ul>
5	<p><b>What is HBase? Give detailed note on features of HBASE(13) BTL4</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Features of HBase 2(M)</li> <li>✓ Commands in HBase (8M)</li> </ul>
6	<p><b>What is the purpose of Sharding? Explain the process of Sharding in MongoDB. BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Purpose of sharding 2(M)</li> <li>✓ Working of MongoDB (8M)</li> </ul>
7	<p><b>Explain the types of NoSQL data stores in detail. BTL3</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of NoSQL databases (5M)</li> <li>✓ Schema Less models (3M)</li> <li>✓ Example (2M)</li> </ul>
8	<p><b>Discuss in detail about the characteristics of NoSQL databases. BTL4</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of NoSQL databases (5M)</li> <li>✓ Schema Less models Characteristics (3M)</li> <li>✓ Example (2M)</li> </ul>
	<b>PART C</b>
1	<p><b>Analyze the use of Hive. How does Hive interact with Hadoop explain in detail.(15) BTL4</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction to Grapg database (3M)</li> <li>✓ Data Fields in data store (1M)</li> <li>✓ Diagram(3M)</li> <li>✓ Hadoop interaction (5M)</li> <li>✓ Example (3M)</li> </ul>

2	<p><b>Explain in detail about brief history of NoSQL. Explain in detail about ACID vs. BASE.(15) BTL6</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of NoSQL databases (5M)</li> <li>✓ Schema Less models (4M)</li> <li>✓ Example (3M)</li> </ul>
3	<p><b>Draw insights out of any one visualization tool. BTL5</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Definition explanation (3M)</li> <li>✓ Types of Tools s (5M)</li> <li>✓ Working models and Example (4M)</li> <li>✓ Example (3M)</li> </ul> <p>The best data visualization tools include Google Charts, Tableau, Grafana, Chartist. js, FusionCharts, Datawrapper, Infogram, ChartBlocks, and D3. ... The best tools offer a variety of visualization styles, are easy to use, and can handle large data sets.</p>
4	<p><b>Formulate how big data analytics helps business people to increase their revenue. Discuss with any one real time application.BTL5</b></p>
<p><b>Answer page :</b></p> <p>Big data significantly contributes to adding value to the organization by:</p> <ul style="list-style-type: none"> <li>• <b>Increasing revenues:</b> As an example, an expectation of using a recommendation engine would be to increase same-customer sales by adding more items into the market basket. (4M)</li> <li>• <b>Lowering costs:</b> As an example, using a big data platform built on commodity hardware for ETL would reduce or eliminate the need for more specialized servers used for data staging, thereby reducing the storage footprint and reducing operating costs. (3M)</li> <li>• <b>Increasing productivity:</b> Increasing the speed for the pattern analysis and matching done for fraud analysis helps to identify more instances of suspicious behavior faster, allowing for actions to be taken more quickly and transform the organization from being focused on recovery of funds to proactive prevention of fraud. (4M)</li> <li>• <b>Reducing risk:</b> Using a big data platform or collecting many thousands of streams of automated sensor data can provide full visibility into the current state of a power grid, in which unusual events could be rapidly investigated to determine if a risk of an imminent outage can be reduced. (4M)</li> </ul>	
5	<p><b>Explain in detail about Market and Business drives for big data analytics.BTL1</b></p> <p><b>Answer page :</b></p> <ul style="list-style-type: none"> <li>✓ Introduction (2M)</li> <li>✓ Definition of Frequent Itemsets (4M)</li> <li>✓ Applications of Frequent Itemsets (4M)</li> <li>✓ Association Rules (2M)</li> <li>✓ Finding Association Rules with High Confidence(2M)</li> <li>✓ Example(3M)</li> </ul>

The market-basket model of data is used to describe a common form of manymany relationship between two kinds of objects. On the one hand, we have items, and on the other we have baskets, sometimes called "transactions."

Each basket consists of a set of items (an itemset), and usually we assume that the number of items in a basket is small – much smaller than the total number of items. The number of baskets is usually assumed to be very large, bigger than what can fit in main memory. The data is assumed to be represented in a file consisting of a sequence of baskets.



**CS8092 COMPUTER GRAPHICS AND MULTIMEDIA****LTPC 3003****OBJECTIVES:**

- To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- To become familiar with various software programs used in the creation and implementation of multi- media
- To appreciate the importance of technical ability and creativity within design practice.
- To gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

**UNIT I ILLUMINATION AND COLOR MODELS****9**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**UNIT II TWO-DIMENSIONAL GRAPHICS****9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, two-dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**UNIT III THREE-DIMENSIONAL GRAPHICS****9**

Three dimensional concepts; Three-dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three-dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**UNIT IV MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING****9**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards –

Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

**UNIT V      HYPERMEDIA**

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

**9****TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Donald Hearn and M. Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2003.
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003.

**REFERENCES:**

3. Judith Jeffcoate, “Multimedia in practice: Technology and Applications”, PHI, 1998.
4. Foley, Vandam, Feiner and Huges, “Computer Graphics: Principles and Practice”, 2nd Edition, Pearson Education, 2003.

**Subject Code: CS8092****Year/Semester: III/06****Subject Name: Computer Graphics & Multimedia****Subject Handler: Daya Mathew****UNIT I- ILLUMINATION AND COLOR MODELS**

**Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.**

**PART\* A**

<b>Q.N O</b>	<b>QUESTIONS</b>
1.	<b>State the nature of Line Primitive in Graphics.</b> (Nov/Dec 2015) <b>BTL4</b> The line type, width and color are the attributes of the line. The line type includes solid line, dashed lines, and dotted lines.
2.	<b>Digitize a line from (10, 12) to (15, 15) on a raster screen using Bresenham's straight line algorithm.</b> (Nov/Dec 2016) <b>BTL3</b> Answer: (11, 13), (12, 13), (13, 14), (14, 14) and (15, 15)
3.	<b>Define Aspect Ratio.</b> (Nov/Dec 2016) <b>BTL1</b> The aspect ratio of an image describes the proportional relationship between its width and its height. It is commonly expressed as two numbers separated by a colon, as in 16:9. For an x:y aspect ratio, no matter how big or small the image is, if the width is divided into x units of equal length and the height is measured using this same length unit, the height will be measured to be y units
4.	<b>What is meant by aliasing?</b> (Nov/Dec 2016) <b>BTL1</b> The distortion of information due to low frequency sampling (Under sampling) is called aliasing. We can improve the appearance of displaying raster lines by applying antialiasing methods that compensate for the under-sampling process.
5.	<b>Distinguish between window port &amp; view port.</b> (Nov/Dec 2016) <b>BTL2</b> A portion of a picture that is to be displayed by a window is known as window port. The display area of the part selected or the form in which the selected part is viewed is known as view port
6.	<b>List out the graphics applications.</b> (Nov/Dec 2016) <b>BTL3</b> <ul style="list-style-type: none"> <li>• Paint programs: Allow you to create rough freehand drawings. The images are stored as bit maps and can easily be edited. Illustration/design programs: Supports more advanced features than paint programs, particularly for drawing curved lines. The images are usually stored in vector-based formats. Illustration/design programs are often called draw programs.</li> <li>• Presentation graphics software: Lets you create bar charts, pie charts, graphics, and other types of images for slide shows and reports. The charts can be based on data imported from spreadsheet applications.</li> </ul>

7.	<b>List out the circle drawing algorithms.</b> DDA circle drawing algorithm Bresenham's algorithms Midpoint algorithms	BTL2
8.	<b>What is HSV model?</b> The HSV(Hue,Saturation,Value) model is a color model which uses color descriptions that have a more intuitive appeal to a user. To give a color specification, a user selects a spectral color and the amounts of white and black that are to be added to obtain different shades, tint, and tones.	BTL1
9.	<b>Describe about RGB model.</b> The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography.	BTL3
10.	<b>What is HLS model?</b> HSL stands for hue, saturation, and lightness, and is often also called HLS. This HLS model describes colours in the following terms: Hue, which is the horizontal axis of square box in the picture above, and varies from magenta - red - yellow - green - cyan - blue - magenta. Saturation, which is the vertical axis of the square box, and describes how "grey" the color. Lightness, which is the second picture box and varies from black through the color to white.	BTL3
11.	<b>State HSV model.</b> The HSV (Hue, Saturation, Value) model is a color model which uses color Descriptions that have a more intuitive appeal to a user. To give a color specification, a user selects a spectral color and the amounts of white and black that are to be added to obtain different shades, tint, and tones.	BTL3
12.	<b>Define CMY.</b> Cyan, magenta, and yellow are the secondary colors with respect to the primary colors of red, green, and blue. However, in this subtractive model, they are the primary colors and red, green, and blue, are the secondaries. In this model, colors are formed by subtraction, where adding different pigments causes various colors not to be reflected and thus not to be seen. Here, white is the absence of colors, and black is the sum of all of them. This is generally the model used for printing.	BTL1
13	<b>Define color model.</b> A Color model is a method for explaining the properties or behavior of color Within some particular context.	BTL2
14	<b>What are the parameters in the HLS color model?</b> Hue Lightness Saturation.	BTL1
15	<b>What are the uses of chromaticity diagram?</b> The chromaticity diagram is useful for the following: Comparing color gamut's for different sets of primaries. Identifying complementary colors. Determining dominant wavelength and purity of a given color.	BTL3

16	<b>How does Y, I, Q represent in YIQ color model?</b>	<b>BTL4</b>
	Y is luminance only part picked up by Black and White Televisions Y is given most bandwidth in signal I, Q channels (or U, V) contain chromaticity information.	
17	<b>Classify fractals.</b>	<b>BTL4</b>
	A Fractal is an object whose shape is irregular at all scales. The patterns in the random fractals are no longer perfect and the random defects at all scale. A geometric fractal is a fractal that repeats self-similar patterns over all scales. Exact self-similarity Quasi self-similarity and Statistical self-similarity	

<b>PART *B</b>		
1	<b>Explain midpoint circle algorithm in detail.</b> <b>Page:1.40-Godse</b> Circle is defined as a set of points that are all at a: given distance r from a center position (Xc, Yc). (3M) This distance relationship is expressed by the Pythagorean Theorem in Cartesian coordinates as $(X-Xc)^2 + (Y-Yc)^2 = r^2$ <p><b>Midpoint Circle Algorithm (10M)</b></p> <ul style="list-style-type: none"> <li>• Input radius r and circle center (xc,yc) and obtain the first point on the circumference of a circle centered on the origin as <math>(x_0,y_0)=(0,r)</math></li> <li>• Calculate the initial value of the decision parameter as <math>P_0=5/4 - r</math></li> <li>• At each xk position, starting at k=0, perform the following test: if <math>P_k &lt; 0</math>, then next point along the circle centered on (0,0) is <math>(x_{k+1},y_k)</math> and <math>P_{k+1}=P_k+2x_k+1 + 1</math> otherwise the next point along the circle is <math>(x_{k+1},y_{k-1})</math> and <math>P_{k+1}=P_k + 2x_k+1 + 1 - 2y_k+1</math> where <math>2x_k+1 = 2x_k + 2</math>,</li> <li>• Determine the symmetry points in the other seven octants</li> <li>• Move each calculated position (x, y) onto the circular path centered on (xc, yc) and plot the coordinate values <math>x=x+xc</math>, <math>y=y+yc</math> Repeat steps 3 to 5 until <math>x \geq y</math></li> </ul>	<b>(13M) BTL4 Answer:</b>
2	<b>Compose the Bresenham's line drawing algorithm for lines with all possible slopes</b> <b>(13M) BTL6</b> <b>Answer: Page:1.17-Godse</b> <b>Bresenham's Line Algorithm (3M)</b> This algorithm uses only integer addition, subtraction, and multiplication by 2. So it is efficient for scan converting algorithms. This algorithm increments either x or y by one unit depending on the slope of the line. The increment in the other variable is determined by examine the distance between the actual line location and the nearest pixel. This distance is called decision variable or the error.	

	<p>Figure: for pixel distance (2M)</p> <p>In mathematical terms the error or decision variable is defined as</p> $e = D_b - D_a$ <p>We have to find the next pixel position either <math>((x_k+1, y_k)</math> and <math>(x_k+1, y_k+1)</math>(2M)</p> <ul style="list-style-type: none"> <li>• Get the two end points (6M)</li> <li>• Calculate the values <math>dx</math>, <math>Dy</math>, <math>2dy</math> and <math>2dy-2dx</math> where <math>dx=X_2-X_1</math> and <math>dy=Y_2-Y_1</math></li> <li>• Calculate the starting decision parameter <math>d=2dy-dx</math></li> <li>• plot the first point</li> <li>• At each <math>X_k</math> along the line, starting at <math>k=0</math>, perform the following test</li> </ul>
3	<p><b>Explain the basic concept of Midpoint ellipse algorithm. Derive the decision parameters for the algorithm and write down the algorithm steps. (13M) (May/June 2016) BTL3</b></p> <p><b>Answer: Page:1.45-Godse</b></p> <p><b>Properties of the Ellipse: (4M)</b></p> <p>An ellipse is a set of points such that the sum of the distances from two fixed positions (foci) is the same for all points. If the distances to any two foci from any point <math>P=(x, y)</math> on the ellipse are labeled <math>d_1</math> and <math>d_2</math> then the general equation of an ellipse can be stated as <math>d_1 + d_2</math> is constant. An ellipse in standard position is symmetric between quadrants. But it is not symmetric between the two octants of the quadrant.</p> <p><b>Midpoint Ellipse Algorithm (9M)</b></p> <ul style="list-style-type: none"> <li>• Input <math>rx</math>, <math>ry</math> and ellipse center <math>(xc, yc)</math> and obtain the first point on an ellipse centered on the origin as <math>(x_0, y_0) = (0, ry)</math></li> <li>• Calculate the initial value of the decision parameter in region 1 as <math>p_{10} = r^2y - r^2xry + \frac{1}{4}r^2x</math></li> <li>• At each <math>x_k</math> position in region 1, starting at <math>k=0</math>, perform the following test If <math>p_{1k} &lt; 0</math>, the next point along the ellipse centered on <math>(0, 0)</math> is <math>(x_{k+1}, y_k)</math> Otherwise the next point along the circle is <math>(x_{k+1}, y_{k-1})</math> <math>p_{1k+1} = p_{1k} + 2r^2yx_{k+1} - 2r^2yx_{k+1} + r^2y</math> With <math>2r^2yx_{k+1} = 2r^2yx_k + 2r^2y - 2r^2xy_k - 2r^2x</math></li> <li>• Calculate the initial value of the decision parameter in region 2 using the last point <math>(x_0, y_0)</math> calculated in region 1 as <math>p_{20} = r^2y(x_0+1/2)^2 + r^2x(y_0-1)^2 - r^2xr^2y</math></li> <li>• At each <math>y_k</math> position in region 2 starting at <math>k=0</math>, perform the following test if <math>p_{2k} &gt; 0</math> the next point along the ellipse centered on <math>(0, 0)</math> is <math>(x_k, y_{k-1})</math> and <math>p_{2k+1} = p_{2k} - 2r^2xy_{k+1} + r^2x</math> Otherwise The next point along the circle is <math>(x_{k+1}, y_{k-1})</math> and <math>p_{2k+1} = p_{2k} + 2r^2yx_{k+1} - 2r^2xy_{k+1} + r^2x</math> Using the same incremental calculations for <math>x</math> and <math>y</math> as in region 1</li> <li>• Determine symmetry points in the other three quadrants. □ Move each calculated pixel position <math>(x, y)</math> onto the elliptical path centered on <math>(xc, yc)</math> and plot the coordinate values. <math>X=x+xc</math>, <math>y=y+yc</math></li> <li>• Repeat the steps for region 1 until <math>2r^2yx &gt;= 2r^2xy</math></li> </ul>
4	<p><b>Discuss briefly about attributes. (13M) BTL2</b></p> <p><b>Answer: Page:1.30-Godse</b></p> <ul style="list-style-type: none"> <li>• Definition Parameter that affects the way a primitive will be displayed</li> <li>• Line Attribute(2M)</li> </ul>

	<p>Type Width Color Pen &amp; Brush</p> <ul style="list-style-type: none"> <li>• Curve Attribute (3M) Thicker curves can be produced by:           <ol style="list-style-type: none"> <li>1. Plotting additional pixel</li> <li>2. Filling the space between two concentric circles.</li> <li>3. Using thicker pen or brush</li> </ol> </li> <li>• Color and gray scale level(2M) Colors are represented by colors codes which are positive integers. Color information is stored in frame buffer or in separate table and use pixel values as index to the color table. Two ways to store color information:     Direct     Indirect</li> <li>• Area filled attribute (3M) Option for filling a defined region is whether solid, pattern and colors.</li> <li>• Text and Characters (3M) Very important output primitive Many pictures require text Two general techniques used           <ul style="list-style-type: none"> <li>– Bitmapped (raster)</li> <li>– Stroked (outline)</li> </ul> </li> </ul>
5.	<p><b>Write brief notes on color models.</b> <span style="float: right;">(13M) BTL4</span></p> <p><b>Answer: Page: 7.8 -Godse</b></p> <p>Way of color can be represented as tuples of numbers</p> <p>Typically, 3 or 4 values of color components Color space (3M)</p> <p>Two types</p> <ul style="list-style-type: none"> <li>Subtractive color model</li> <li>Additive color model</li> </ul> <p>Color model list(4M)</p> <ul style="list-style-type: none"> <li>RGB</li> <li>YIQ</li> <li>CMY</li> <li>HSV</li> <li>HLS</li> <li>CIE</li> </ul> <p>Applications: (3M)</p> <ul style="list-style-type: none"> <li>Color monitors</li> <li>Light interacts with every objects</li> <li>Light is observed by a scattered at object surface</li> <li>Observed by sensor</li> </ul> <p>Property 1 (frequency)</p> <p>Property 2 (Brightness)</p> <p>Property 3 (saturation or purity)</p> <p>Other property (photons)</p> <p>Chromaticity (3M)</p> <p>Purity and frequency</p> <p>Complementary colors</p>

	When two color sources are combined to produce white color Primary color Used to produce gamut in a particular model
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**PART\* C**

1	<b>Plot a circle at origin having centre as (0,0) and radius=8 using Bresenham's circle algorithm. (15M)</b> <b>(NOV/DEC 2016) BTL 6</b> <b>Answer: Page:1.49-Godse</b> Initial values (2M) Decision variable Pk(2M) Next Decision variable: Pk+1(3M) Plot the curve(8M)
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**UNIT 2- TWO-DIMENSIONAL GRAPHICS**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, two-dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**PART\* A**

Q.NO	QUESTIONS	
1	<b>Write outline viewing pipeline.</b> The viewing pipeline is a group of processes common from wireframe display through to near photo-realistic image generation, and is basically concerned with transforming objects to be displayed from specific viewpoint and removing surfaces that cannot be seen from this viewpoint.	<b>BTL2</b>
2	<b>What is meant by clipping? Where it happens?</b> Any procedure that identifies those portions of a picture that are either inside or outside of a	<b>BTL1</b>

	specified region of space is referred to as a clipping algorithm, or simply clipping. The region against which an object is to be clipped is called a clip window.	
3	<b>Distinguish between window port &amp; view port.</b> A portion of a picture that is to be displayed by a window is known as window port. The display area of the part selected or the form in which the selected part is viewed is known as view port.	<b>BTL2</b>
5	<b>Distinguish between uniform scaling and differential scaling.</b> When the scaling factors sx and sy are assigned to the same value, a uniform scaling is produced that maintains relative object proportions. Unequal values for sx and sy result in a differential scaling that is often used in design application.	<b>BTL2</b>
6	<b>Write down the shear transformation matrix.</b> Shear is a transformation that distorts the shape of an object such that the transformed shape appears as if the object were composed of internal layers that had been caused to slide over each other. Two common shearing transformations are those that shift coordinate x values and those that shift y values. An x direction shear relative to the x axis is produced with the transformation matrix $1 \ shx \ 0 \ 0 \quad 1 \ 0 \ 0 \quad 0 \ 1$ Which transforms coordinate positions as $X' = x + shx.y \ y' = y$ .	<b>BTL4</b>
7	<b>What is point clipping and write its inequalities?</b> Assuming that the clip window is a rectangle in standard position, we save a point P = (x, y) for display if the following inequalities are satisfied: $xwmin \leq x \leq xwmax$ $ywmin \leq y \leq ywmax$	<b>BTL2</b>
8	<b>Define Scan-line Polygon fill algorithm.</b> For each scan line crossing a polygon, the area-fill algorithm locates the intersection points of the scan line with the polygon edges. These intersection points are then sorted from left to right, and the corresponding frame-buffer positions between each intersection pair are set to the specified fill color.	<b>BTL1</b>
9	<b>Define Boundary-Fill algorithm.</b> Area filling starts at a point inside a region and paint the interior outward toward the boundary. If the boundary is specified in a single color, the fill algorithm proceeds outward pixel by pixel until the boundary color is encountered. This method, called the boundary-flood fill algorithm.	<b>BTL1</b>
10	<b>Define Flood-Fill algorithm.</b> Sometimes we want to fill in (or recolor) an area that is not defined within a single color boundary. We can paint such areas by replacing a specified interior color instead of searching for a boundary color value. This approach is called a flood-fill algorithm	<b>BTL1</b>
11	<b>What is Transformation?</b> Transformation is the process of introducing changes in the shape size and orientation of the object using scaling rotation reflection shearing & translation etc.	<b>BTL2</b>
12	<b>What is translation?</b> Translation is the process of changing the position of an object in a straight-line path from one coordinate location to another. Every point (x, y) in the object must undergo a displacement to (x <sub>I</sub> , y <sub>I</sub> ). the transformation is: $x' = x + tx ; y' = y + ty$	<b>BTL2</b>
13	<b>What is rotation?</b> A 2-D rotation is done by repositioning the coordinates along a circular path, in the x-y	<b>BTL2</b>

	plane by making an angle with the axes. The transformation is given by: $X' = r \cos (q + f)$ and $Y' = r \sin (q + f)$ .	
14	<b>Define scaling</b> A scaling transformation alters the size of an object. This operation can be carried out for polygons by multiplying the coordinate values (x, y) of each vertex by scaling factors sx and sy to produce the transformed coordinates (x', y'). $x' = x \cdot sx$ , $y' = y \cdot sy$	<b>BTL2</b>
15	<b>What is shearing?</b> The shearing transformation actually slants the object along the X direction or the Y direction as required. ie this transformation slants the shape of an object along a required plane.	<b>BTL2</b>
16	<b>What is reflection?</b> The reflection is actually the transformation that produces a mirror image of an object. For this use some angles and lines of reflection.	<b>BTL2</b>
17	<b>List out the types of clipping.</b> Point Text Curve Interior/exterior Line Polygon	<b>BTL3</b>
18	<b>What are the types of geometric transformation?</b> Translation Rotation reflection scaling shearing	<b>BTL2</b>
19	<b>What is Composite transformations?</b> Sequence of transformations is called as composite transformation. It is obtained by forming products of transformation matrices is referred as a concatenation (or)composition of matrices.	<b>BTL2</b>
<b>PART * B</b>		
1	<b>Describe 2D geometric transformations.</b> <b>BTL2</b> Answer: Page:2.2-Godse A Translation is applied to an object by repositioning it along a straight line path from one coordinate location to another. We translate a two dimensional point by adding translation distances tx and ty to the original position (x,y) to move the point to a new location (x',y') $X' = x + tx$ $Y' = y + ty$ $\text{triangle} = \{ p1=(1,0), p2=(2,0), p3=(1.5,2) \}$ figure (refer notes) (3M) <b>Rotation (5M)</b>  A two dimensional rotation is applied to an object by repositioning it along a circular path	(13M)

	<p>in the xy plane. To generate a rotation, we specify a rotation angle theta and the position (xr, yr) of the rotation point (or pivot point) about which the object is to be rotated.</p> $X' = x \cos \theta - y \sin \theta$ $Y' = x \sin \theta + y \cos \theta$ <p>Figure: rotation</p> <h3>Scaling (5M)</h3> <p>A scaling transformation alters the size of an object. This operation can be carried out for polygon by multiplying the coordinate values (x,y) of each vertex by scaling factors <math>s_x</math> and <math>s_y</math> to produce the transformed coordinates (x',y').</p> $X' = x \cdot s_x$ $Y' = y \cdot s_y$ $P = X_1$ $P' = X_1'$ $S = s_x 0$ $X_2' = 0 \cdot s_y$ $P' = P * S$ <p>If <math>s_x = s_y</math>, then it produces the uniform scaling</p>
2	<p><b>Explain Cohen- Sutherland line clipping algorithm with an example. (13M) BTL3</b></p> <p><b>Answer: Page:3.13-Godse</b></p> <p>It is developed by Dan Cohen and Ivan Sutherland.</p> <p>To speed up the processing this algorithm performs initial tests that reduces the number of intersections that must be calculated. (2M)</p> <p>The given a line segment, repeatedly:</p> <ul style="list-style-type: none"> <li>Check for trivial acceptance both</li> <li>Check for trivial rejection <ul style="list-style-type: none"> <li>Both endpoints of the same side of clip rectangle</li> <li>Both endpoints outside clip rectangle (2M)</li> </ul> </li> </ul> <p>Divide segment in two where one part can be trivially rejected</p> <p>Clip rectangle extended into a plane divided into 9 regions. Each region is defined by a unique 4bit string (2M)</p> <p>For each line segment: (7M)</p> <ul style="list-style-type: none"> <li>Each end point is given the 4-bit code of its region</li> <li>Repeat until acceptance or rejection</li> <li>If both codes are 0000 -&gt; trivial acceptance</li> <li>If logical AND of codes is not 0000 -&gt; trivial rejection</li> <li>Divide line into 2 segments using edge of clip rectangle</li> <li>Find an endpoint with code not equal to 0000</li> <li>Lines that cannot be identified as completely inside or outside are checked for the intersection with two boundaries.</li> <li>Break the line segment into 2 line segments at the crossed edge</li> <li>Forget about the new line segment lying completely outside the clip rectangle</li> <li>Draw the line segment which lies within the boundary reign.</li> </ul>
3	<p><b>Discuss on the various input techniques in detail. (13M) BTL1</b></p> <p><b>Answer: Page:1.34-Godse</b></p> <p>Graphics program uses several kind of input data (2M)</p>

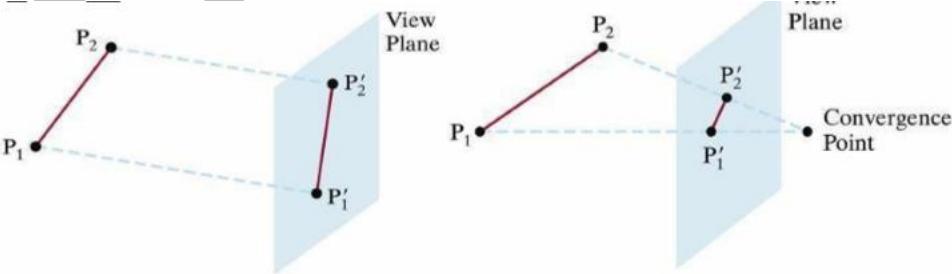
	<p>Package independent of the particular software's.</p> <p>Logical classification of input devices (2M)</p> <ul style="list-style-type: none"> <li>LOCATOR</li> <li>STROKE</li> <li>STRING</li> <li>VALUATOR</li> <li>CHOICE</li> <li>PICK</li> </ul> <p>Input Functions (3M)</p> <p>It deals with,</p> <ul style="list-style-type: none"> <li>How graphics program and devices are to interact.</li> <li>When the data are to be input?</li> <li>Which devices is to be used at that time?</li> </ul> <p>Type of modes (2M)</p> <ul style="list-style-type: none"> <li>Request mode</li> <li>Sample mode</li> <li>Event mode</li> </ul> <p>Interactive picture constructing technique: (2M)</p> <p>Several techniques are used</p> <ul style="list-style-type: none"> <li>• Constraints</li> <li>• Grids</li> <li>• Gravity field</li> <li>• Rubber band method</li> <li>• Dragging</li> <li>• Painting and drawing</li> </ul> <p>Initial values for input devices parameters (2M)</p> <p><b>Example:</b> Initialize.. (ws, device code, ..., pe, coordext, datarec)</p> <p>Here</p> <ul style="list-style-type: none"> <li>Pe----prompt and echo types</li> <li>Coordtext-----four coordinate values</li> <li>Datarec ---- records values for control parameters</li> </ul>
3	<p><b>Show a transformation matrix for rotating an object about a specified pivot point. (13M)</b></p> <p><b>BTL1</b></p> <p><b>Answer:page:2.15-Godse</b></p> <ul style="list-style-type: none"> <li>• A two-dimensional rotation is applied to an object by repositioning it along a circular path in the xy plane. (4M)</li> <li>• To generate a rotation, we specify a rotation angle theta and the position (xr, yr) of the rotation point (or pivot point) about which the object is to be rotated.</li> <li>• Positive value of the rotation angle defines counter clock wise rotation.</li> <li>• Negative value of the rotation angle defines the clock wise rotation.</li> </ul> $X' = x \cos \theta - y \sin \theta$ $Y' = x \sin \theta + y \cos \theta$ <p>Using column vector <math>P' = P * R</math> <math>R = \begin{pmatrix} \cos \theta &amp; -\sin \theta \\ \sin \theta &amp; \cos \theta \end{pmatrix}</math> (2M)</p>

	<p>Figure : (2M)</p> <p>Rotation of an arbitrary pivot point (2M)</p> <p>Rotation of a point about any specified rotation position (xr,yr)</p> <ul style="list-style-type: none"> <li>○ <math>X' = X_r + (X - X_r) \cos\theta - (Y - Y_r) \sin\theta</math></li> <li>○ <math>Y' = Y_r + (X - X_r) \sin\theta + (Y - Y_r) \cos\theta</math></li> </ul> <ul style="list-style-type: none"> <li>▪ It moves objects without deformations.</li> <li>▪ Every point on an object is rotated through the same angle.</li> </ul> <p>General pivot point rotation (3M)</p> <p>Rotation about any selected pivot point (xr, yr) by performing the following sequence of translate – rotate – translate operations.</p> <ul style="list-style-type: none"> <li>○ Translate the object so that the pivot point is at the co-ordinate origin.</li> <li>○ Rotate the object about the coordinate origin</li> <li>○ Translate the object so that the pivot point is returned to its original position</li> </ul> <p><math display="block">\begin{matrix} 1 &amp; 0 &amp; x_r &amp; \cos\theta &amp; -\sin\theta &amp; 0 &amp; 1 &amp; 0 &amp; -x_r &amp; 0 &amp; 1 &amp; y_r &amp; \sin\theta &amp; \cos\theta &amp; 0 &amp; 0 &amp; 1 &amp; -y_r &amp; 0 &amp; 0 &amp; 1 &amp; 0 &amp; 0 &amp; 1 \end{matrix}</math></p>
<b>PART * C</b>	
1	<p><b>Perform a 45° rotation of triangle A(0,0), B(1,1), C(5,2) about P(-1,-1). (NOV/DEC 2016) (15 M) BTL6</b></p> <p>Answer: Page:2.14-Godse</p> <p>Finding Rotation matrix R (3M)</p> <p>Finding Translation matrix T1(3M)</p> <p>Finding Translation matrix T2 (3M)</p> <p>Finding R xT1 xT2 (3M)</p> <p>Plotting a triangle curve (3M)</p>
2	<p><b>Use the Cohen sutherland out code algorithm to clip two lines P1(40,15), P2(75,45), P3(70,20), P4(100,10) against a window A (50,10), B(80,10), C(80,40), D(50,40) (15M) BTL6</b></p> <p>Answer: Page:3.21-Godse</p> <p>Line 1</p> <ul style="list-style-type: none"> <li>finding XL, XR, YB, YR (3M)</li> <li>finding (XL, YL) (3M)</li> <li>finding (X, YL) (3M)</li> </ul> <p>Line 2</p> <ul style="list-style-type: none"> <li>Slope m? (2M)</li> <li>Finding (XR, Y) (3M)</li> </ul> <p>Representing Result I and plotting the curve (1M)</p>

### UNIT 3- THREE-DIMENSIONAL GRAPHICS

**Three dimensional concepts;** Three-dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. **TRANSFORMATION AND VIEWING:** Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three-dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

#### PART \* A

1	<b>Define Raster Animation.</b> Raster based animation frames (and all raster images for that matter) are made up of individual pixels. These pixels each contain information about the color and brightness of that particular spot on the image. This is somewhat similar to the concept of pointillism in painting, with the sum of the points making up the totality of the picture or frame.	<b>(NOV/DEC 2015) BTL1</b>
2	<b>Write the advantages of B spline over Bezier Curve.</b> B-spline curves can be considered a generalization of Bezier curves; they share many properties (they must obey the convex hull property, for one). Advantages in using B-splines is that they do provide affine invariance. This means that the coordinate system it is represented in can change without affecting the relative geometry of the curve; this is seen when the geometry of curve remains consistent when it is rotated, scaled, or translated. B-spline curves also address the issue of local control. This means that that modifying one control point only affects the part of the curve near that control point, which is really useful when designing shapes.	<b>BTL2</b>
3	<b>Define polygon or quadric surfaces.</b> Surfaces represented by second degree polynomials are quadratic surfaces. Ex: Sphere, Ellipsoid, Torus and cones	<b>(NOV/DEC 2015) BTL2</b>
4	<b>Differentiate parallel projection from perspective projection.</b> Objection descriptions are projected to the view plane	<b>BTL2</b>
		
5	<b>What is Composite transformation?</b> It can be formed by multiplying the matrix representation for the individuals operations in the	<b>(May/June 2016) BTL2</b>

	transformation sequence	
6	<b>Define Morphing.</b> Transformation of object shapes from one form to another is called morphing.	(NOV/DEC 2016) BTL2
7	<b>What are the steps involved in 3D transformation?</b> <ul style="list-style-type: none"> <li>• Modeling Transformation</li> <li>• Viewing Transformation</li> <li>• Projection Transformation</li> <li>• Workstation Transformation</li> </ul>	BTL2
8	<b>What is meant by view reference coordinate systems?</b> View Plane defined by: point on the plane - View Reference Point (VRP) normal to the plane pointing towards the center of projection- View-Plane Normal (VPN) View plane can be anywhere in the world-space The center of projection represents the location of the viewer's eye or the camera's lens. Need to define a 3D Viewing Reference Coordinate system (VRC) which has axis u, v, n <ul style="list-style-type: none"> <li>• Origin of VRC is the VRP</li> <li>• n axis of VRC is the VPN</li> <li>• v axis of VRC is called the View-UP vector (VUP)</li> <li>• u axis of VRC is defined to form a right-hand coordinate system with n and v</li> </ul>	BTL2
9	<b>What are the different ways of specifying spline curve?</b> Using a set of boundary conditions that are imposed on the spline. Using the state matrix that characterizes the spline Using a set of blending functions that calculate the positions along the curve path by specifying combination of geometric constraints on the curve.	BTL3
10	<b>What are spline curves?</b> A spline curve is a mathematical representation for which it is easy to build an interface that will allow a user to design and control the shape of complex curves and surfaces. The general approach is that the user enters a sequence of points, and a curve is constructed whose shape closely follows this sequence. The points are called control points. A curve that actually passes through each control point is called an interpolating curve; a curve that passes near to the control points but not necessarily through them is called an approximating curve	BTL2

### PART \*B

1.	<b>Explain in detail about Rotations in 3D space.</b> <b>BTL4</b> <b>Answer: Page: 5.3 - Godse</b> Axis for rotation (2M) In 2D, axis of rotation is perpendicular to x, y plane Whereas in 3D the axis of rotation can have any spatial orientation <ul style="list-style-type: none"> <li>• Inverse rotation (2M)</li> </ul>	(13M) (NOV/DEC 2015)
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	<p>Z-axis rotation X-axis rotation Y-axis rotation Rotation about arbitrary point</p> <ul style="list-style-type: none"> <li>• Z-axis rotation (3M) Figure: z-axis rotation Homogenous coordinates Equation</li> <li>• X-axis rotation (3M) Figure: x-axis rotation Cyclic permutation of the coordinate parameter Equation</li> <li>• Y-axis rotation (3M) Figure: y-axis rotation Inverse rotation matrix is formed by replacing the rotation angle Equation</li> <li>• Rotation about Arbitrary point Object is rotated about axis that is parallel to one of the coordinates axis Figure: rotation about arbitrary point</li> </ul>
2.	<p><b>Describe in detail on three dimensional transformations.</b> <span style="float: right;">(13M) BTL1</span></p> <p><b>Answer: Page: 6-6 -Godse</b></p> <p>Representation schemes for solid objects are divided into two categories as follows:</p> <p><b>Boundary Representation (B-reps) (2M)</b></p> <p>It describes a three-dimensional object as a set of surfaces that separate the object interior from the environment. Examples are polygon facets and spline patches.</p> <p><b>Space partitioning representation (2M)</b></p> <p>It describes the interior properties, by partitioning the spatial region containing an object into a set of small, nonoverlapping, contiguous solids (usually cubes).</p> <p>Eg: Octree Representation.</p> <p><b>Polygon Surfaces:(2M)</b></p> <p>Polygon surfaces are boundary representations for a 3D graphics object is a set of polygons that enclose the object interior.</p> <p><b>Polygon Tables :(2M)</b></p> <p>The polygon surface is specified with a set of vertex coordinates and associated attribute parameters. For each polygon input, the data are placed into tables that are to be used in the subsequent processing. Polygon data tables can be organized into two groups: Geometric tables and attribute tables.</p> <p><b>Geometric Tables: (1M)</b></p> <p>It Contains vertex coordinates and parameters to identify the spatial orientation of the polygon surfaces. Attribute tables (2M)</p> <p>Contains attribute information for an object such as parameters specifying the degree of transparency of the object and its surface reflectivity and texture characteristics. A convenient organization for storing geometric data is to create three lists:</p> <ol style="list-style-type: none"> <li>1. The Vertex Table</li> <li>2. The Edge Table</li> <li>3. The Polygon Table</li> </ol>

	<p>Figure: refer notes Note: Extra information can be added to the data tables for faster information extraction.</p> <p><b>Plane Equations: (2M)</b></p> <p>To produce a display of a 3D object, we must process the input data representation for the object through several procedures such as, Transformation of the modeling and world coordinate descriptions to viewing coordinates. Then to device coordinates:</p> <ul style="list-style-type: none"> <li>Identification of visible surfaces.</li> <li>The application of surface-rendering procedures.</li> </ul>	
3.	<p><b>Discuss briefly about parallel projections. (13M) BTL2</b></p> <p><b>Answer: Page: 6.9 -Godse</b></p> <p>Coordinate positions are transformed to the view plane along parallel lines.</p> <p>All projectors are parallel to each other. (2M)</p> <p>Orthographic parallel projection: (5M)</p> <p><b>Projection vector</b></p> <p>Direction for the projection lines</p> <p>Perpendicular to view plane</p> <p>Used in engineering drawing</p> <p>Projection on one of the coordinate planes.</p> <p>Figure: Parallel projection (refer Godse book)</p> <p>Matrix of projection on to <math>x=0</math> plane is (Refer notes)</p> <p>Elevation</p> <p>Front side and rear orthographic projections of an object</p> <p>Figure: Refer notes</p> <p><b>Axonometric projection (3M)</b></p> <p>Displays more than one face of an object</p> <p>Isometric</p> <p>Diametric</p> <p>Trimetric</p> <p><b>Oblique projection (3M)</b></p> <p>Not perpendicular to the view plane</p> <p>Intersect the plane of projection an oblique angle</p> <p>Two types</p> <ul style="list-style-type: none"> <li>Cavalier projection</li> <li>Cabinet projection</li> </ul>	
4.	<p><b>Write a short note on 3D viewing. (13M) (Nov/Dec 12) BTL3</b></p> <p><b>Answer: Page: 6.2-Godse</b></p> <p>Viewing Pipeline(2M)</p> <ul style="list-style-type: none"> <li>Figure: conceptual model of 3D transformation process (3M)</li> <li>Example: Flight Simulator program(1M)</li> </ul> <p>Viewing coordinates – film plane in camera which is positioned and oriented for a particular shot of the scene(2M)</p> <ul style="list-style-type: none"> <li>Establishing viewing coordinates system</li> <li>View reference point</li> <li>View plane normal vector</li> </ul>	

	<p>Figure: right-handed viewing coordinates systems(2M)</p> <p>Viewing coordinates (3M)</p> <p>View reference point and view plane vector</p> <p>3D viewing coordinates</p> <p>Rotating view plane</p> <p>Viewing object</p>
<b>PART * C</b>	
1	<p><b>Explain visible surface detection.</b> <span style="float: right;">(15 M) BTL1</span></p> <p>Answer: Page: 5.45-Godse</p> <p>Hidden surface elimination methods</p> <p>Non transparent objects and surfaces are not possible to view from behind the object closer to eye</p> <p>Removing hidden surface(2M)</p> <p>Hidden surface problem: (2M)</p> <p>Identification and removal of these surfaces</p> <p>Two approaches</p> <p>Object</p> <p>Images</p> <p>List of visible surface algorithms ( any three types --3M each)</p> <p>Back face detection</p> <p>Identifying the back faces of a polyhedron</p> <p>Inside-outside test</p> <p>Scan line methods</p> <p>Painting algorithm</p> <p>Developed by Newell and Sancha</p> <p>Image and object space</p> <p>Two basic functions</p> <ul style="list-style-type: none"> <li>• Surface is sorted in order of decreasing path</li> <li>• Surface are scan-converted in order stating with surface of greatest path</li> </ul>

	<p>Depth buffer algorithms</p> <ul style="list-style-type: none"> <li>Z-buffer algorithm</li> <li>Image space approach</li> <li>Developed by Catmull</li> <li>Compare surface depth at each pixel position on the projection plane</li> </ul> <p>Buffer algorithm</p> <p>BSP Tree Methods</p> <p>Octree methods</p> <ul style="list-style-type: none"> <li>Object based approach</li> <li>Hierarchical tree structure</li> <li>Medical imaging and display of cross sections</li> <li>It reduces the storage requirements of 3D objects</li> <li>Quadtrees are generated successfully</li> <li>Divided as quadrants</li> <li>Same color-homogeneous</li> <li>Otherwise-heterogeneous</li> </ul> <p>Ray casting methods</p> <p>Area sub division method</p> <ul style="list-style-type: none"> <li>Developed by Warnock</li> <li>Object based approach</li> <li>Sub divides area into four equal square</li> </ul>
2	<p><b>A cube has its vertices located at a(0,0,10) , a(0,0,10) , c(10,10,10) ,d(0,10,10) , e(0,0,0) , f(10,0,0) , g(10,10,0), h(0,10,0). The Y axis is vertical and Z axis is oriented towards the viewer. The cube is being viewed from point (0,20,80). Calculate the perspective view of the cube on XY plane.</b> (15M) BTL6</p> <p>Answer: Page:6.39-Godse</p> <p>Perspective Projection (3M)</p> <p>Projection Transformation Matrix Perx (4M)</p>

	Coordinate matrix V (4M) Image Coordinates(4M)
3	<p><b>Calculate the new coordinates of a block rotated about x axis by an angle 30 degrees. The original coordinates of the block are given relative to the global xyz axis system. A (1,1,2) B(2,1,2) C(2,2,2) D(1,2,2) E(1,1,1) F(2,1,1) G(2,2,1) H(1,2,1) (15M) BTL 6</b></p> <p>Answer: Page: 5.14-Godse Transformation matrix for rotation about x-axis (3M) Definition (2M)</p> <p>Finding Rotation about x-axis Rx where angle 30 degrees(5M)</p> <p>New Coordinates are</p> <p>Original coordinates x Rotation Matrix (5M)</p>

## UNIT-4 MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING

**Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.**

### PART \* A

1	<b>Give the applications of Multimedia.</b> Document Imaging Image Processing and Image Recognition Full Motion Digital Video Applications Electronic messaging Entertainment Corporate Communications	<b>(NOV/DEC 2016) BTL2</b>
2	<b>What are the data elements of Multimedia? (NOV/DEC 2015), (MAY/JUNE 2016) BTL2</b> Facsimile Document Images Photographic Images Geographic Information System Maps (GIS) Voice Commands and Voice Synthesis Audio Messages Video Messages Full motion stored and Live Video Holographic Images Fractals	<b>BTL2</b>
3	<b>Define Multimedia.</b> Multimedia is defined as a Computer based Interactive Communication process that incorporates text, numeric data, record-based data, graphic art, video and audio elements, animation etc. It is used for describing sophisticated systems that support moving images and audio. Eg. Personal Computer.	<b>BTL1</b>
4	<b>What are the applications of Photographic Images?</b> Photographic images are used in Imaging Systems that are used for identification Security Badges Fingerprint Cards Photo Identification Systems Bank Signature Cards Patient Medical Histories	<b>BTL2</b>
5	<b>What are the two technologies used for storage and display of GIS systems?</b> Raster Storage Raster Image (Raster Image has basic color map; vector overlay and text display).	<b>BTL2</b>
6	<b>What is the use of Document Images?</b> It is used for storing business documents that must be retained for long periods of time and accessed by large number of people. It removes the need for making several copies for storage or distribution.	<b>BTL2</b>

7	<b>Discuss Full motion and live video.</b> Full motion video refers to pre stored video clip. i.e., video stored in CD Eg: games, courseware, training manuals, MM online manuals etc. Live video refers to live telecast. It is live and must be processed while the camera is capturing it i.e., Instant occurring is transferred at the same time. Eg: Live Cricket Show (in television)	BTL3
8	<b>Write the terms of Holography and Hologram.</b> Holography is defined as the means of creating a unique photographic image without the use of lens. The photographic recording of the image is called a Hologram.	BTL2
9	<b>State the properties of Holographic images.</b> Holographic images are Not clear diagrams 3-dimensional can also be recorded on materials other than photographic plates Records intensity of light and phase created by coherent light using a laser beam	BTL2
10	<b>Define Fractals.</b> Fractals are regular objects with a high degree of irregular shapes. It is a lossy Compression technique but it doesn't change the shape of the image. Fractals are decompressed images that result from a compression format.	BTL2
11	<b>State the applications of Document Imaging.</b> Document Imaging is used in organizations such as <ul style="list-style-type: none"> <li>• Insurance agencies</li> <li>• Law offices</li> <li>• Country and State Governments</li> <li>• Federal Government</li> <li>• Department of Defense (DOD)</li> </ul>	BTL4
12	<b>What is meant by Multimedia database? (NOV/DEC 2015)</b> A Multimedia database (MMDDB) is a collection of related multimedia data. The multimedia data include one or more primary media data types such as text, images, graphic objects (including drawings, sketches and illustrations) animation sequences, audio and video.	BTL1
13	<b>State Optical Character Recognition (OCR).</b> Optical Character Recognition is used for data entry by scanning typed or printed words in a form. OCR technology is now available in software it has the capability to decipher a large number of printed fonts used in many document image applications. It is used for reading the number of invoice or for capturing entire photographs of text.	BTL3
	<b>PART * B</b>	
1	<b>Discuss any four multimedia applications in detail. (13M)</b> Answer: Page: 10.5-Godse <b>Document imaging(3M)</b> Document Image Management	BTL2

	<p>Scanning documents and retaining their images  Figure: Hardware requirement (Document Image Management)</p> <p><b>Image processing and image recognition (3M)</b></p> <p>Manipulation of digital images through digital computers</p> <p>Example: Photoshop</p> <ul style="list-style-type: none"> <li>Image Acquisition</li> <li>Image Enhancement</li> <li>Image restoration</li> <li>Color image processing</li> <li>Wavelet and multi resolution</li> <li>Image Compression</li> <li>Segmentation</li> <li>Object recognition Representation and description</li> <li>Hardware Requirements</li> </ul> <p><b>Full motion digital video application (3M)</b></p> <p>It contains textual messages ex: email and voice messages.</p> <ul style="list-style-type: none"> <li>Video snapshots</li> <li>Live video full motion picture and sound</li> <li>Storage and transmission</li> <li>Decompression</li> <li>Viewer interactive live video</li> </ul> <p><b>Electronic messaging (2M)</b></p> <p><b>Universal multimedia application (2M)</b></p>	
2	<p><b>Explain multimedia system architecture. (13M)</b></p> <p><b>Answer: Page: 10.3-Godse</b></p> <p>Components of multimedia system (1M)</p> <p>Live and orchestrated Types: (3M)</p> <p>Standalone GUI Multimedia extension OS Software drivers Server (3M)</p> <p>Inter-operability Desktop and server</p> <p>Network (3M)</p> <p>Special networks Task based mule level networking Standards Ethernet Token ring</p> <p>Fig: Network Types of layers: (3M)</p> <p>Layer1</p> <p>Layer2</p> <p>Layer3</p> <p>Layer4</p>	BTL5
3	<p><b>Describe the importance of multimedia and its elements. (13M) BTL3</b></p> <p><b>Answer: Page: 10.1-Godse</b></p> <p><b>Importance:(1M)</b></p> <ul style="list-style-type: none"> <li>Business</li> <li>Education</li> <li>Entertainment</li> <li>Home</li> <li>Public places</li> </ul>	

	<p><b>Elements: Text (3M)</b></p> <ul style="list-style-type: none"> <li>Basic elements</li> <li>Use of size, types, colour</li> <li>Hypertext</li> </ul> <p><b>Graphics (3M)</b></p> <ul style="list-style-type: none"> <li>Make more attractive</li> <li>Ideas through pictures</li> <li>Types</li> <li>Bitmaps</li> <li>Vector</li> </ul> <p><b>Audio (3M)</b></p> <ul style="list-style-type: none"> <li>Speech, music, sound effects</li> <li>Types</li> <li>Analog</li> <li>Digital</li> </ul> <p><b>Video (3M)</b></p> <ul style="list-style-type: none"> <li>Powerful impact</li> <li>More popular</li> <li>Can be easily stored</li> <li>Can be easily transferred</li> </ul> <p><b>Animation</b></p> <ul style="list-style-type: none"> <li>Making static images looks like moving.</li> <li>Digital animation</li> <li>Types</li> <li>2D</li> <li>3D</li> </ul>
4.	<p><b>Explain about the data types of Multimedia Systems.</b> <span style="float: right;">(13M) BTL4</span></p> <p><b>Answer: Page: 10.5-Godse</b></p> <p>Basic data types of an objects</p> <p><b>Text (3M)</b></p> <ul style="list-style-type: none"> <li>Base elements for relational database.</li> <li>Hypertext</li> <li>Hypermedia</li> </ul> <p><b>Major attributes</b></p> <ul style="list-style-type: none"> <li>Paragraph styling</li> <li>Character styling</li> <li>Font families and sizes</li> <li>Relative location</li> </ul> <p><b>Images (3M)</b></p> <ul style="list-style-type: none"> <li>Visible           <ul style="list-style-type: none"> <li>Photographs</li> <li>Drawing</li> <li>Documents</li> <li>painting</li> </ul> </li> <li>Non visible           <ul style="list-style-type: none"> <li>Temperature gauge</li> <li>Pressure gauge</li> </ul> </li> <li>Abstract</li> <li>Discrete</li> </ul>

	<p>continuous</p> <p><b>Audio and voice (3M)</b></p> <ul style="list-style-type: none"> <li>Compressed audio information</li> <li>Contains music, speech , telephonic conversation and voice commands</li> <li>Sound clip</li> </ul> <p><b>Holograms</b></p> <p><b>Animation (1M)</b></p> <p><b>Virtual reality</b></p> <p><b>Full motion video (3M)</b></p> <ul style="list-style-type: none"> <li>Pre stored video clips</li> <li>Live-being capturing by camera</li> <li>Database storage, network media , decompression engines</li> </ul>
5.	<p><b>Illustrate briefly about multimedia data interface standards.</b> <span style="float: right;">(13M) BTL3</span></p> <p><b>Answer:</b> Page: 10.6-Godse</p> <p>The standards are layered which allows individuals layers to provides technology advances without affecting other layers.</p> <p>File formats of multimedia systems (5M)</p> <ul style="list-style-type: none"> <li>DIB</li> <li>RDIB</li> <li>MIDI</li> <li>PAF</li> <li>RTF</li> <li>WAVE</li> <li>WMF</li> <li>MMM</li> <li>DVCS</li> <li>VIM</li> </ul> <p>Video processing standards (3M)</p> <ul style="list-style-type: none"> <li>Commercial workstations</li> <li>Apples quick time</li> <li>Intel's digital video interface</li> <li>Microsoft audio video interface</li> </ul> <p>Microsoft AVI standards (3M)</p> <ul style="list-style-type: none"> <li>Low cost and low-resolution video processing for average desktop users</li> <li>Supports several compression algorithms (2M)</li> </ul>
	<b>PART * C</b>
1	<p><b>Describe multimedia application used in your current college or work Environment.</b> <span style="float: right;">(15M) BTL6</span></p> <p><b>Answer:</b> Page: 10.2-Godse(2M)</p> <ul style="list-style-type: none"> <li>• Multimedia combines a wide range of absorbing sight and sound, and is designed to</li> </ul>

	<p>impress audiences with both the content of the presentation and the technology behind it.</p> <ul style="list-style-type: none"> <li>Two applications for multimedia are garnering the most attention: presentations and training. These two applications for multimedia are proving to be useful, profitable tasks.</li> <li>Organizations require the ability to teleconference and videoconference, aspects of which multimedia has been slow to utilize.</li> <li>High bandwidth networks and phone lines are not plentiful in corporate (or consumer) markets. Presentations 66% (3M)</li> <li>Most visible trend in corporate multimedia is the rise of computer-based presentations.</li> <li>Presentation applications in the workplace differ from the presentations that academicians think of when they hear the word “presentation”.</li> <li>Presentation magazine reported earlier this year that 40 percent of its readers now use electronic presentations rather than traditional methods.</li> <li>For more complex presentations, companies are still turning to outside experts</li> </ul> <p><b>Training 63% (3M)</b></p> <ul style="list-style-type: none"> <li>Indications are that multimedia in the workplace begins where productivity gains can be most immediately felt, or where costs can be cut.</li> <li>Training to accommodate both money saving efforts has received the largest amount of attention.</li> </ul> <p><b>Case Study (3M)</b></p> <ul style="list-style-type: none"> <li>The Organization Group divides its clients into type A, B, or C categories,</li> <li>with A being the most technologically aggressive,</li> <li>B the more mainstream companies that wait until there is less risk associated with an emerging technology,</li> <li>type C being businesses that haven't yet formed a clear technology strategy.</li> <li>Gartner's study indicates that even type B companies are beginning to use multimedia for training, because it's a lower risk application.</li> </ul> <p><b>Note (1M)</b></p> <ul style="list-style-type: none"> <li>While corporate training applications require a larger investment than presentations self-paced multimedia courses delivered on a CD-ROM or over a network can</li> </ul>
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	<p>save millions of dollars.</p> <ul style="list-style-type: none"> <li>• Savings aside, many are finding it is more effective to teach with pictures, sound and video than boring lectures and overheads</li> </ul> <p>Videoconferencing 25% (3M)</p> <ul style="list-style-type: none"> <li>• The third most often use for multimedia in the workplace is video conferencing</li> <li>• The server can deliver a presentation over a wide area network to a kiosk or other remote locations.</li> <li>• The approach has advantages over conventional disk-based kiosks because the material can be updated and sent virtually anywhere in the world.</li> <li>• collaborative multimedia is desktop videoconferencing.</li> <li>• Businesses are spending billions each year by sending employees to meetings</li> <li>• Aside from the network upgrades necessary to handle increased traffic, corporations need high-speed telephone connections such as ISDN to make video-conferencing viable on a scale wide enough to save money.</li> <li>• Groupware, or software designed to manage server-client networks is fostering implementation of cross-connectivity between and within organizations.</li> </ul> <p>Advertising 19%</p> <p>CD-ROM Titles 11%</p> <p>Others 8%</p>
2	<p><b>Write briefly about multimedia databases.</b> <span style="float: right;"><b>(15M) BTL4</b></span></p> <p><b>Answer:</b> Page: 10.7-Godse</p> <p>DBMS provides automatically maintained indexing</p> <p>Multimedia storage and retrieval (4M)</p> <ul style="list-style-type: none"> <li>• Massive data volume</li> <li>• Storage technologies</li> <li>• Multimedia object storage</li> <li>• Multimedia object retrieval</li> </ul> <p>Database management systems for multimedia systems (4M)</p>

	<ul style="list-style-type: none"> <li>• RDBMS extension for multimedia</li> <li>• Object oriented databases for multimedia systems</li> </ul> <p>Database organization for multimedia application (4M)</p> <ul style="list-style-type: none"> <li>• Data independence</li> <li>• Common distributed database architecture</li> <li>• Distributed database servers</li> <li>• Multimedia object management</li> </ul> <p>Transaction management for multimedia systems (3M)</p> <ul style="list-style-type: none"> <li>• The transaction is complete when user releases the hypermedia document and stores back edited version or discards</li> </ul>
3	<p><b>Describe Evolving technologies for multimedia system.</b> (15M) <b>BTL3</b></p> <p><b>Answer: Page: 10.4-Godse</b></p> <p>Hypermedia documents (3M)</p> <ul style="list-style-type: none"> <li>Text, embedded or linked multimedia objects Image, audio, hologram , full motion videos Hypertext</li> <li>Hypermedia Hyper speech</li> </ul> <p>HDTV and UDTV</p> <p>3D technologies (3M)</p> <ul style="list-style-type: none"> <li>3D pointing devices</li> <li>3D displays</li> </ul> <p>Fuzzy logics (3M)</p> <ul style="list-style-type: none"> <li>Resembles human reasoning</li> <li>Decision making</li> <li>Example:</li> <li>Temperature controller</li> <li>Aerospace</li> </ul>

	<p>Automatic</p> <p>Chemical industry</p> <p>Digital signal processing (3M)</p> <p>Improving the accuracy and reliability of digital communication</p> <p>Example:</p> <p>Space</p> <p>Medical</p> <p>Commercial</p> <p>telephone</p> <p>Internet synchronization and communication (3M)</p> <p>Message queue</p> <p>Shared memory</p> <p>Quick response event flags</p>
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<b>UNIT 5 - HYPERMEDIA</b>	
<b>PART * A</b>	
<b>Q.NO</b>	<b>ANSWERS</b>
1	<p><b>What does database security refer to?</b> BTL 2</p> <p>Database security refers to the protection from unauthorized access and malicious destruction or alteration.</p>
2	<p><b>List some security violations (or) name any forms of malicious access.</b> BTL 2</p> <ol style="list-style-type: none"> <li>1. Unauthorized reading of data</li> <li>2. Unauthorized modification of data</li> <li>3. Unauthorized destruction of data.</li> </ol>

3	<b>Give the limitations of SQL authorization.</b> BTL 2 The code for checking authorization becomes intermixed with the rest of the application code. Implementing authorization through application code rather than specifying it declaratively in SQL makes it hard to ensure the absence of loopholes.
4	<b>Define Data mining.</b> BTL 1 Data mining - knowledge discovery in database. Data mining is the process of semi automatically analyzing large databases to find useful patterns.
5	<b>List the types of security mechanisms.</b> BTL 2 1. Discretionary security mechanisms 2. Mandatory security mechanisms
6	<b>List the actions performed by DBA?</b> BTL 2 1. Account creation 2. Privilege granting 3. Privilege revocation 4. Security level assignment
7	<b>What is authorization graph? List the types of authorization.</b> BTL2 Authorization Graph: Passing of authorization from one user to another can be represented by an authorization graph. Types of authorization: Read authorization Write authorization Update authorization Drop authorization.
8	<b>What are the various levels in security measures?</b> BL2 1. Database system 2. Operating system 3. Network 4. Physical 5. Human
9	<b>Name the various privileges in SQL?</b> BTL1 a) Delete b) Select c) Insert d) update
10	<b>Give some encryption techniques?</b> BTL1 a) DES b) AES c) Public key encryption
11	<b>What does authentication refer? List some authentication techniques.</b> BTL2 Authentication refers to the task of verifying the identity of a person. <b>Authentication techniques:</b> Challenge response scheme Digital signatures Nonrepudiation
12	<b>What are the control measures that are used to provide security of data in databases?</b> BTL2 <ul style="list-style-type: none"> <li>• Access control</li> <li>• Inference control</li> <li>• Flow control</li> <li>• Data Encryption</li> </ul>
13	<b>What is meant by Hypermedia? (May/June 2016)</b> BTL2 The linking of media for easy access is called Hypermedia. The media may be of any type such as text, audio, video etc. A hypermedia document contains a text and any other sub objects such as images, sound, full-motion video etc
14	<b>What is meant by Hypertext?</b> BTL2 The linking of associated data for easy access is called Hypertext. It is an application of

	indexing text to provide a rapid search of specific text strings in one or more documents. It is an integral component of Hypermedia. Hypermedia document is the basic object and text is a sub object.	
15	<b>What is the use of multimedia?</b> Multimedia improves information relation. Multimedia applications includes the following: 1. Business 2. Schools 3. Home	<b>BTL2</b>
16	<b>List out the User Interface design tools.</b> 1. Media Editors 2. Authoring Application 3. Hypermedia Object Creation 4. Multimedia Object Locator and Browser	<b>BTL3</b>
17	<b>What is navigation?</b> Navigation refers to the sequence in which the application progress and objects are created, searched and used. It can be done in direct mode or browse mode.	<b>BTL2</b>
18	<b>State the different Metaphors used for Multimedia applications.</b> 1. Organizer Metaphor 2. Telephone metaphor 3. Aural User Interface (AUI) 4. VCR Metaphor	<b>BTL1</b>
19.	<b>What is called as Organizer metaphor?</b> Organizer metaphor associates the concept of embedding multimedia objects in the appointment diary or notepad. The Lotus organizer was the first to use a screen representation of office-diary type organizer.	<b>BTL1</b>
20.	<b>Describe about AUI.</b> Aural User Interface (AUI) allows computer systems to accept speech as direct input and provide an oral response to the user actions. The real challenge in AUI systems is to create an aural desktop that voice and ear for the keyboard and display.	<b>BTL1</b>
21.	<b>Define Mobile Messaging. (NOV/DEC 2015)</b> Mobile Messaging (MM) is a presence enabled messaging service that aims to transpose the Internet desktop messaging such as ICQ or MSN experience to the usage scenario of being connected via a mobile/cellular device.	<b>BTL2</b>
22.	<b>What is programmed degradation?</b> The playback control can be exercised at the time of decompression and playback. This is called programmed degradation. Programmed degradation get into effective when the client workstation is unable to keep up with the incoming data.	<b>BTL2</b>
23.	<b>What is the use of Database server?</b> <ul style="list-style-type: none"> <li>• The database server supports the database requirements of the application and stores the attribute information for real-world objects in the application.</li> <li>• Database servers are based on the UNIX OS/2 or Windows platform.</li> </ul>	<b>BTL2</b>

**Part \* B**

1	<p><b>Discuss briefly about multimedia I/O technologies. (13M)</b></p> <p>Answer: Page: 4.45-Godse</p> <ul style="list-style-type: none"> <li>o They are capable of accepting video images and sound and also capable of displaying video images and reproduction of sounds (1M)</li> <li>o Input and output devices</li> <li>o Input devices           <ul style="list-style-type: none"> <li>o Pen input</li> <li>o Video and image display system               <ul style="list-style-type: none"> <li>• Display system technologies</li> <li>• Display performance issues</li> </ul> </li> <li>o Image scanners(1M)               <ul style="list-style-type: none"> <li>• Capture the image of a documents, drawing, graphs, or photos</li> <li>• Scanners from factors                   <ul style="list-style-type: none"> <li>A size – 8.5 inch x 11 inch</li> <li>B size – 11 inch x 17 inch</li> </ul> </li> <li>• Scanning mechanism and usage issues: (2M)                   <ul style="list-style-type: none"> <li>Moving paper or CCD</li> <li>Paper is moved across the CCD or an array</li> <li>CCD or array of CCD is moved but paper will remain same</li> <li>Mirror is moved and the CCD works off the reflected images in the mirror</li> </ul> </li> <li>• Types of scanners: (2M)                   <ul style="list-style-type: none"> <li>Sizes, capabilities, functions, speeds, resolutions                       <ul style="list-style-type: none"> <li>Flatbed scanners</li> <li>Rotary drum scanners</li> <li>Handheld scanners</li> </ul> </li> <li>• Output Technologies                       <ul style="list-style-type: none"> <li>Information can be viewed on a monitor, printed on the printer or listened through speakers or a headset                           <ul style="list-style-type: none"> <li>• Printers (2M)                               <ul style="list-style-type: none"> <li>Impact printer</li> <li>o Inked ribbon</li> <li>Line printer</li> <li>Drum printer</li> <li>Chain printer</li> <li>dot matrix printer also called as serial printer</li> </ul> </li> <li>• Non-impact printer                               <ul style="list-style-type: none"> <li>Laser technologies</li> <li>Ink jet printer</li> <li>Laser printer</li> </ul> </li> <li>• Plotters(2M)                               <ul style="list-style-type: none"> <li>Pen plotter</li> <li>Flatbed plotter</li> <li>Drum plotter</li> <li>Electro static plotter</li> </ul> </li> </ul> </li> </ul> </li> </ul> </li> </ul> </li></ul></li></ul>	BTL2
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	<ul style="list-style-type: none"> <li>• Display devices (3M)</li> <li>Cathode ray tube</li> <li>Vector scan / Random scan display</li> <li>Raster scan display</li> <li>Color CRT</li> <li>Direct view storage tubes</li> </ul>	
2	<p><b>Explain briefly about types of Digital voice and audio. (13M)</b></p> <p>Answer: Page: 4.47-Godse</p> <p>Audio (3M)</p> <ul style="list-style-type: none"> <li>• musical keyboards</li> <li>• microphones</li> <li>• sound boards</li> <li>• cassette tape</li> <li>• live music</li> <li>• wave file input</li> <li>• audio CD</li> </ul> <p>Digital Audio (4M)</p> <p>Microphones-</p> <ul style="list-style-type: none"> <li>• Captures voice and music – it generates an electrical signal</li> <li>• Signal-sine wave of a certain amplitude and frequency</li> <li>• Sine wave- harmonic with their individual amplitudes and frequency</li> <li>• Regular interval--- sampling rate</li> <li>• Compression and decompression techniques also be used to store a data</li> </ul> <p>Digital voice: (3M)</p> <p>Speech- analog signal</p> <ul style="list-style-type: none"> <li>• Converted to digital form (using analog to digital converter (ADC))</li> <li>• ADC- takes sampled amplitudes and converts into 8, 16, 32-bit digital value</li> <li>• Sampling rate</li> <li>• Resolution</li> <li>• Linearity</li> <li>• Conversion speed</li> </ul> <p>Advantages: (3M)</p> <ul style="list-style-type: none"> <li>• Enter data or communicate with computer without typing or clicking the mouse</li> <li>• No need of having skilled keyboard users.</li> <li>• While driving vehicle using a voice command and communicate using the head phone</li> </ul>	BTL4
3	<p><b>Explain about the data types of Multimedia Systems.</b></p> <p>Answer: Page: 10.5-Godse</p> <p>Basic data types of an objects Text (3M)</p> <p>Base elements for relational database.</p> <p>Hypertext</p> <p>Hypermedia</p> <p>Major attributes</p>	(13M) BTL4

	<ul style="list-style-type: none"> <li>• Paragraph styling</li> <li>• Character styling</li> <li>• Font families and sizes</li> <li>• Relative location</li> </ul>	
4	<p><b>Discuss briefly about Hypermedia and applications. (13M)</b></p> <p>Answer: Page:5.7-Godse</p> <p>Hypermedia:(3M)</p> <ul style="list-style-type: none"> <li>• Workstation user requires an authoring tool to create a multimedia document. It's a part of a messaging system</li> <li>• Text with embedded graphics , sound track, video clips</li> <li>• Result of analysis is based on books or CD-ROM, and other online application</li> <li>• Three components must be combined in a message</li> </ul> <p>Essential for good hypermedia design: (3M)</p> <ul style="list-style-type: none"> <li>• Determining the type of hypermedia</li> <li>• Structuring the information</li> <li>• Designing the UI</li> <li>• Methodologies for accessing the information</li> </ul> <p>Integration of application:(3M)</p> <ul style="list-style-type: none"> <li>• E-mail</li> <li>• Word processing</li> <li>• Graphics and formal presentation</li> <li>• Spreadsheet</li> <li>• Customized application <ul style="list-style-type: none"> <li>◦ Billing</li> <li>◦ Portfolio management</li> <li>◦ Others</li> </ul> </li> </ul> <p>Two major themes (2M)</p> <ul style="list-style-type: none"> <li>• Appearance of an application</li> <li>• Ability of an application to exchange data</li> </ul> <p>Common UI (2M)</p> <ul style="list-style-type: none"> <li>• Dialog boxes</li> <li>• Buttons</li> <li>• Help frames</li> <li>• Scroll bars</li> <li>• Tool bars</li> </ul>	BTL2
5	<p><b>Illustrate the procedure to manage Distributed multimedia objects. (13M)</b></p> <p>Answer: Page:5.50-Godse</p> <p>Managed by following ways</p> <ul style="list-style-type: none"> <li>• Inter server communication</li> <li>• Object server architecture(2M) <ul style="list-style-type: none"> <li>◦ Multimedia application</li> <li>◦ Object request broker</li> <li>◦ Object name server</li> <li>◦ Object server</li> </ul> </li> <li>• Identification methods (2M)</li> </ul>	BTL6

	<ul style="list-style-type: none"> <li>○ Uniquely identifying all objects           <ul style="list-style-type: none"> <li>Domain name</li> <li>Address</li> <li>Time stamp</li> <li>Object class identifier</li> </ul> </li> <li>● Object revision management(2M)           <ul style="list-style-type: none"> <li>○ Versioning of an object               <ul style="list-style-type: none"> <li>Object attributes</li> <li>Object operations</li> <li>Object methods</li> </ul> </li> </ul> </li> <li>● Optimizing network location of objects           <ul style="list-style-type: none"> <li>Reduce design issues</li> <li>Stored in many locations</li> </ul> </li> <li>● Object directory services           <ul style="list-style-type: none"> <li>Directory manager for all multimedia objects in LAN</li> <li>It manages object directory</li> </ul> </li> <li>● Multimedia object retrieval (2M)           <ul style="list-style-type: none"> <li>Managing all the requests</li> <li>Object request broker</li> <li>Keeps track of all multimedia objects</li> </ul> </li> <li>● Database replication techniques (1M)           <ul style="list-style-type: none"> <li>Data management</li> <li>Duplicate os databases</li> <li>replication</li> </ul> </li> <li>● Object migration schemes (2M)           <ul style="list-style-type: none"> <li>Online media</li> <li>Type of database</li> <li>Class of object parameter</li> </ul> </li> <li>● Optimizing object storage           <ul style="list-style-type: none"> <li>Optimizing server by object type</li> <li>Automatic load balancing</li> <li>Versioning object storages</li> </ul> </li> <li>● Figure : object server architecture(2M)</li> </ul>
6.	<p><b>Explain about the integrated multimedia message standards. (13M) <span style="float: right;">BTL5</span></b></p> <p>Answer: Page:2.2-Godse</p> <p>Standards for interoperability of an application from different software vendor Vendor independent messaging (VIM) (2M)</p> <p>It provides messaging between VIM enabled electronic mailing system    Objectives: (2M)</p> <p>It provides services necessary for developers to provide mail-aware and mail enabled application It allow inter application collaboration in a non-real time manner</p> <p>Benefits: (1M)</p> <ul style="list-style-type: none"> <li>It is enhanced to support other VIM enabled application</li> <li>It provides seamless application between applications</li> </ul> <p>VIM messages: (3M)</p> <ul style="list-style-type: none"> <li>Object is transported by a messaging system           <ul style="list-style-type: none"> <li>Message definition (2M)</li> <li>Nesting of messages</li> <li>Mail message</li> <li>Message delivery</li> <li>Message container</li> </ul> </li> </ul>

	<p>Address books  <b>VIM services (3M)</b>            Electronic message composition            Sending and receiving            Message extraction from mail system            Address book service</p>	
7	<p><b>Explain the multimedia databases. (13M)</b></p> <p>Answer: Page:5.46-Godse</p> <p>It contains number of different multimedia objects (1M)</p> <p>It includes relational databases</p> <p>Can able to store images, still videos, audio, full motion video</p> <p>Binary large objects(BLOB)</p> <p>Database issues: (3M)</p> <ul style="list-style-type: none"> <li>Locations of an objects</li> <li>Composite object creation and storing and managing.</li> <li>Rendering of an object</li> <li>Unique object identification</li> <li>Object migration through storage classes</li> </ul> <p>Database organization of multimedia Application: (3M)</p> <p>Data independence</p> <p>Flexible access</p> <p>Features:</p> <ul style="list-style-type: none"> <li>Storage design</li> <li>Explicit data definition</li> <li>No need to know data formats</li> <li>Integrity assurance</li> <li>Recovery</li> </ul> <p>Common distributed database Architecture (3M)</p> <p>Isolation of data from an application and distributed application</p> <p>Features</p> <ul style="list-style-type: none"> <li>Ability for a multiple independent data structure</li> <li>Uniform distributed access Single point for recovery Expandability</li> </ul> <p>Tunability and creation</p> <p>Multiple data servers: (3M)</p> <p>Database server</p> <p>Dedicated resource on a network accessible to a number of an application</p> <p>Bottlenecks</p> <p>Solved by providing multiple data servers</p>	BTL3

	<b>PART * C</b>
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1	<p><b>Explain about the Integrated Document management (IDM). (15M)</b></p> <p><b>Answer:</b> Page:5.30-Godse</p> <p>It is used to describe the technologies, tools, methods used to capture manage, store, preserve, deliver, disposal of documents across the enterprise.</p> <p>Documents (1M)</p> <p>Images, office documents, graphics, drawing</p> <p>Email, web pages, instant messages</p> <p>Figure: IDM system (refer notes) (2M)</p> <p>Integrated (2M)</p> <p>Transformation of document management from an end user application to network based services</p> <p>Middleware (2M)</p> <p>Bridge between OS or database and applications</p> <p>Messaging: (2M)</p> <p>Documents are forwarded to other users , then all multimedia objects available for receivers of the forward messages</p> <p>Multimedia object server and mail server (3M)</p> <p>Storing email messages</p> <p>Mail boxes</p> <p>User mail file</p> <p>Review or delete mails</p> <p>Figure: IDM servers (3M)</p>	<b>BTL5</b>
2.	<p><b>Describe User Interfaces Design (UID). (15M)</b></p> <p><b>Answer:</b> Page:5.12-Godse</p> <p>Multimedia Application contains UID</p> <p>Development Tools (3M)</p> <ul style="list-style-type: none"> <li>• Media editors</li> <li>• An authoring application</li> </ul>	<b>BTL 4</b>

	<ul style="list-style-type: none"> <li>• Hypermedia object creation</li> <li>• Multimedia object locator and browser</li> </ul> <p>Navigation through the Application(2M)</p> <ul style="list-style-type: none"> <li>• Direct</li> <li>• Free form mode</li> <li>• Browse mode</li> </ul> <p>Designing User Interfaces(2M)</p> <p>Design guidelines</p> <ul style="list-style-type: none"> <li>• Planning the overall structure of the application</li> <li>• Planning the content of the application</li> <li>• Planning the interactive behavior</li> <li>• Planning the look and feel of the application</li> </ul> <p>Special metaphors for multimedia Applications(2M)</p> <p>Main characteristics</p> <ul style="list-style-type: none"> <li>• Time based metaphor</li> <li>• Card based metaphor</li> <li>• Icon based metaphor</li> <li>• Theoretical based metaphor</li> </ul> <p>Other Metaphors (3M)</p> <ul style="list-style-type: none"> <li>• Organizer metaphors</li> <li>• Telephone metaphors</li> <li>• Aural UI Metaphors</li> <li>• VCR Metaphor</li> <li>• Scripting metaphor</li> <li>• Slide show metaphor</li> <li>• Hierarchical metaphor</li> </ul>
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	<ul style="list-style-type: none"><li>• Frames metaphor</li><li>• Cast / Score metaphors</li></ul> <p>Audio/Video Indexing Functions (3M)</p> <ul style="list-style-type: none"><li>• Indexing is helped to users to mark the location on tape</li><li>• Indexing is based on time</li><li>• Tape counter helps to show playtime.</li><li>• Tape counter location helps to<ul style="list-style-type: none"><li>o Listing special events</li><li>o Mark user events</li><li>o Special location</li></ul></li></ul>
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**IT8076****SOFTWARE TESTING****LTPC  
3003****UNIT I INTRODUCTION****9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

**UNIT II TEST CASE DESIGN STRATEGIES****9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

**UNIT III LEVELS OF TESTING****9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

**UNIT IV TEST MANAGEMENT****9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- . The Technical Training Program.

**UNIT V TEST AUTOMATION****9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**Subject Code: IT8076    Year/Semester :III/06****Subject Name : Software Testing****Subject Handler: Mrs. Aruna Jasmine****UNIT I INTRODUCTION**

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Testers Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository

**PART\* A**

<b>Q.NO</b>	<b>QUESTIONS</b>
1.	<b>Define Software Engineering.(BTL1)</b> Software Engineering is a discipline that produces error free software with in a time and budget.
2.	<b>Define software Testing.(AU April/May 2016)(BTL1)</b> Testing can be described as a process used for revealing defects in software, and for establishing that the software has attained a specified degree of quality with respect to selected attributes.
3.	<b>List the elements of the engineering disciplines.(BTL1)</b> <ul style="list-style-type: none"> <li>• Basic principles</li> <li>• Processes</li> <li>• Standards</li> <li>• Measurements</li> <li>• Tools</li> <li>• Methods</li> <li>• Best practices</li> <li>• Code of ethics</li> <li>• Body of knowledge</li> </ul>
4.	<b>Define process in the context of software quality.(BTL1)</b> “Process” in the software engineering domain, is a set of methods, practices, Standards, documents, activities, polices, and procedures that software engineers use to develop and maintain a software system and its associated artifacts, such as project and test plans, design documents, code, and manuals
5.	<b>Define the term Testing(BTL1)</b> <ul style="list-style-type: none"> <li>• Testing is generally described as a group of procedures carried out to evaluate some aspect of a piece of software.</li> <li>• Testing can be described as a process used for revealing defects in software, and for</li> </ul>

	establishing that the software has attained a specified degree of quality with respect to selected attributes.
6.	<p><b>Interpret the term Debugging or fault localization.(BTL1)</b></p> <p>Debugging or fault localization is the process of</p> <ul style="list-style-type: none"> <li>• Locating the fault or defect</li> <li>• Repairing the code, and</li> <li>• Retesting the code.</li> </ul>
7.	<p><b>List the levels of TMM.(AU Nov/Dec2016)(BTL1)</b></p> <p>The testing maturity model or TMM contains five levels.</p> <p>They are</p> <ul style="list-style-type: none"> <li>• Level1: Initial</li> <li>• Level2: Phase definition</li> <li>• Level3: Integration</li> <li>• Level4: Management and Measurement</li> <li>• Level5: Optimization /Defect prevention and Quality Control.</li> </ul>
8.	<p><b>List the members of the critical groups in a testing process.</b> (BTL1)</p> <ul style="list-style-type: none"> <li>• Manager</li> <li>• Developer/Tester</li> <li>• User/Client</li> </ul>
9.	<p><b>Define Error.(BTL1)</b></p> <p>An error is mistake or misconception or misunderstanding on the part of a software developer.</p>
10.	<p><b>Define Faults (Defects).(AU Nov/Dec2016) ( BTL1)</b></p> <p>A fault is introduced into the software as the result of an error. It is an anomaly in the software that may cause it to behave incorrectly, and not according to its specification.</p>
11.	<p><b>Define failures.(AU NOV/DEC 2016) (BTL5)</b></p> <p>A failure is the inability of a software or component to perform its required functions within specified performance requirements.</p>
12	<p><b>What is the need of TMM?</b></p> <p>Test maturity model gives the level at which an organization stands in meeting Testing criterias.</p>
13	<p><b>Define Validation.(BTL1)</b></p> <p>Validation is the process of evaluating a software system or component during, or at the end of, the development cycle in order to determine whether it satisfies specified requirements.</p>
14	<p><b>Explain in short about Verification.( BTL1)</b></p> <p>Verification is the process of evaluating a software system or component to determine whether the product of a given development phase satisfy the conditions imposed at the start of that phase.</p>
15	<p><b>Programmer A and Programmer B are working on a group of interfacing modules. Programmer A tends to be a poor communicator and does not get along well with Programmer B. Due to this situation, what types of defects are likely to surface in these interfacing modules?( BTL3)</b></p> <ul style="list-style-type: none"> <li>• Communication defects.</li> </ul>

16	<b>List the stages in Software Engineering (BTL1)</b> <ul style="list-style-type: none"> <li>• Requirement Analysis</li> <li>• Design</li> <li>• Coding</li> <li>• Deployment</li> <li>• Delivery</li> </ul>
17	<b>Define Test Cases.</b> ( BTL1) <p>A test case in a practical sense is a test related item which contains the following information.</p> <p><b>A set of test inputs.</b> These are data items received from an external source by the code under test. The external source can be hardware, software, or human.</p> <p><b>Execution conditions.</b> These are conditions required for running the test, for example, a certain state of a database, or a configuration of a hardware device.</p> <p><b>Expected outputs.</b> These are the specified results to be produced by the code under test.</p>
18.	<b>Define Test Oracle</b> ( BTL1) <p>Test Oracle is a document, or a piece of software that allows tester to determine whether a test has been passed or failed.</p>
19.	<b>Define Test Bed.(AU Nov/Dec 2017)( BTL1)</b> <p>A test bed is an environment that contains all the hardware and software needed to test a software component or a software system.</p>
20.	<b>Define Software Quality.</b> ( BTL1) <p>Quality relates to the degree to which a system, system component, or process meets specified requirements. Quality relates to the degree to which a system, system component, or process meets Customer or user needs, or expectations.</p>
21.	<b>List the Quality Attributes.</b> ( BTL1) <ul style="list-style-type: none"> <li>• Correctness</li> <li>• Reliability</li> <li>• Usability</li> <li>• Integrity</li> <li>• Portability</li> <li>• Maintainability</li> <li>• Interoperability</li> </ul>
22.	<b>Define SQA group.</b> (BTL1) <p>The software quality assurance (SQA) group is a team of people with the necessary training and skills to ensure that all necessary actions are taken during the development process so that the resulting software confirms to established technical requirements.</p>
23.	<b>Explain the work of SQA group.</b> ( BTL2) <p>Testers to develop quality related policies and quality assurance plans for each project. The group is also involved in measurement collection and analysis, record keeping, and Reporting. The SQA team members participate in reviews and audits, record and track Problems, and verify that corrections have been made.</p>
24.	<b>Define reviews.</b> ( BTL1) <p>A review is a group meeting whose purpose is to evaluate a software artifact or a set of Software artifacts. Review and audit is usually conducted by a SQA group.</p>
25.	<b>List the sources of Defects or Origins of defects.</b> (AU April/May 2017)( BTL1) <ul style="list-style-type: none"> <li>• Education</li> <li>• Communication</li> </ul>

- Oversight
- Transcription
- Process.

### PART \*B

1	<b>Discuss about the role of process in software quality (Testing). (13M) BTL2</b>
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**Answer:** page : 1 - Notes

**Process** – Creates an impact in the system.(2M)

**Testing as a process:** Set of activities well planned in advance.(2M)

**Figure** - Components of an engineered process.(2M) (Pg no: 2 in notes)

**Explanation:**

**Testing Maturity model TMM (4M)**

- Level 1: Initial
- Level 2: Phase Definition
- Level 3: Integration
- Level 4: Management and Measurement
- Level 5: Optimization/Defect Prevention/Quality control

**Verification and Validation Model(3M)**

- **Diagram :** Pg no:2 in notes
- **Verification:** Checks if software confirm to Functional and Non – Functional requirements
- **Validation:** Confirms if Software meets user requirements.

2	<b>Draw the 5-level structure of the testing maturity model ,discuss about it.(13M) BTL2</b>
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**Answer :** page : 9 - Notes

**Test maturity model :** Gives an overview of the activities done in each level of testing.

**Explanation: Testing Maturity model TMM (4M)**

- Level 1: Initial
- Level 2: Phase Definition
- Level 3: Integration
- Level 4: Management and Measurement
- Level 5: Optimization/Defect Prevention/Quality control

**Verification and Validation Model(3M)**

- **Diagram :** Pg no:2 in notes (4M)
- **Verification:** Checks if software confirm to Functional and Non – Functional requirements
- **Validation:** Confirms if Software meets user requirements.

3	<b>Explain in detail about the software testing principles.(13M)</b>
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**April/may 2017BTL2**

**Answer : Page: 3-23 - Srinivasan & Ramaswamy**

**Definition:** Principle is any rule that governs the system.

**Explanation:**

- Principle 1 :Revealing defects and evaluating quality (2M)
- Principle 2 :Effectiveness of testing effort (1M)
- Principle 3 : Test results should be inspected (1M)
- Principle 4 : Test case must contain the expected output (1M)
- Principle 5:Test case developed for both valid and invalid input conditions (1M)

	<ul style="list-style-type: none"> <li>• Principle 6 :Defects ratio (1M)</li> <li>• Principle7 : Testing should be carried out by a group (1M)</li> <li>• Principle8 : Tests must be repeatable and reusable (1M)</li> <li>• Principle9 :Testing should be planned (1M)</li> <li>• Principle 10: Testing activities should be integrated into software lifecycle (1M)</li> <li>• Principle 11: Testing is a creative and challenging task (2)</li> </ul>
4	<p><b>Give an example for defect classes and discuss them in detail.(13M)</b>  <b>(Nov/Dec 2016) BTL4</b></p> <p><b>Answer : page : 10 - Notes</b></p> <p><b>Definition:</b>Any abnormal condition that affects the execution of a program is called defect. (2M)</p> <p><b>Figure:</b>Defect classes and a defect repository.(2M)</p> <p><b>Explanation: (9M)</b></p> <ul style="list-style-type: none"> <li>• <b>Requirements and specification defects</b> <ol style="list-style-type: none"> <li>a. Functional Description defects</li> <li>b. Feature defects</li> <li>c. Feature interaction defects</li> <li>d. Interface description defects,</li> </ol> </li> <li>• <b>Design defects</b> <ol style="list-style-type: none"> <li>a. Algorithmic and processing defects</li> <li>b. Control ,logic, and sequence defects</li> <li>c. Data defects.</li> <li>d. Module interface description defects</li> <li>e. External Interface description defects.</li> </ol> </li> <li>• <b>Coding defects</b> <ol style="list-style-type: none"> <li>a. Algorithmic and processing defects.</li> <li>b. Control ,logic, and sequence defects</li> <li>c. Typographical defects</li> <li>d. Initialization defects.</li> <li>e. Dataflow defects</li> <li>f. Data defects</li> <li>g. Module interface defects,</li> <li>h. Code document defects.</li> <li>i. External hardware and software interface defects,</li> <li>j. Testing defects.</li> <li>k. Test harness defects</li> <li>l. Test case design and test procedure Defects.</li> </ol> </li> </ul>
5	<p><b>Explain in detail about Testing as a Process.</b> <span style="float: right;">(13M )BTL2</span></p> <p><b>Anwer : Page :29 - 31 - Srinivasan &amp; Ramaswamy book</b></p> <p><b>Process –</b> Creates an impact in the system.(2M)</p> <p><b>Testing as a process:</b> Set of activities well planned in advance.(2M)</p> <p><b>Figure -</b> Components of an engineered process.(2M) (Pg no: 2 in notes)</p> <p><b>Explanation:</b></p> <p><b>Testing Maturity model TMM (4M)</b></p> <ul style="list-style-type: none"> <li>• Level 1: Initial</li> <li>• Level 2: Phase Definition</li> <li>• Level 3: Integration</li> <li>• Level 4: Management and Measurement</li> </ul>

	<ul style="list-style-type: none"> <li>• Level 5: Optimization/Defect Prevention/Quality control</li> </ul> <p><b>Verification and Validation Model(3M)</b></p> <ul style="list-style-type: none"> <li>• <b>Diagram :</b> Pg no:2 in notes</li> <li>• <b>Verification:</b> Checks if software confirm to Functional and Non – Functional requirements</li> </ul> <p><b>Validation:</b> Confirms if Software meets user requirements.</p>
6	<p><b>Give a detailed account on the origins of defects.</b> (13M)  <b>(Nov/Dec 2016) BTL2</b></p> <p><b>Answer : page: 10 - Notes</b></p> <p><b>Definition:</b> Any abnormal condition that affects the execution of a program is called defect. (2M)</p> <p><b>Figure:</b> Defect classes and a defect repository.(4M)</p> <p><b>Explanation:</b> (3M)</p> <p><b>Types of Defect:</b></p> <ul style="list-style-type: none"> <li>• Variance from product specification</li> <li>• Variance from customer or user specification</li> <li>• Wrong requirement</li> <li>• Missing Requirement</li> <li>• Extra Requirement</li> </ul> <p><b>Sources of Error:</b></p> <ul style="list-style-type: none"> <li>• Education</li> <li>• Communication</li> <li>• Oversight</li> <li>• Transcription</li> <li>• Process</li> </ul> <p><b>Hypothesis:</b></p> <ul style="list-style-type: none"> <li>• Design Test</li> </ul> <p><b>Fault Model:</b> Employed to prepare fault list.</p> <p><b>Physical Defects:</b></p> <ul style="list-style-type: none"> <li>• Manufacturing Errors</li> <li>• Component Wear out.</li> <li>• Environmental Effects</li> </ul> <p><b>Figure : Origins of defects.(4M)</b></p>
7	<p><b>Discuss the Coin Problem along with the defect categories associated withit.(13M) BTL6</b></p> <p><b>Answer : page : 17 - Notes</b></p> <p><b>Figure :</b> Sample specification with defects.(4M)</p> <p><b>Figure :</b> a sample design specification with defects(4M)</p> <p><b>Explanation:(5M)</b></p> <ul style="list-style-type: none"> <li>• Algorithmic and processing defects.</li> <li>• Precondition</li> <li>• Post-condition</li> <li>• Control,logic, and sequence defects.</li> <li>• Typographical defects.</li> </ul>

	<ul style="list-style-type: none"> <li>Initialization defects.</li> <li>Dataflow defects.</li> </ul>
8	<p><b>Analyse the role of tester in software development Organization.(13M) BTL4 (Nov/Dec 2017)</b></p> <p><b>Answer : page:9 - Notes</b></p> <p><b>Tester:</b> Objective of testing to get high quality software which should satisfy all requirements of software. Role of tester to ensure whether all requirements of software are satisfied. (2M)</p> <p><b>Explanation:</b></p> <p><b>Tester's job:(4M)</b></p> <ul style="list-style-type: none"> <li>Reveal defects</li> <li>Find weak points</li> <li>Inconsistent behavior</li> <li>Circumstances where the software does not work as expected.</li> </ul> <p><b>Tester's Need:</b></p> <ul style="list-style-type: none"> <li>Communication Skills</li> <li>Team working skills</li> <li>Decision Making skills</li> </ul> <p><b>Testers are said to be specialist:</b></p> <ul style="list-style-type: none"> <li>Provide plan</li> <li>Do Execution</li> <li>Recording result</li> <li>Analysing the test result</li> </ul>
	<b>PART – C</b>
1	<p><b>Given 6 different denominations of coins ,The program finds total dollars &amp; cents values for a set of coins and outputs the number of dollars. Find the possible defects in the above scenario.(15M) BTL6 (April/May 2017)</b></p> <p><b>Answer : Appendix - Srinivasan,Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>Requirements or functional Defects(4M)</li> <li>Functional description defects</li> <li>Interface description defects</li> <li>Pre conditions(5M)</li> <li>Post conditions</li> <li>Control,Logic and sequence defects(3M)</li> <li>Algorithmic and processing defects</li> <li>Data flow defects(3M)</li> <li>Data Defects</li> <li>External</li> </ul>
2	<p><b>If you were testing a feature of your software on Monday and finding a new bug every hour, at what rate would you expect to find bugs on Tuesday? (15M) BTL4</b></p> <p><b>Answer : Appendix - Srinivasan,Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>Number of bugs remaining is proportional to the number of bugs you have already found.(8M)</li> <li>Pesticide paradox – Tells you that if you continue to run the same tests over and over that you eventually won't find new and different bugs until you add more tests.(7M)</li> </ul>
3	<b>Visiting all the states that the program has assures that you have also traverses all the</b>

**transitions among them. The statement is true or false? Justify your answer.(15M) BTL4**

**Answer : Appendix - Srinivasan Ramaswamy**

**STATEMENT :False(8M)**

**Explanation(7M)**

- Think of visiting 50 different cities spread out across the entire United states.
- You could plan a trip that would take you to each city.
- But it would be impossible for you to travel all the roads that connects all the cities.

JIT - 2106

## UNIT II TEST CASE DESIGN STRATEGIES

Test case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

### PART \*A

1	<b>Define Smart Tester.(BTL1)</b> Software must be tested before it is delivered to users. It is responsibility of the testers to Design tests that (i) reveal defects (ii) can be used to evaluate software performance, usability and reliability. To achieve these goals, tester must select a finite no. of test cases (i/p, o/p, & conditions).
2	<b>Define responsibility.(AU Nov/Dec 2016)(BTL1)</b> A straightforward definition for object-responsibility is this: An object must contain the data (attributes) and code (methods) necessary to perform any and all services that are required by the object.
3	<b>Write short notes on Random testing and Equivalence class portioning.(BTL1) (Nov/Dec 2015)</b> Each software module or system has an input domain from which test input data is selected. If a tester randomly selects inputs from the domain, this is called random testing. In equivalence class partitioning the input and output is divided in to equal classes or partitions.
4	<b>Define State.(BTL1)</b> A state is an internal configuration of a system or component. It is defined in terms of the values assumed at a particular time for the variables that characterize the system or component.
5	<b>Define Finite-State machine. (BTL1)</b> A finite-state machine is an abstract machine that can be represented by a state graph having a finite number of states and a finite number of transitions between states.
6	<b>Define Error Guessing.(BTL1)</b> The tester/developer is sometimes able to make an educated “guess” as to which type of defects may be present and design test cases to reveal them. Error Guessing is an ad-hoc approach to test design in most cases.
7	<b>Define COTS Components.(BTL1)</b> The reusable component may come from a code reuse library within their org or, as is most likely, from an outside vendor who specializes in the development of specific types of software components. Components produced by vendor org are known as commercial off-the shelf, or COTS, components.
8	<b>Express the benefits of low coupling.(BTL2)</b> <b>Maintainability</b> – changes are confined in a single module <b>Testability</b> – modules involved in unit testing can be limited to a minimum <b>Readability</b> – classes that need to be analysed are kept at a minimum.
9	<b>Define usage profiles and Certification.(BTL1)</b> Usage profiles are characterizations of the population of intended uses of the software in its intended environment. Certification refers to third party assurance that a product,process, or service meets a specific set of requirements.

10	<b>Write the application scope of adequacy criteria?(BTL4)</b> <ul style="list-style-type: none"> <li>Helping testers to select properties of a program to focus on during test.</li> <li>Helping testers to select a test data set for a program based on the selected properties.</li> <li>Supporting testers with the development of quantitative objectives for testing</li> <li>Indicating to testers whether or not testing can be stopped for that program.</li> </ul>
11	<b>Define path.(BTL1)</b> A path is a sequence of control flow nodes usually beginning from the entry node of a graph through to the exit node.
12	<b>Write the formula for cyclomatic complexity?(AU Nov/Dec 2016)(BTL1)</b> The complexity value is usually calculated from control flow graph(G) by the formula. $V(G) = E - N + 2$ Where The value E is the number of edges in the control flow graph The value N is the number of nodes.
13	<b>List the various iterations of Loop testing. ?(BTL1)</b> <ul style="list-style-type: none"> <li>Zero iteration of the loop</li> <li>One iteration of the loop</li> <li>Two iterations of the loop</li> <li>K iterations of the loop where <math>k &lt; n</math></li> <li><math>n-1</math> iterations of the loop</li> <li><math>n+1</math> iterations of the loop</li> </ul>
15	<b>What are the errors uncovered by black box testing?(BTL1)</b> <ul style="list-style-type: none"> <li>Incorrect or missing functions</li> <li>Interface errors</li> <li>Errors in data structures</li> <li>Performance errors</li> <li>Initialization or termination error.</li> </ul>
16	<b>Define Equivalence class partitioning?(BTL1)</b> If a tester is viewing the software-under-test as a black box with well defined inputs and outputs, a good approach to selecting test inputs is to use a method called Equivalence class partitioning.
17	<b>Define Cause effect graphing?(BTL1)</b> Cause Effect Graph is a black box testing technique that graphically illustrates the relationship between a given outcome and all the factors that influence the outcome.
18	<b>What is Certification?(BTL1)</b> Certification refers to third-party assurance that a product, process, or service meets a specific set of requirements.
19	<b>What is the goal of smart tester?(BTL1)</b> The goal of the smart tester is to understand the functionality, input/output domain, and the environment of use for the code being tested.
20	<b>List the two major assumptions in Mutation testing.(BTL1)</b> <ul style="list-style-type: none"> <li>The component programmer hypothesis</li> <li>The coupling effects</li> </ul>
21	<b>List the two basic Testing strategies.(BTL1)</b> <ul style="list-style-type: none"> <li>Black box testing.</li> <li>White box testing.</li> </ul>
22	<b>What are the knowledge sources for Black box testing?(BTL2)</b> <ul style="list-style-type: none"> <li>Requirement</li> <li>Document specification</li> <li>Domain knowledge</li> </ul>

	<ul style="list-style-type: none"> <li>Defect analysis data</li> </ul>
23	<p><b>What are the knowledge sources for White box testing? (AU Nov/Dec 2015)(BTL2)</b></p> <ul style="list-style-type: none"> <li>High level design</li> <li>Detailed design</li> <li>Control flow graphs</li> <li>Cyclomatic complexity</li> </ul>
24	<p><b>List the methods of Black box testing?(AU Nov/Dec 2017)(BTL1)</b></p> <ul style="list-style-type: none"> <li>Equivalence class partitioning</li> <li>Boundary value analysis</li> <li>State transition testing</li> <li>Cause and effect graphing</li> <li>Error guessing</li> </ul>
25	<p><b>List the methods of White box testing?(AU Nov/Dec 2017)(BTL1)</b></p> <ul style="list-style-type: none"> <li>Statement testing</li> <li>Branch testing</li> <li>Path testing</li> <li>Data flow testing</li> <li>Mutation testing</li> <li>Loop testing</li> </ul>
<b>PART* B</b>	
1	<p><b>Elaborate the qualities of a smart Tester.BTL2(13M)</b></p> <p><b>Answer : page : 18 - Notes</b></p> <ul style="list-style-type: none"> <li>Reveal defects(4M) <ul style="list-style-type: none"> <li>Find the bugs before the software becomes operational</li> <li>Find errors at the early stage (Requirement Analysis)</li> <li>Find the weak points</li> <li>Situations at which error may occur</li> </ul> </li> <li>Evaluate quality(4M) <ul style="list-style-type: none"> <li>Ensures if software meets user requirements</li> <li>Ensures if software meets requirement specification</li> <li>Ensures if software meets performance criteria such as reliability,usability, portability</li> </ul> </li> <li>Finite no of test case(5M) <ul style="list-style-type: none"> <li>Number of test cases.</li> <li>A test case that makes the tester to makesure that software meets all user requirements.</li> <li>Test cases that are capable enough to make the system to crash.</li> </ul> </li> </ul>
2	<p><b>Discuss the test case design strategies.BTL2 (13M)</b></p> <p><b>Answer: page : 18 - Notes</b></p> <ul style="list-style-type: none"> <li>Two strategies</li> <li>Whitebox (clear or glass box) (2M)</li> <li>Testing the software with X – Ray glasses</li> <li>Black box(Functional or specification)(2M)</li> <li>Testing the software blind folded.</li> </ul>

	<ul style="list-style-type: none"> <li>Table: The two basic testing strategies.(9M)Page 18 in notes</li> </ul>
3	<p><b>List and explain the types of black box testing.AU April/May 2016 BTL2 (13M)</b></p> <p><b>Answer:Page:73 - 105 - Srinivasan &amp; Ramaswamy</b></p> <ul style="list-style-type: none"> <li>Random testing (1M) <ul style="list-style-type: none"> <li>Randomly select the input.</li> <li>Three conditions.</li> </ul> </li> <li>Equivalence class partitioning(2M) <ul style="list-style-type: none"> <li>Adv of Equivalence class partitioning</li> <li>List of conditions.</li> <li>Figure: A specification of a square root function</li> <li>Example of equivalence class reporting table</li> </ul> </li> <li>Boundary value analysis(1M) <ul style="list-style-type: none"> <li>List the conditions</li> <li>Figure: Boundaries of on Equivalence partition</li> <li>Example of Boundary value analysis.</li> </ul> </li> <li>State Transition Testing(1M) <ul style="list-style-type: none"> <li>Abstract Machine</li> <li>State graph having a finite number of states and transitions between</li> <li>Internal configuration of system or component</li> </ul> </li> <li>Error guessing(1M) <ul style="list-style-type: none"> <li>Tester/Developer's past experience</li> </ul> </li> <li>Cause and Effect Graphing(2M) <ul style="list-style-type: none"> <li>Nodes in the graph are causes and effects</li> <li>Tester need to identify causes and effects</li> <li>Graph must be annotated with constraints</li> <li>Graph is then converted into decision table</li> <li>Columns in the decision table are converted into test cases</li> </ul> </li> <li>Requirement Based Testing(1M) <ul style="list-style-type: none"> <li>Test Requirement Specification</li> <li>Explicit Requirement</li> <li>Implicit Requirement</li> <li>Requirement traceability Matrix</li> </ul> </li> <li>Compatibility Testing(1M) <ul style="list-style-type: none"> <li>Confirms working of product with different infrastructure components</li> <li>Forward Compatibility Testing</li> <li>Backward Compatibility testing</li> </ul> </li> <li>User documentation Testing(2M) <ul style="list-style-type: none"> <li>Manuals, User guidelines</li> <li>Installation guidelines</li> <li>Setup guidelines, Readme files</li> <li>Software Release notes,Online help</li> </ul> </li> <li>Domain Testing(1M) <ul style="list-style-type: none"> <li>Needs business domain knowledge than software knowledge</li> <li>They get trained in software ,instead of training the software professional in business domain.</li> </ul> </li> </ul>

4	<p><b>Discuss the various approaches in White Box test design.(13M)</b></p> <p><b>AU Nov/Dec 2016 BTL2</b></p> <p><b>Answer:</b> Page :29 - 31 - Srinivasan &amp; Ramaswamy</p> <ul style="list-style-type: none"> <li>• Coverage and control flow graph(3M)             <ol style="list-style-type: none"> <li>1. Three basic primes</li> <li>2. Sequential</li> <li>3. Condition</li> <li>4. Iteration</li> </ol> </li> <li>• Coverage code logic(3M)             <ol style="list-style-type: none"> <li>1. Figure: Code sample with branch and loop.</li> <li>2. Figure: A control flow graph representation for the code.</li> <li>3. Table: A test case for the code ,that satisfies the decision</li> </ol> </li> <li>• coverage criterion.(3M)             <ol style="list-style-type: none"> <li>1. Table: Test cases for simple decision coverage</li> <li>2. Table: Test cases for condition coverage</li> <li>3. Table: Test cases for decision condition coverage.</li> </ol> </li> <li>• Path Testing (4M)             <ol style="list-style-type: none"> <li>1. Path</li> <li>2. Cyclomatic complexity formula.</li> </ol> </li> </ul>
5	<p><b>Evaluate test adequacy Criteria with necessary properties.(13M) BTL3</b></p> <p><b>Answer:</b> page:27 - Srinivasa &amp; Ramamurty</p> <ul style="list-style-type: none"> <li>• Axioms –Set of assumptions(1M)</li> <li>• Applicability Property(1M)</li> <li>• Non exhaustive applicability property(1M)</li> <li>• Monotonicity Property(2M)</li> <li>• Inadequate Empty set(1M)</li> <li>• General multiple change Property(1M)</li> <li>• Anti decomposition Property(2M)</li> <li>• Renaming Property(1M)</li> <li>• Complexity Property(1M)</li> <li>• Statement Coverage Property(2M)</li> </ul>
6	<p><b>Demonstrate the various black box testing approaches using Equivalence partitioning and boundary value Analysis.(13M)</b></p> <p><b>Nov/Dec 2016 BTL5</b></p> <p><b>AnswerPage : 84,90 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Equivalence Partition:</b> (8M)</p> <p>Software testing technique – divides input data of software unit into partitions of equivalent data – test cases can be derived – main principle of test cases are deigned to coverpartition at least once.</p> <p><b>Boundary value analysis:</b> (5M)</p> <p>Test case design technique to test boundary value between partitions-boundary value is an input or output value on the border of an equivalence partition.</p>
7	<p><b>Compare static testing with that of dynamic testing and list the major difference between both.(13M) BTL4</b></p>

	<b>STATIC TESTING</b>	<b>DYNAMIC TESTING</b>
Prevention.	Cure.	
More cost-effective.	Less cost – effective.	
Greater marginal benefits.	Lesser marginal benefits.	
Comprehensive diagnostics for code.	More diagnostics for code.	
Finds more bugs.	Finds fewer bugs.	
Takes lesser time.	Takes longer time.	
Testing covers more areas.	Testing covers less areas.	
Done in verification stage.	done in validation stage.	

### **PART \*C**

1	<p><b>Explain What a tester should worry about with this line from a spec. The software will allow up to 100 million simultaneous connections, although no more than 1 million will normally be used.BTL4(15 M)</b></p> <p><b>Answer : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• Testability(4M)</li> <li>• It doesn't matter that typical usage is only 1 million connections.(4M)</li> <li>• If the specification states that 100 million are possible(4M)</li> <li>• The 100 million must be tested.(3M)</li> </ul>
2	<p><b>Assume that you are assigned to test the windows calculator, Is it possible to test all the test cases. How do you test it systematically and explain the principle involved.BTL6(15M)</b></p> <p><b>Answer: Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• Equivalence Partitioning(5M)</li> <li>• Grouping similar input(4M)</li> <li>• Grouping similar Output(4M)</li> <li>• Grouping similar operations of software(2M)</li> </ul>
3	<p><b>Visiting all the states that the program has assures that you have also traverses all the transitions among them. The statement is true or false? Justify your answer.BTL4(15M)</b></p> <p><b>Answer : Appendix - Srinivasan Ramaswamy</b></p> <p>False(8M)</p> <p><b>Explanation(7M)</b></p> <ul style="list-style-type: none"> <li>• Think of visiting 50 different cities spread out across the entire United States.</li> <li>• You could plan a trip that would take you to each city.</li> <li>• But it would be impossible for you to travel all the roads that connect all the cities.</li> </ul>

### UNIT III LEVELS OF TESTING

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

#### PART A

1	<b>Define Unit Testing (Nov/Dec 2017)BTL1</b> A unit is the smallest possible testable software component that can be characterized in several ways.
2	<b>Write the different levels of testing.BTL1</b> <ul style="list-style-type: none"> <li>• Unit test</li> <li>• Integration test</li> <li>• System test</li> <li>• Acceptance test.</li> </ul>
3	<b>List the components suitable for unit test.BTL1</b> <ul style="list-style-type: none"> <li>• Procedures and functions</li> <li>• Classes/objects and methods</li> </ul> Procedure-sized reusable components.
4	<b>List the phases in the unit test planning. (April/May 2015)BTL1</b> <ul style="list-style-type: none"> <li>• Phase 1: Describe unit test approach and risks.</li> <li>• Phase 2: Identify unit features to be tested.</li> <li>• Phase 3: Add levels of detailed to the plan.</li> </ul>
5	<b>Write the issues in the unit test.BTL1</b> <ul style="list-style-type: none"> <li>• Issue 1: Adequately testing classes.</li> <li>• Issue 2: Observation of objects states and state changes.</li> <li>• Issue 3: The retesting of classes-I</li> <li>• Issue 4: The retesting of classes-II</li> </ul>
6	<b>What is Test harness?(Nov/Dec 2016)BTL1</b> The auxiliary code developed to support to testing of units and components is called a test harness. The harness consists of drivers that call the target code and stubs that represent modules it calls.
7	<b>List the major goals of Integration test.BTL1</b> <ul style="list-style-type: none"> <li>• To detect defects that occurs on the interfaces of units.</li> <li>• To assemble the individual units into working subsystems and the finally a complete system that is ready for system test</li> </ul>
8	<b>What is the advantage of Bottom up integration?BTL1</b> Bottom-up integration has the advantage that the lower-level modules are usually well tested early in the integration process. This is important if these modules are candidates for reuse.
9	<b>What is a cluster?BTL1</b> A cluster consists of classes that are related, for example, they may work together to support a required functionality for the complete system.

10	<b>List the several types of system tests.(Nov/Dec 2016)BTL1</b> <ul style="list-style-type: none"> <li>• Functional testing</li> <li>• Performance testing</li> <li>• Stress testing</li> <li>• Configuration testing</li> <li>• Security testing</li> <li>• Recovery testing</li> </ul>
11	<b>Define Load.</b> BTL1 A load is a series of inputs that simulates a group of transactions.
12	<b>List the two major requirements of Performance testing.</b> BTL1 <ul style="list-style-type: none"> <li>• Functional requirements</li> <li>• Quality requirements.</li> </ul>
13	<b>What is meant by Stress testing?</b> BTL1 When a system is tested with a load that causes it to allocate its resources in maximum amounts, this is called stress testing.
14	<b>Define Recovery testing.</b> BTL1 Recovery testing subjects a system to losses of resources in order to determine if it can recover properly from these losses.
15	<b>Define Use case.</b> BTL1 A use case is a pattern, scenario, or exemplar of usage. It describes a typical interaction between the software system under development and a user.
16	<b>Define Regression testing .</b> BTL1 Regression testing is not a level of testing, but it is the retesting of the software that occurs when the changes are made to ensure that the new version of the software has retained the capabilities of the old version and that no defect have been introduced due to the changes.
17	<b>Write the objectives of configuration testing.</b> BTL1 <ul style="list-style-type: none"> <li>• Show that all the configuration changing commands and menus work properly</li> <li>• Show that all interchangeable devices are really interchangeable, and that they each enter the proper states for the specified conditions</li> <li>• Show that the system's performance level is maintained when devices are interchanged,or when they fail.</li> </ul>
18	<b>List the effect of security breaches.</b> BTL1 <ul style="list-style-type: none"> <li>• Loss of information</li> <li>• Corruption of information</li> <li>• Misinformation</li> <li>• Privacy violations</li> <li>• Denial of service</li> </ul>
19	<b>Define functional Testing.</b> BTL1 Functional tests at the system level are used ensure that the behavior of the system adheres to the requirement specifications.
20	<b>What is load generator and Load?</b> BTL1 An important tool for implementing system tests is a load generator. A load generator is essential for testing quality requirements such as performance and stress. A load is a series of inputs that simulates a group of transactions.
21	<b>What are the approaches used to develop the software?</b> BTL1 There are two major approaches to software development

	<ul style="list-style-type: none"> <li>• Bottom-Up</li> <li>• Top-Down</li> </ul>
22	<b>List the objectives of configuration testing.</b> BTL1 <ul style="list-style-type: none"> <li>• Show that all the configuration changing commands and menus work properly</li> <li>• Show that all interchangeable devices are really interchangeable, and that they each enter the proper states for the specified conditions</li> <li>• Show that the system's performance level is maintained when devices are interchanged, or when they fail.</li> </ul>
23	<b>List the effect of security breaches.</b> BTL1 <ul style="list-style-type: none"> <li>• Loss of information</li> <li>• Corruption of information</li> <li>• Misinformation</li> <li>• Privacy violations</li> <li>• Denial of service.</li> </ul>
24	<b>Give the examples of security testing.</b> BTL2 <ul style="list-style-type: none"> <li>• Password checking.</li> <li>• Legal and illegal entry with password.</li> <li>• Password Expiration.</li> <li>• Encryption.</li> <li>• Browsing.</li> <li>• Trap doors.</li> <li>• Viruses.</li> </ul>
25	<b>List the areas covered during recovery testing.</b> BTL1 <ul style="list-style-type: none"> <li>• Restart.</li> <li>• Switchover.</li> </ul>

### PART B

1	<p><b>How would you define a software unit? In terms of your definition, what constitutes a unit for procedural code; for object-oriented code?(13M)BTL4</b></p> <p><b>Answer : Page : 38,261-264 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Functions, procedures, classes and methods as units</li> <li>• <b>Fig:</b> Some components suitable for unit test(1M)</li> <li>• Unit Test: Need for preparation           <ul style="list-style-type: none"> <li>• Planning</li> <li>• Both black box and White box</li> <li>• Reviewe</li> <li>• Several Tasks</li> </ul> </li> </ul> <p>1. Unit Test Planning(4M)</p> <p>Phase I: Describe unit test approach and Risks</p> <p>Phase II: Identify unit features to be tested</p> <p>Phase III: Add levels of detail to the planning</p> <p>2. Designing the Unit Test(3M)</p> <ul style="list-style-type: none"> <li>• Test Cases</li> <li>• Test Procedure</li> </ul> <p>3. Running and recording the results(3M)</p>
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	<ul style="list-style-type: none"> <li>• Perform the unit test in all the units of system</li> <li>• Record the results.</li> </ul> <p>4. Test Harness(2M)</p> <ul style="list-style-type: none"> <li>• Additional code included to perform testing.</li> </ul>
2	<p><b>Why is it so important to design a test harness for reusability?(13M)BTL2</b></p> <p><b>Answer:</b> Page : 35 - Notes</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Auxiliary code developed</li> <li>• Support testing of units , components (3M)</li> <li>• Harness consists of drivers that call the target code</li> <li>• Stubs that represent modules it calls.(3M)</li> </ul> <p><b>Fig:</b> The test Harness(4M)</p> <p>Driver(2M) Stub(1M)</p>
3	<p><b>What are the key differences in integrating procedural-oriented systems as compared to object-oriented systems?(13M)BTL3</b></p> <p><b>Answer:</b> Page : 35 - Notes</p> <ul style="list-style-type: none"> <li>• Goals(2M)</li> <li>• Integration Strategies: <ul style="list-style-type: none"> <li>i. Top – Down</li> <li>ii. Bottom – Up</li> <li>iii. Bi – Directional</li> </ul> </li> <li>• Designing Integration Test: <ul style="list-style-type: none"> <li>i.Black Box Approach</li> <li>ii.White Box Approach</li> </ul> </li> <li>• Integration test strategy for procedures(5M)</li> <li>• Integration test strategy for classes(6M)</li> <li>• Critical Module characteristics</li> </ul>
4	<p><b>Describe the activities/Tasks and responsibilities for developer/testers in support of multilevel testing.(13M)BTL2</b></p> <p><b>Answer :</b> Page :261 - Srinivasan &amp; Ramaswamy</p> <ul style="list-style-type: none"> <li>• <b>Fig:</b> Levels of testing</li> </ul> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Levels of Testing(4M) <ul style="list-style-type: none"> <li>i. Unit Test</li> <li>ii. Integration test</li> <li>iii. System Test</li> <li>iv. Acceptance Test</li> </ul> </li> <li>• Two Approaches(4M) <ul style="list-style-type: none"> <li>Bottom_Up</li> <li>Top_Down</li> </ul> </li> <li>• Two types of Language(5M) <ul style="list-style-type: none"> <li>Procedure Oriented</li> <li>Object Oriented</li> </ul> </li> </ul>
5	<p><b>Explain Integration Test with example.(13M) (Nov/dec 2016)BTL3</b></p> <p><b>Answer:</b>Page : 107 - Srinivasan &amp; Ramaswamy</p>

	<p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Goals(2M)</li> <li>• Integration Strategies:           <ul style="list-style-type: none"> <li>i. Top – Down</li> <li>ii. Bottom – Up</li> <li>iii. Bi – Directional</li> </ul> </li> <li>• Designing Integration Test:           <ul style="list-style-type: none"> <li>1. Black Box Approach</li> </ul> </li> <li>• White Box Approach</li> <li>• Integration test strategy for procedures(5M)</li> <li>• Integration test strategy for classes(6M)</li> <li>• Critical Module characteristics</li> <li>• Example : Sandwich Testing</li> </ul>
6	<p><b>Explain the different types of system testing with example.(13M)BTL2</b></p> <p><b>Answer:Page : 130 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Functional testing(1M)</li> <li>• Performance testing(1M)</li> <li>• Stress testing(1M)</li> <li>• Configuration testing(1M)</li> <li>• Security testing(1M)</li> <li>• Recovery testing(1M)</li> <li>• <b>Fig:</b> Types of System Test(4M)</li> <li>• <b>Fig:</b> Example of special resources needed for a performance test(3M)</li> </ul>
7	<p><b>Explain in detail about scenario Testing.(13M)BTL2</b></p> <p><b>Answer:Page : 130 - Srinivasan &amp; Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• Two Methods(4M)           <ul style="list-style-type: none"> <li>i. System Scenarios</li> <li>ii. Use Case Scenarios</li> </ul> </li> <li>• Why Scenario test?(4M)           <ul style="list-style-type: none"> <li>i. Learn product</li> <li>ii. Connect Testing to documented requirement</li> <li>iii. Expose failure to deliver described benefits</li> <li>iv. Expose expert use of program</li> <li>v. Bring requirement related issues</li> </ul> </li> <li>• Twelve ways to create good scenarios(5M)</li> </ul>
7	<p><b>How would you identify hardware and software for configuration testing and how would you apply website testing?(13M)(Nov/dec 2016)BTL5</b></p> <p><b>Answer:Page : 195,198,369 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Configuration testing - testing application with multiple combinations (7M)</li> <li>• To find out the optimal <b>configurations</b></li> <li>• Web testing - focuses on web applications.(6M)</li> <li>• Complete testing of web-based system before going live</li> <li>• Help address issues before system revealed to the public.</li> </ul>

8	<p><b>i) Explain about Defect Bash Elimination.(7M)BTL2</b></p> <p><b>Answer : Page : 39 – Notes</b></p> <ul style="list-style-type: none"> <li>• Ad-hoc Testing(2M)</li> <li>• Not based on written test cases(2M)</li> <li>• Brings together plenty of good practices(1M)</li> <li>• Steps in defect bash(2M)</li> </ul> <p><b>ii) Explain about Ad-hoc Testing in detail.(6M)BTL2</b></p> <p><b>Answer : Page : 39 – Notes</b></p> <ul style="list-style-type: none"> <li>• Discovers unfound errors in software(2M)</li> <li>• Impacted due to(2M) <ul style="list-style-type: none"> <li>i. Intuition</li> <li>ii. Previous Experience</li> <li>iii. Expert knowledge of the platform</li> <li>iv. Experience in Testing</li> </ul> </li> <li>• Drawback</li> <li>• Figure : Ad - hoc Testing(2M)</li> </ul>
9	<p><b>i) Explain about usability and accessibility Testing.(7M)BTL2</b></p> <p><b>Answer : Page : 49 - Notes</b></p> <p><b>Usability testing:(4M)</b></p> <ul style="list-style-type: none"> <li>• Characteristics</li> <li>• Quality Factors</li> <li>• Approach to usability</li> <li>• Aesthetic testing</li> </ul> <p><b>Accessibility Testing:(3M)</b></p> <ul style="list-style-type: none"> <li>• Basic accessibility</li> <li>• Product accesibility</li> </ul> <p><b>ii) Explain Testing OO Model in detail.(6M)(BTL2)</b></p> <ul style="list-style-type: none"> <li>• Unit Testing</li> <li>• Integration testing</li> <li>• Validate and system testing</li> <li>• Regression testing</li> </ul>

10	<p>i) Differentiate Alpha and Beta Testing and discuss the phases in which alpha and beta testing are done?(7M)</p> <p>ii) Explain about documentation testing in detail.(6M)(Nov/Dec 2017)BTL3</p> <p><b>Answer:</b>Page : 137-140 - Srinivasan &amp; Ramaswamy</p> <p><b>Alpha Testing:</b> (4M)</p> <ul style="list-style-type: none"> <li>• Type of acceptance testing</li> <li>• Performed to identify all possible issues/bugs</li> <li>• Before releasing the product to everyday users or public.</li> <li>• Aim to carry out the tasks that a typical user might perform.</li> </ul> <p><b>Beta Testing:</b>(3M)</p> <ul style="list-style-type: none"> <li>• Second phase of <b>Software Testing</b></li> <li>• Sampling of the intended audience tries the product out.</li> <li>• Beta Testing of a product is performed by <b>real users</b> of the software application in a <b>real environment</b>.</li> </ul> <p><b>ii)Explanation:</b></p> <ul style="list-style-type: none"> <li>• Importance of documentation testing</li> <li>• Main things to look for in reviewing the document</li> <li>• Packaging and text graphics</li> <li>• Marketing materials,ads and other inserts</li> <li>• Warranty/Registration</li> <li>• EULA</li> <li>• Label and stickers</li> <li>• Installation setup &amp; Instructions</li> <li>• Users Manual</li> <li>• Online help</li> </ul>
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### PART – C

1	<p>If you are assigned to test compatibility of your product's data file formats, How would you approach the task?(15M)BTL6</p> <p><b>Answer:</b>Appendix - Srinivasan Ramaswamy</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Research whether your program follows existing standards for its files.(6M)</li> <li>• If so, test that it meets its standards.(1M)</li> <li>• Equivalence partition the possible programs that would read and write your program's files.(6M)</li> <li>• Design test documents with representative sample of the types of data.(2M)</li> </ul>
2	<p>Explain the significance of control flow graph and cyclomatic complexity with the pseudo code for the sum of n numbers(13M).(Nov/Dec 2017)BTL6</p> <p><b>Answer :</b> Appendix - Srinivasan Ramaswamy</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Cyclomatic complexity is a software metric used to measure the complexity of a program.(5M)</li> </ul>

	<ul style="list-style-type: none"> <li>• This metric measures independent paths through the program's source code. An independent path is defined as a path that has at least one edge which has not been traversed before in any other paths.(6M)</li> <li>• Cyclomatic complexity can be calculated with respect to functions, modules, methods or classes within a program.(4M)</li> </ul>
3	<p><b>What basic elements of a web page can easily be tested with black box Approach?(15M)BTL6</b></p> <p><b>Answer : Appendix - Srinivasan Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• The elements that are similar to what is multimedia CD – ROM software – text graphics ,and hyperlinks.(3M)</li> <li>• Web testing - focuses on web applications.(6M)</li> <li>• Complete testing of web-based system before going live (3M)</li> <li>• Help address issues before system revealed to the public.(3M)</li> </ul>

<b>UNIT IV TEST MANAGEMENT</b>	
People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.	
<b>PART* A</b>	
1	<b>Define Goal in testing.</b> BTL1 A Goal can be described as a statement of intent or a statement of accomplishment of an individual test person.
2	<b>What are the three types of goals in testing?</b> BTL1 <ul style="list-style-type: none"><li>• Business Goal</li><li>• Technical Goal</li><li>• Political Goal</li></ul>
3	<b>Define the term policy.(Nov/Dec2016)</b> BTL1 A policy can be defined as a high-level statement of principle or course of action that is used to govern a set of activities in an organization.
4	<b>Define Test Plan.( Nov/Dec 2015)</b> BTL1 A Plan is a document that provides a frame work or approach for achieving a set of goals.
5	<b>List the various Test Plan components.(Nov/Dec2016)</b> BTL1 <ul style="list-style-type: none"><li>• Test Plan identifier</li><li>• Introduction</li><li>• Items to be tested</li><li>• Features to be tested</li><li>• Pass/Fail criteria</li><li>• Suspension &amp; Resumption criteria</li><li>• Testing tasks</li><li>• Test environment</li><li>• Risks &amp; Contingencies</li><li>• Testing costs</li><li>• Approvals</li></ul>
6	<b>Define Features.</b> BTL1 Features may be described as distinguishing characteristics of a software component or system.
8	<b>What is the meaning of the term Pass / Fail Criteria?</b> BTL1 Given a test item and a test case, the tester must have a set of criteria to decide on whether the test has been passed or failed upon execution.
9	<b>What is Suspension &amp; Resumption criteria?</b> BTL1 The criteria to suspend and resume testing are described in the simplest of cases testing is suspended at the end of a working day and resumed the following morning.
10	<b>Define Work Breakdown Structure (WBS).</b> BTL1 A Work Break Down structure is a hierarchical or tree like representation of all the tasks that are required to complete a project.
11	<b>Define Risks &amp; Contingencies.</b> BTL1 Every testing effort has risks associated with it. Testing software with a high degree of critically, complexity, or a tight delivery deadline all impose risks that may have negative impacts on project goals.
12	<b>What is Cost Drive?</b> BTL1

	A Cost Driver can be described as a process or product factor that has an impact on overall project costs.
13	<b>What are the various components of the test plan?</b> AU Nov/Dec 2016 BTL1 <ul style="list-style-type: none"> <li>• Test Design Specification</li> <li>• Test Case Specification</li> <li>• Test Procedures specifications</li> </ul>
14	<b>Define Test Summary Report.</b> BTL1 This report is prepared when testing is complete. It is summary of the results of the testing efforts. It also becomes a part of the projects historical database and provides a basis for lessons learned as applied to future projects.
15	<b>List the skills needed by a Test specialist.</b> BTL1 <ul style="list-style-type: none"> <li>• Organizational and planning skills</li> <li>• The ability to keep track of and pay attention to details</li> <li>• The determination to discover and solve problems</li> <li>• The ability to mentor and train others</li> <li>• The ability to work with users and clients</li> <li>• The ability to think creatively</li> </ul>
16	<b>What is the use of V-model in testing?</b> BTL1 The V-model is model that illustrates how testing activities can be integrated in to each phase of the standard software life cycle.
17	<b>Write the WBS elements for testing.</b> BTL1 <ul style="list-style-type: none"> <li>• Project start-up</li> <li>• Management coordination</li> <li>• Tool selection</li> <li>• Test planning</li> <li>• Test design</li> <li>• Test development</li> <li>• Test execution</li> <li>• Test measurement, and monitoring</li> <li>• Test analysis and reporting</li> <li>• 10. Test process improvement</li> </ul>
18	<b>What is the function of Test Item Transmittal Report or Locating Test Items?</b> BTL2 Suppose a tester is ready to run tests on the data described in the test plan. We needs to be able to locate the item and have knowledge of its current status. This is the function of the Test Item Transmittal Report. Each Test Item Transmittal Report has a unique identifier.
19	<b>Define Test Log.</b> BTL1 The Test log should be prepared by the person executing the tests. It is a diary of the events that take place during the test. It supports the concept of a test as a repeatable experiment.
20	<b>What are the Three critical groups in testing planning and test plan policy? ( April/May 2015)</b> BTL1 <ul style="list-style-type: none"> <li>• Managers:</li> <li>• Developers/Testers</li> <li>• Users/Clients</li> </ul>
21	<b>What is scenario Testing?</b> The process of giving the usage scenario of the system in the client's point of view and checking how the system reacts to it is called as scenario Testing.

22	<b>What are the information present in the Test Item Transmittal Report or Locating Test Items?BTL1</b> <ul style="list-style-type: none"> <li>• Version/revision number of the item</li> <li>• Location of the item</li> <li>• Person responsible for the item (the developer)</li> <li>• References to item documentation and test plan it is related to.</li> <li>• Status of the item</li> <li>• Approvals – space for signatures of staff who approve the transmittal.</li> </ul>
23	<b>What are the skills needed by a test specialist?BTL1</b> <ul style="list-style-type: none"> <li>• Personal and managerial Skills <ul style="list-style-type: none"> <li>• Organizational, and planning skills, work with others, resolve conflicts, mentor and train others, written /oral communication skills, think creatively.</li> </ul> </li> <li>• Technical Skills <ul style="list-style-type: none"> <li>• General software engineering principles and practices, understanding of testing principles and practices, ability to plan, design, and execute test cases, knowledge of networks, database, and operating System.</li> </ul> </li> </ul>
24	<b>Write the test term hierarchy?BTL2</b> <ul style="list-style-type: none"> <li>• Test Manager</li> <li>• Test leader</li> <li>• Test Engineer</li> <li>• Junior Test Engineer</li> </ul>
25	<b>Write the approaches to test cost Estimation?BTL2</b> <ul style="list-style-type: none"> <li>• The COCOMO model and heuristics</li> <li>• Use of test cost drivers</li> <li>• Test tasks</li> <li>• Tester/developer ratios</li> <li>• Expert judgment</li> </ul>
	<b>PART* B</b>
1	<b>Explain the role of the 3 critical groups in software testing. (13M)BTL2</b> <b>Answer:Page: 321 - Srinivasan &amp; Ramaswamy</b> <ol style="list-style-type: none"> <li>1. <b>Managers(4M)</b> <ul style="list-style-type: none"> <li>• Task forces,policies,standards</li> <li>• Planning</li> <li>• Resource allocation</li> <li>• Support for education and training</li> <li>• Interact with users</li> </ul> </li> <li>2. <b>Developers/ testers(5M)</b> <ul style="list-style-type: none"> <li>• Apply black and white box methods</li> <li>• Assist with test planning</li> <li>• Test at all levels</li> <li>• Train and mentor</li> <li>• Participate in task forces</li> <li>• Interact with users</li> </ul> </li> <li>3. <b>Users/clients(4M)</b> <ul style="list-style-type: none"> <li>• Specify requirements clearly</li> <li>• Participate in usability test</li> </ul> </li> </ol>

2	<p><b>Explain the various documents involved in reporting Test Results. (13M)BTL2</b></p> <p><b>Answer:</b> Page : 59 - Notes</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Test log(1M)</li> <li>• Test log identifier(2M)</li> <li>• Description(1M)</li> <li>• Activity and event entities(1M)</li> <li>• Test incident report(3M)</li> <li>• Test incident report identifier(1M)</li> <li>• Summary(1M)</li> <li>• Impact(1M)</li> <li>• Test summary report(2M)</li> </ul>
3	<p><b>Explain the various Test Plan attachments? (13M)BTL2</b></p> <p><b>Answer:</b> Page : 381 - Srinivasan &amp; Ramaswamy</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Test design specifications(4M)</li> <li>• Test case specifications(5M)</li> <li>• Test procedure specifications(4M)</li> </ul>
4	<p><b>Discuss in detail about the test plan components.(13M)(Nov/Dec 2016,Nov/Dec 2017)</b></p> <p><b>BTL2 Answer:</b> Page : 59 – Notes</p> <p><b>Test Plan Components(13M)</b></p> <ul style="list-style-type: none"> <li>• Test plan identifier(5M)</li> <li>• Introduction</li> <li>• Items to be tested</li> <li>• Features to be tested</li> <li>• Approach</li> <li>• Pass/fail criteria(4M)</li> <li>• Suspension and resumption criteria</li> <li>• Test deliverables</li> <li>• Testing tasks</li> <li>• Test environment</li> <li>• Responsibilities(4M)</li> <li>• Staffing and training needs</li> <li>• Scheduling</li> <li>• Risks and contingencies</li> <li>• Testing costs</li> <li>• Approvals</li> </ul>
5	<p><b>Evaluate the testing and debugging goals and policies in detail.(13M)(April/May 2017)BTL5</b></p> <p><b>Answer:</b> Page :62 - Notes</p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Debugging goal (4M)</li> <li>• Debugging policy(4M)</li> <li>• Testing Policy: Organization X(3M)</li> <li>• Debugging policy: Organization X(2M)</li> </ul>
6	<p><b>Describe Test planning in detail. (13M) BTL2</b></p> <p><b>Answer:</b> Page : 352 - Srinivasan &amp; Ramaswamy</p>

	<p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Planning(1M)</li> <li>• Milestone (1M)</li> <li>• Overall test objectives(2M)</li> <li>• What to test (Scope of the tests) (1M)</li> <li>• Who will test? (2M)</li> <li>• How to test? (2M)</li> <li>• When to test? (2M)</li> <li>• When to stop Testing? (2M)</li> </ul>
7	<p><b>Explain in detail about Mutation testing. (13M) (April/May 2017) BTL2</b></p> <p><b>Answer: Page : 58 - Notes</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Mutation testing is a method of software testing in which program or source code is deliberately manipulated(4M)</li> <li>• Followed by suite of testing against the mutated code(5M)</li> <li>• The mutations introduced to source code are designed to imitate common programming errors.(4M)</li> </ul>
8	<p><b>Discuss in detail about the various skills needed by test specialist.(13M) (Nov/dec2017)BTL2</b></p> <p><b>Answer:Page : 352 - Srinivasan &amp; Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• <b>Personal and managerial Skills(7M)</b> <ul style="list-style-type: none"> <li>➢ Organizational, and planning skills, work with others, resolve conflicts, mentor and train others, written /oral communication skills, think creatively.</li> </ul> </li> <li>• <b>Technical Skills(6M)</b> <ul style="list-style-type: none"> <li>• General software engineering principles and practices, understanding of testing principles and practices, ability to plan, design, and execute test cases, knowledge of networks, database, and operating System.</li> </ul> </li> </ul>
9	<p><b>Explain the organizational structure for testing in single product companies.(13M) BTL2 (April/May 2017)</b></p> <p><b>Answer:Page :321 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Exploits the rear loading nature of testing activities.(2M)</li> <li>• Enables Engineers to gain experience in all aspects of life cycle(4M)</li> <li>• Is amenable to the fact that the organization mostly has informal processes.(2M)</li> <li>• Some defects may be detected earlier.(3M)</li> <li>• Accountability for testing quality reduces.(1M)</li> <li>• Schedule pressures normally compromise testing.(1M)</li> </ul>
	<b>PART* C</b>
1	<p><b>Describe pesticide paradox and how bring in new people to look at the software helps solve it.(15M)BTL5</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <p>This is the situation that occurs if you continue to test (3M)</p> <ul style="list-style-type: none"> <li>• Software with the same tests or same people.(4M)</li> <li>• Eventually, the software seems to build up immunity to the test because no new bugs are found.(3M)</li> </ul>

	<ul style="list-style-type: none"> <li>• If you change the tests or bring in new testers ,you will find new bugs.(2M)</li> <li>• The bugs are already there,it's the new technique which made the bugs visible.(3M)</li> </ul>
2	<p><b>Why is the process of creating the test plan matters ,not the plan itself?(15M)BTL5</b></p> <p><b>Answer:Page: Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• Because all the issues and the questions defined in the test plan either impact or influenced by other project functional groups or team members.(4M)</li> <li>• Getting everyone to understand and agree to the contents of the plan is what matters.(4M)</li> <li>• Privately creating a paper document and putting it on a shelf is not just a waste of time, but also jeopardizes the project.(7M)</li> </ul>
3	<p><b>Justify the statement “ A schedule should be made to meet absolute dates ,so that there is no question when a testing task or phase is to start and when it is to end”.(15M)BTL6</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• The statement is false (3M)</li> <li>• Because testing depends so much on other aspects of the project(5M)</li> <li>• For example ,you can't test something until its coded), a test schedule is best made relative to the delivery status.(7M)</li> </ul>
4	<p><b>Name a few typical testing resources that should be considered when test planning.(15M)BTL6</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• People, Equipment, Offices, Labs , Software ,Outsourcing Companies and miscellaneous supplies.(3M)</li> <li>• What are the entrance and exit criteria?(4M)</li> <li>• The requirements must be met to move from one testing place to another.(3M)</li> <li>• A Phase can't be left until its exit criteria are met.(3M)</li> <li>• A new phase can't be entered until its entrance criteria are met.(2M)</li> </ul>

# JIT

<b>UNIT V TEST AUTOMATION</b>	
Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.	
<b>PART * A</b>	
1	<b>Define the term Project monitoring.</b> BTL1 <ul style="list-style-type: none"><li>• Project Monitoring refers to activities and tasks managers engage in to periodically check the status of each project.</li><li>• Reports are prepared that compare the actual work done to the work that was planned.</li></ul>
2	<b>Define the term Project controlling.</b> BTL1 Project Controlling consists of developing and applying a set of corrective actions to get a project on track when monitoring shows a deviation from what was planned.
3	<b>Define Milestones. (Nov/Dec2016)</b> BTL1 Milestones are tangible events that are expected to occur at a certain time in the project's lifetime. Managers use them to determine project status.
4	<b>Differentiate version control and change control.</b> BTL2 <ul style="list-style-type: none"><li>• Version Control combines procedures and tools to manage different versions of configuration objects that are created during software process.</li><li>• Change control is a set of procedures to evaluate the need of change and apply the changes requested by the user in a controlled manner.</li></ul>
5	<b>What are the goals of Reviewers?</b> BTL1 <ul style="list-style-type: none"><li>• Identify problem components or components in the software artifact that need improvement.</li><li>• Identify components of the software artifact that do not need improvement.</li><li>• Identify specific errors or defects in the software artifact.</li><li>• Ensure that the artifact conforms to organizational standards.</li></ul>
6	<b>What are the benefits of a Review program?</b> BTL1 <ul style="list-style-type: none"><li>• Higher quality software</li><li>• Increased productivity</li><li>• Increased awareness of quality issues</li><li>• Reduced maintenance costs</li><li>• Higher customer satisfaction</li></ul>
7	<b>What are the Various types of Reviews?</b> BTL1 <ul style="list-style-type: none"><li>• Inspections</li><li>• Walk Throughs</li></ul>
8	<b>Conclude on the need of Integration testing.(AU Nov/Dec2016)</b> BTL2 <ul style="list-style-type: none"><li>• Component integration testing that checks the interconnections between various parts (components) in a product.</li><li>• System integration testing that tests the connections between the product and external systems.</li></ul>
9	<b>What is Inspections?</b> BTL1 It is a type of review that is formal in nature and requires prereview preparation on the

	part of the review team. The Inspection leader prepares is the checklist of items that serves as the agenda for the review.
10	<p><b>What is Walkthrough?(Nov/Dec 2017) BTL1</b></p> <p>It is a type of technical review where the producer of the reviewed material serves as the review leader and actually guides the progression of the review .It have traditionally been applied to design and code.</p>
11	<p><b>List out the members present in the Review Team.BTL1</b></p> <ul style="list-style-type: none"> <li>• SQA(Software Quality Assurance) staff</li> <li>• Testers</li> <li>• Developers</li> <li>• Users /Clients.</li> <li>• Specialists.</li> </ul>
12	<p><b>List the components of review plans.(AU April/May 2015)BTL1</b></p> <ul style="list-style-type: none"> <li>• Review Goals</li> <li>• Items being reviewed</li> <li>• Preconditions for the review.</li> <li>• Rolls, Team size, participants</li> <li>• Training requirements.</li> <li>• Review steps.</li> <li>• Time requirement</li> </ul>
13	<p><b>What are the advantages of review approach.BTL1</b></p> <p>There are two pass approach for detect detection.</p> <ul style="list-style-type: none"> <li>• Pass 1 has individuals first reading reviewed item</li> <li>• Pass 2 has the item read by the group as a whole.</li> </ul>
14	<p><b>What are the various roles in review program?BTL1</b></p> <ul style="list-style-type: none"> <li>• Review Leader</li> <li>• Review Recorder</li> <li>• Reader Reviewer</li> </ul>
15	<p><b>List the various review team membership constituencyReview Team Members.BTL1</b></p> <ul style="list-style-type: none"> <li>• SQA Staff</li> <li>• Testers</li> <li>• Developers</li> <li>• Users / Clients</li> <li>• Specialists</li> </ul>
16	<p><b>What are the various different types of software artifacts.BTL1</b></p> <ul style="list-style-type: none"> <li>• Requirement Reviews</li> <li>• Design Reviews</li> <li>• Code Reviews</li> <li>• Test Plan reviews</li> </ul>
17	<p><b>Define Change Control Board (CCB).BTL1</b></p> <ul style="list-style-type: none"> <li>• There are 2 aspects of change control – one is tool based, the other term based.</li> <li>• The team involved is called CCB.</li> </ul>
18	<p><b>Define Project monitoring.BTL1</b></p> <p>Project monitoring refers to the activities and tasks managers engage into periodically check the status of each project.Reports are prepared that compare the actual work done to the work that was planned or tracking.</p>

19	<p><b>Define Project Controlling.BTL1</b></p> <p>It is the process of developing and applying a set of corrective actions to get a project on track when monitoring shows a deviation from what was planned.</p>
20	<p><b>Define Defect Removal Leverage (DRL).BTL1</b></p> <p>This is a ratio of the defect detection rates from two review or test phases and can be expressed as</p> $DRL = \frac{\text{Defects / hour (review or test phase X)}}{\text{Defects / hour (review or test phase Y)}}$
21	<p><b>What are the various steps in the inspection process?BTL1</b></p> <ul style="list-style-type: none"> <li>• Entry Criteria</li> <li>• Initiation</li> <li>• Preparation</li> <li>• Inspection Meeting</li> <li>• Reporting results</li> <li>• Rework &amp; follow up</li> </ul>
22	<p><b>What is the Role of process in Software quality?BTL1</b></p> <ul style="list-style-type: none"> <li>• Capability Maturity Model.</li> <li>• Testing Maturity model ( TMM )</li> </ul>
23	<p><b>List the measurements and milestones for monitoring and controlling.BTL1</b></p> <ul style="list-style-type: none"> <li>• Measurements for monitoring testing status</li> <li>• Coverage measures</li> <li>• Test case development</li> <li>• Test execution</li> <li>• Test harness development</li> <li>• Measurements to monitor tester productivity</li> <li>• Measurements for monitoring testing costs</li> <li>• Measurements for monitoring errors, faults, and failures</li> <li>• Monitoring test effectiveness</li> </ul>
24	<p><b>Overview of the Testing Maturity Model(TMM)&amp; the test related activities that should be done for V-model architecture.BTL1</b></p> <ul style="list-style-type: none"> <li>• Test related issues</li> <li>• Benefits of test process improvement</li> <li>• Introduction to TMM</li> <li>• TMM levels</li> </ul>
25	<p><b>List the criteria for test completion.BTL1</b></p> <ul style="list-style-type: none"> <li>• All the planned tests that were developed have been executed and passed</li> <li>• All specified coverage goals have been met</li> <li>• The detection of a specific number of defects has been accomplished</li> <li>• The rates of defect detection for a certain time period have fallen below a specified</li> </ul>

	level , Fault seeding ratios are favorable
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<b>PART * B</b>
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| 1 | <b>Illustrate with a sketch describe the design and architecture for test automation. (13M)(Nov/Dec ,2016)BTL1</b> |
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**Answer:Page : 396 - Srinivasan & Ramaswamy**

**Explanation:**

- External modules.(3M)
- Scenario and configuration file modules.(3M)
- Test cases and test framework modules.(3M)
- Tools and results modules.(2M)
- Report generator and report metrics modules.(2M)

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| 2 | <b>Explain the various generations of automations and the skills for each.(13M)(Nov/Dec,2017)BTL1</b> |
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**Answer:Page :392 - Srinivasan & Ramaswamy**

**Explanation:**

- First Generation – Record and playback(4M)
- Second Generation – Data Driven(5M)
- Third Generation - Action Driven(4M)

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| 3 | <b>Explain the design and architecture of test automation and list the challenges.(13M)(April /May ,2017).BTL2</b> |
|---|--|

**Answer:Page :396 - Srinivasan & Ramaswamy**

**Explanation:**

- External modules.(2M)
- Scenario and configuration file modules.(2M)
- Test cases and test framework modules.(2M)
- Tools and results modules.(2M)
- Report generator and report metrics modules.(2M)
- Challenges(3M)
- Certain types of testing cannot be executed without automation.
- Automation means end to end not test execution alone.

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| 4 | <b>Discuss in detail about the controlling and monitoring: three critical views. (13M)BTL2</b> |
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**Answer:Page : 71 – Notes**

**Explanation:**

- Measurements for monitoring testing status(1M)
- Coverage measures(1M)
- Test case development(2M)
- Test execution(1M)

	<ul style="list-style-type: none"> <li>• Test harness development(2M)</li> <li>• Measurements to monitor tester productivity(2M)</li> <li>• Measurements for monitoring testing costs(1M)</li> <li>• Measurements for monitoring errors, faults, and failures(1M)</li> <li>• Monitoring test effectiveness(2M)</li> </ul>
5	<p><b>Explain in detail about the role of reviews in testing software deliverables.(13M) BTL2</b></p> <p><b>Answer:Page : 68 - Notes</b></p> <p><b>Planning the Review (5M)</b></p> <ul style="list-style-type: none"> <li>• The role and responsibilities of the review leader</li> <li>• Identifying the deliverable to review and its review criteria</li> <li>• Developing review checklists for the reviewers based on requirements</li> <li>• Selecting the review team and assign review duties</li> </ul> <p><b>Conducting the Review (4M)</b></p> <ul style="list-style-type: none"> <li>• The role and responsibilities of the review leader</li> <li>• Inform the reviewers of their review duties, tasks, and schedule</li> <li>• Collect the reviews in a review meeting</li> <li>• Dealing with interpersonal issues</li> <li>• Common review pitfalls and how to avoid them</li> </ul> <p><b>Report and Follow-up on the Review(4M)</b></p> <ul style="list-style-type: none"> <li>• The role and responsibilities of the review leader</li> <li>• Compile the review findings into a single review report</li> <li>• Track review findings or issues</li> <li>• Follow-up on review findings or issues</li> </ul>
6	<p><b>Describe the various metrics and measurements in software testing and explain the various areas of metrics. (13M) (Nov/Dec 2016) BTL2</b></p> <p><b>Answer:Page: 420 - Srinivasan &amp; Ramaswamy</b></p> <p><b>Explanation:</b></p> <ul style="list-style-type: none"> <li>• Project metrics(2M)</li> <li>• Effort variance(3M)</li> <li>• Schedule Variance(3M)</li> <li>• Effort Distribution across phase(5M)</li> </ul>
1	<p><b>How will you differentiate tools and automation? Name the few benefits and drawbacks of using software test tools and automation. (15M)BTL6</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>• A testing tool will help you test .making it easier for you to perform a manual testing task.(3M)</li> <li>• Automation is also a tool but it will run without your intervention.(3M)</li> <li>• Think power saw and hammer building a house while the carpenter sleeps.(3M)</li> </ul> <p><b>Benefits:(3M)</b></p> <ul style="list-style-type: none"> <li>• Speed up the amount of time it takes to run your test process.</li> <li>• Precise and relentless.</li> </ul> <p><b>Drawbacks:(3M)</b></p>

	<ul style="list-style-type: none"> <li>Because software can change during the product's development, your test tools will be need to change.</li> <li>It is easy to rely on automation much.</li> </ul>
2	<p><b>If you were using metrics from the bug – tracking database to measure your progress or success at testing, why would just counting the number of bugs you find per day or computing your average find rate be an insufficient measure? (15M)BTL6</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>It does not tell the entire story. You could be testing the complex area of the software.(4M)</li> <li>Your area could have been written by the most experienced programmer.(4M)</li> <li>It could have been written by the least experienced programmer.(4M)</li> <li>The code that you are testing may already have been tested or may be brand new.(3M)</li> </ul>
3	<p><b>“The test team is responsible for the quality of the product” Does the statement make sense, Justify your answer with necessary explanation. (15M)BTL6</b></p> <p><b>Answer:Page : Appendix - Srinivasan Ramaswamy</b></p> <ul style="list-style-type: none"> <li>False! Testing looks for bugs .(7M)</li> <li>Testers didn't put the bugs in the product and can't guarantee when they are done testing that no more bugs exist.(8M)</li> </ul>

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