

NMAM INSTITUTE OF TECHNOLOGY, NITTE*(An Autonomous Institution affiliated to VTU, Belagavi)***Third Semester M.C.A. (Credit System) Degree Examinations**

November - December 2016

15MCA302 – OPERATING SYSTEMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer Five full questions choosing One full question from each Unit.***Unit – I**

- | | | |
|--|-----------------------------|-------------------------------|
| 1. a) Explain the term operating system.
b) Explain multiprocessor system.
c) What are system calls? List and explain the major categories of system calls. | Marks
5
7
8 | BT*
L*2
L2
L2 |
| 2. a) Define Process. Explain process states with state diagram.
b) What are schedulers? List and explain different types of schedulers.
c) What are co-operating processes? What are the advantages of such processes?
Explain how they communicate. | 6
7
7 | L2
L2
L2 |

Unit – II

- | | | |
|---|-------------|----------------|
| 3. a) What are threads? Explain the benefits of using threads.
b) Explain different multithreading models.
c) Explain different CPU scheduling criteria. | 6
6
8 | L2
L2
L2 |
| 4. a) What is semaphore? Explain the application of semaphore for providing synchronization to the Reader- Writer problem.
b) What is dead-lock? What are the necessary conditions for the same? Explain Banker's algorithm to solve the same. | 10
10 | L3
L2 |

Unit – III

- | | | |
|---|----------|----------|
| 5. a) What is paging? Explain the basic method and hardware for the same.
b) What is Segmentation? Explain the basic method and hardware of the same. | 10
10 | L2
L2 |
| 6. a) What is demand paging? Explain the basic concept of demand paging and steps in handling a page fault.
b) What is thrashing? Explain the cause and remedy of thrashing. | 10
10 | L2
L2 |

Unit – IV

- | | | |
|---|----------|----------|
| 7. a) What is a file? List and explain file attributes and operations.
b) List and explain different file access methods. | 10
10 | L2
L2 |
| 8. a) What is a directory? Explain different logical structures of a directory.
b) What is file system protection? List and explain access types and access control. | 10
10 | L2
L2 |

Unit – V

- | | | |
|--|----------|----------|
| 9. a) Define and explain the terms: Threat, Attack, confidentiality, integrity, availability, threat of service and denial of service.
b) List and explain program threats. | 10
10 | L1
L1 |
| 10. a) Explain design principles of Linux.
b) Explain Kernel modules of Linux. | 10
10 | L2
L2 |

BT* Bloom's Taxonomy, L* Level

NMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)
Third Semester M.C.A. (Credit System) Degree Examinations
 November – December 2016

15MCA303 – DATA COMMUNICATION AND COMPUTER NETWORKS

Max. Marks: 100

Duration: 3 Hours

Note: Answer **Five full questions choosing One full question from each Unit.**

Unit – I

- | | | |
|--|-------|-----|
| a) Discuss the ISO-OSI reference model. | Marks | BT* |
| b) What are the main design issues in existing computer networks? | 9 | L*4 |
| c) The spectrum of the channel is between 3MHZ and 4MHZ, the SNR is 24dB. Find the capacity of the channel and signal level. | 6 | L2 |
| | 5 | L3 |
| a) Briefly discuss goals for setting up computer networks, especially with respect to the organization. | 6 | L2 |
| b) Find the thermal noise power density where the room temperature is $T=17^{\circ}\text{C}$ or 290K. | 4 | L3 |
| c) With the help of a neat diagram, explain the protocol hierarchies for a three-layer Computer network? | 6 | L4 |
| d) Define the following terms
i. Half duplex
ii. Digital signal
iii. Bandwidth
iv. Noise | 4 | L1 |

Unit – II

- | | | |
|--|---|----|
| a) Encode 101100111001010 bits using
i).NRZ-I
ii). Bipolar AMI
iii). Manchester
iv). Differential Manchester | 8 | L6 |
| b) Differentiate between synchronous and asynchronous transmission. | 6 | L4 |
| c) Explain stop and wait ARQ. | 6 | L4 |
| a) Compute CRC for the given data $M=1010001101$, $P(X)=X^5 + X^4 + X^2 + 1$ using modulo 2 arithmetic. | 8 | L6 |
| b) With the help of a neat diagram explain basic characteristics of HDLC frame structure. | 8 | L4 |
| c) Encode the following bit stream 100110001101 by using FSK and PSK techniques. | 4 | L6 |

Unit – III

- | | | |
|---|----|----|
| a) Write a note on Store-and-Forward Packet Switching. | 5 | L2 |
| b) Compare Virtual circuit subnet with datagram subnet. | 10 | L4 |
| c) Write a note on Optimality Principle. | 5 | L4 |
| a) Discuss the frame structure of IEEE802.3 LAN standard. | 10 | L4 |
| b) Describe Fiber Distributed Data Interface. | 10 | L2 |

15MCA303

SEE – November – December 2016

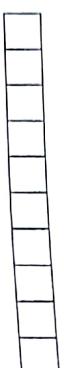
Unit – IV

- | | |
|---|----|
| a) Draw and explain the IPV6 header format. | 10 |
| b) Discuss the techniques of achieving good quality of service. | 10 |
| a) Explain different congestion reactive techniques used in virtual-circuits and in the datagram subnets. | 10 |
| b) Discuss the policies used at different layers to prevent congestion. | 10 |

Unit – V

- | | |
|---|----|
| a) Explain multiplexing and crash recovery. | 10 |
| b) Discuss different TCP socket primitives. | 10 |
| a) Explain the TCP Connection Establishment process in the normal case and in call collision. | 10 |
| b) Discuss the hierarchical addressing scheme used in the DNS Name Space with suitable diagram. | 10 |

Bloom's Taxonomy, L* Level



NMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)
Fifth Semester M.C.A. (Credit System) Degree Examinations
November - December 2016

14MCA511 – DATA MINING

DURATION: 3 Hours

Note: Answer Five full questions choosing One full question from each Unit.

Max. Marks: 100

	Unit – I	Marks	BT*
1. a) What is data Warehousing? Explain ODS & ETL	6	L1	L2
b) What is OLAP? Explain the different characteristics of OLAP. List the differences between OLAP and OLTP.	10	L2	L2
c) Explain data cube with an example.	4	L2	
2. a) Explain the different schemas for developing the data model for data ware housing .	8	L2	
b) Explain the different guide lines for the implementation of Data Warehousing.	6	L2	
c) Explain the different operations that can be performed on the Data cube with examples.	6	L2	
Unit – II			
3. a) What are the different problems that "Data Mining" can Solve ?	6	L1	
b) "Data Mining is an integral part of Knowledge discovery in data bases"-Justify. Also explain the challenges.	10	L4	L4
c) Distinguish between discrete and continuous attributes with example.	4	L4	
4. a) Compute the SMC and Jaccard coefficient between the binary Vectors $P=(100000000)$ q=(0000001001). Briefly explain Cosine Similarities.	10	L4	
b) What are the issues related to the proximity measure?	5	L1	
c) Discuss the various dissimilarity measures that are used to compute the distance between data objects.	5	L2	
Unit – III			
5. a) What is association rule mining? Explain the Apriori algorithm to find frequent item sets with suitable example.	10	L2	
b) Explain the alternative methods for generating methods for generating frequent item sets.	10	L2	
c) Explain the different methods of generate candidate item sets with example.	10	L2	
d) Explain the steps of FP tree construction considering the following transactions of market – basket data.	8	L2	
	Tid	Items Brought	
	1	Milk, Bread, Cookies, Juice	
	2	Milk , Juice	
	3	Milk , Eggs	
	4	Bread, Cookies	
	5	Milk , Juice, Bread	
	6	Juice, Eggs	
	7	Eggs	
		c) Discuss any two techniques used to improve the efficiency of Apriori algorithm.	6
			4
		Unit – IV	L4
7. a) Write and explain the algorithm for decision tree induction. Illustrate with an example.	14	L2	
b) Define rule-based classifier with vertebrate classification example.	6	L4	
c) Define classification. Write and explain the Hunt's algorithm for classification.	8	L2	

14MCA511

Explain nearest neighbor classifiers. Explain the K-Nearest Neighbour classification algorithm. List the characteristics of nearest neighbour classifiers.

SEE – November – December 2016

12 L4

a) Explain the basic Agglomerative Hierarchical Clustering Algorithm with examples.

10 L2

b) What are the different methods for defining the proximity between clusters? Explain with examples.

5 L2

c) List the strength and weakness of K-means clustering algorithm.

5 L1

d) Describe the DBSCAN algorithm with an example.

10 L4

e) Perform hierarchical clustering of six samples, using the single linkage or minimum method. Draw the dendrogram.

Point	x	y
P1	0.4	0.53
P2	0.22	0.38
P3	0.35	0.32
P4	0.26	0.19
P5	0.08	0.41
P6	0.45	0.36

10

om's Taxonomy, L* Level

NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Third Semester M.C.A. (Credit System) Degree Examinations**Make up Examinations - January 2017****15MCA302 – OPERATING SYSTEMS**

Duration: 3 Hours

Max. Marks: 100

Note: Answer Five full questions choosing One full question from each Unit.**Unit – I**

- | | |
|--|---|
| 1. a) Discuss the naming and synchronization mechanisms in the message-passing system model of IPC.
b) List and explain any four services provided by an operating system that provide convenience to the users.
c) Explain virtual machine design and implementation for an operating system.
2. a) Explain the layered approach to operating system design along with the advantages and disadvantages of such a design. Illustrate with the help of a suitable diagram.
b) Explain the components of the Process control block with a suitable diagram.
c) Distinguish between client-server and peer-to-peer models of distributed systems. | Marks BT*
10 L*2
4 L1
6 L2
10 L2
6 L2
4 L4 |
|--|---|

Unit – II

3. a) Find the average waiting time and average turnaround time for the following processes using:
- FCFS
 - SJF (non-preemptive)
 - Priority (non-preemptive)
 - Round Robin (1 ms quantum)

Draw the Gantt charts for each algorithm and identify that scheduling algorithm which has least wait and shortest turnaround time.

Process	Burst	Priority
P1	8	4
P2	6	1
P3	1	2
P4	9	2
P5	3	3

- b) Describe the one-to-one and many-to-many multi-threading models in brief. 16 L3
- 4 L2
4. a) Consider a Deadlock avoidance system with the following snapshot at time T_0 :
- Is the system in a safe state? If the system is in a safe state, illustrate how all the processes can complete their execution successfully. If the system is unsafe, explain how the deadlock might occur.
 - If a request from Process P1 arrives for (1, 4, 2, 0), can the request be granted immediately?

Allocation**Max****Available**

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	0	1	2	2	0	1	2				
P1	1	0	0	0	2	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	7	5	2				
P4	0	0	1	4	0	7	5	6				

10 L4

P.T.O.

- b) Explain the Multi-level Feedback Queue scheduling algorithm. Why this is beneficial compared to multi-level queue scheduling algorithm?
- c) Explain the necessary conditions for a dead lock to arise.

8 L2
2 L2

Unit – III

- a) Consider the following page reference string:
1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5

- i) Calculate the number of page faults that would occur for the following page replacement algorithm with frame size 4: LRU and FIFO.
ii) Calculate the number of page faults that would occur for the following page replacement algorithm with frame size 3: FIFO. Does the Belady's anomaly occur? What is Belady's anomaly and state the algorithm that was discovered as a result of this?

12 L3
8 L2

- b) Explain demand paging.

- a) Explain the basic method for implementing paging memory management scheme. Describe how one translates the logical address to a physical address.
b) Explain the difference between External fragmentation and Internal fragmentation. How can the problem of "external fragmentation" be solved?
c) Describe thrashing and discuss the reason for the occurrence of thrashing

10 L1
6 L1
4 L1

Unit – IV

- a) Suppose a disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 100. The queue of pending requests is 23, 89, 132, 42, 187. Starting from the current head position, what is the total distance in cylinders that the disk arm moves to satisfy all pending requests for each of the following disk-scheduling algorithms?

16
4
4

- i) FCFS ii) SSTF iii) SCAN iv) LOOK
b) Describe the tree-structured directories in brief.

- a) Describe the mechanism of Disk formatting.
b) Explain the principle of least privilege and need-to-know principle, with an example.

6

- c) What are operations that can be performed on a directory? Illustrate the acyclic graph-directory structure.

10

Unit – V

- a) Describe in brief the design principles applied in Linux operating system.

1

- b) Explain in detail the Access Matrix model of protection.

- c) Explain the following security threats possible for a system with examples:

- i) Trojan Horse
ii) Program Threats

- a) Explain the difference between a trap door and a logic bomb.

- b) What is meant by user authentication? Explain the vulnerabilities of password usage.

- c) Explain process management on Linux platform.

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Third Semester M.C.A. (Credit System) Degree Examinations
Make up Examinations - January 2017

15MCA303 – DATA COMMUNICATION AND COMPUTER NETWORKS

Duration: 3 Hours

Max. Marks: 100

Note: 1) Answer **Five full** questions choosing **One full** question from each Unit.
 2) Answer the questions briefly and draw the figure where ever it is necessary.

Unit – I

- | | Marks | BT* |
|--|-------|----------------|
| a) Write a short note on the basic network topologies. Highlight any advantages and disadvantages of each. | 8 | L ¹ |
| b) Explain the functioning of terrestrial and satellite systems in wireless transmission. Give their respective characteristics. | 6 | L ² |
| c) Consider that a 48,000 bit packet is to be transmitted on a link having the propagation speed of 2×10^8 m/sec and physical link length of 1,000 m. Now suppose that the node can transmit at a rate of 4 Gbps. | | |
| (i) What is the transmission time for the packet? | 6 | L ³ |
| (ii) What is the propagation delay on the link? | | |
| (iii) Suppose that if the node starts transmitting the packet at time t=0, then at what time is the packet fully received at the destination? | | |
| a) What is the purpose of the cladding in an optical fiber? Write a short note on the modes of propagation in optical fibers. | 10 | L ² |
| b) Write the ways in which the OSI reference model and TCP/IP reference model are different and the ways they are similar. | 5 | L ⁴ |
| c) A channel has $B = 8$ kHz and a signal-to-noise ratio of 30 dB. Determine maximum information rate for 128-level encoding. | 5 | L ³ |

Unit – II

- | | | |
|---|----|----------------|
| a) Briefly explain the line Coding Schemes used in Digital Transmission. | 8 | L ¹ |
| b) With an appropriate example, explain briefly the process of bit stuffing at the sender and receiver sites. What is byte stuffing? | 8 | L ² |
| c) Draw the waveform for the data: 10101101 | | |
| i) NRZ-L | | |
| ii) Differential Manchester Encoding | 4 | L ³ |
| iii) Manchester Encoding | | |
| a) Consider a message D, presented by the following polynomial $x^{19} + x^{17} + x^{16} + x^{13} + x^{12} + x^{11} + x^9 + x^5 + x^2 + 1$, which is transmitted using the standard Cyclic Redundancy Check (CRC) method. The generator polynomial is $x^7 + x^5 + x^4 + x^3 + x^2 + 1$. Find the CRC and show the actual bit string to be transmitted. | 10 | L ⁴ |
| b) Explain Go-Back-N ARQ protocol and explain the scenario when both a frame and an ACK is lost during transmission? | 10 | L ⁴ |

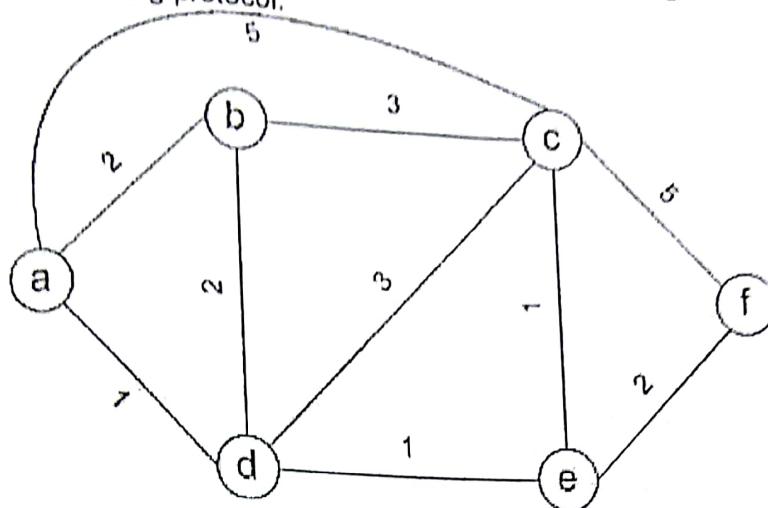
Unit – III

- | | | |
|--|----|----------------|
| a) Assume that your company has the network ID 145.141.0.0. You are responsible for creating subnets on the network, and each subnet must provide at least 950 host IDs. What subnet mask meets the requirement for the minimum number of host IDs and provides the greatest number of subnets? Justify your answer along with necessary calculations. | 10 | L ⁶ |
|--|----|----------------|

P.T.O.

- b) Explain the connection-oriented transfer service and connectionless transfer service in peer-to-peer protocols. Give an illustration for each.
- c) For the given following network, calculate the values for routing table, based on distance vector routing protocol.

10 L4



10 L6

Unit - IV

7. a) What is the function of a bridge in networking? Discuss the architecture and operation of a bridge connected network.
- b) What is QoS? Describe the techniques used for achieving good QoS in networks, in detail.

10 L6

10 L2

8. a) Define fragmentation. Briefly explain the types of fragmentation with their drawbacks and advantages.
- b) Briefly describe the congestion control algorithms used for virtual-circuit subnets. Compare and contrast between them based on their merits.

10 L2

10 L4

Unit - V

9. a) With a neat diagram explain IPv4 header and compare it with IPv6.
- b) Design a chat system that allows multiple groups of users to chat. A chat coordinator resides at a well-known network address, uses UDP for communication with chat clients, sets up chat servers for each chat session, and maintains a chat session directory. There is one chat server per chat session. A chat server uses TCP for communication with clients. A chat client allows users to start, join, and leave a chat session. Design the coordinator, server, and the client.

10 L4

10 L5

10. a) What is Remote Procedure Call (RPC)? With a neat diagram explain the steps in making a remote procedure call. Also mention the problems associated with RPC.
- b) Explain the following issues of Transport layer protocols in detail.
i) Addressing ii) Connection Establishment (different scenarios)
iii) Connection Release (different scenarios)

10 L

10 I

USN

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NMAM INSTITUTE OF TECHNOLOGY, NITTE
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Fifth Semester M.C.A. (Credit System) Degree Examinations
Make up Examinations - January 2017

Duration: 3 Hours

14MCA511- DATA MINING

Max. Marks: 100

Note: Answer **Five full** questions choosing **One full question from each Unit.**

- | | | Unit - I | Marks | BT* | | | | | | | | | | | | |
|---|-----------------------------|--|-------|-------|---|-------------|---|-----------------------------|---|----------------------------|---|-----------------------------|---|-------------------------|--|--|
| 1. | a) | Outline the guidelines for data warehouse implementation. | 10 | L*1 | | | | | | | | | | | | |
| | b) | Define FASMI characteristics of OLAP. | 5 | L2 | | | | | | | | | | | | |
| | c) | Discuss the structure of a data warehouse system. | 5 | L2 | | | | | | | | | | | | |
| 2. | a) | Generate and discuss multidimensional view of data cube with (country x degree x semester) dimensions with reference to the University example. | 10 | L5 | | | | | | | | | | | | |
| | b) | Illustrate simple snow flake schema for two-dimensional data. | 5 | L4 | | | | | | | | | | | | |
| | c) | Write a note on ODS. | 5 | L2 | | | | | | | | | | | | |
|
Unit - II | | | | | | | | | | | | | | | | |
| 3. | a) | Discuss some of the most important Data preprocessing ideas and approaches. | 10 | L4 | | | | | | | | | | | | |
| | b) | Explain the process of knowledge discovery in databases (KDD). | 5 | L3 | | | | | | | | | | | | |
| | c) | 'Data Mining as a confluence of many disciplines', Illustrate. | 5 | L3 | | | | | | | | | | | | |
| 4. | a) | Discuss different types of ordered data set. | 10 | L2 | | | | | | | | | | | | |
| | b) | Illustrate any four of the core data mining tasks. | 5 | L4 | | | | | | | | | | | | |
| | c) | Compute Simple matching coefficient and Jaccard coefficient for the following binary vectors;
$X=(1,0,0,0,0,0,0,0,0)$
$Y=(0,0,0,0,0,1,0,0,1)$ | 5 | L3 | | | | | | | | | | | | |
|
Unit - III | | | | | | | | | | | | | | | | |
| 5. | a) | Explain the technique of frequent item set generation in Apriori algorithm. | 10 | L3 | | | | | | | | | | | | |
| b) | | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">TID</th> <th style="text-align: left; padding: 2px;">Items</th> </tr> </thead> <tbody> <tr> <td style="text-align: left; padding: 2px;">1</td> <td style="text-align: left; padding: 2px;">Bread ,Milk</td> </tr> <tr> <td style="text-align: left; padding: 2px;">2</td> <td style="text-align: left; padding: 2px;">Bread,Biscuit,Babysoap,Eggs</td> </tr> <tr> <td style="text-align: left; padding: 2px;">3</td> <td style="text-align: left; padding: 2px;">Milk,Biscuit,Babysoap,coke</td> </tr> <tr> <td style="text-align: left; padding: 2px;">4</td> <td style="text-align: left; padding: 2px;">Bread,Milk,Biscuit,Babysoap</td> </tr> <tr> <td style="text-align: left; padding: 2px;">5</td> <td style="text-align: left; padding: 2px;">Bread,Milk,Biscuit,Coke</td> </tr> </tbody> </table> | TID | Items | 1 | Bread ,Milk | 2 | Bread,Biscuit,Babysoap,Eggs | 3 | Milk,Biscuit,Babysoap,coke | 4 | Bread,Milk,Biscuit,Babysoap | 5 | Bread,Milk,Biscuit,Coke | | |
| TID | Items | | | | | | | | | | | | | | | |
| 1 | Bread ,Milk | | | | | | | | | | | | | | | |
| 2 | Bread,Biscuit,Babysoap,Eggs | | | | | | | | | | | | | | | |
| 3 | Milk,Biscuit,Babysoap,coke | | | | | | | | | | | | | | | |
| 4 | Bread,Milk,Biscuit,Babysoap | | | | | | | | | | | | | | | |
| 5 | Bread,Milk,Biscuit,Coke | | | | | | | | | | | | | | | |
| With reference to above table, for the rule, { Milk,Biscuit}=>{Babysoap}, calculate support and confidence. | | | | | 5 | L4 | | | | | | | | | | |
| With an example discuss Brute-force approach for mining association rules. | | | | | 5 | L2 | | | | | | | | | | |

TID	Items
1	{a,b}
2	{b,c,d}
3	{a,c,d,e}
4	{a,d,e}
5	{a,b,c}
6	{a,b,c,d}
7	{a}
8	{a,b,c}
9	{a,b,d}
10	{b,c,a}

10 L5

- b) With an example, discuss how FP growth algorithm generates frequent item sets from an FP-tree in bottom-up fashion.

10 L4

7. a) Elaborate rule-based classifier with vertebrate classification example.
b) Define and explain the concepts of root node, internal node and leaf node in decision tree algorithm with suitable example.

10 L4

10 L4

8. a) How exactly Bayesian classifier works on below training set for predicting the loan default problem, explain.

TId	Home owner	Marital status	Annual income	Defaulted borrower
1	Yes	Single	125k	No
2	No	Married	100k	No
3	No	Single	70k	No
4	Yes	Married	120k	No
5	No	Divorced	95k	Yes
6	No	Married	60k	No
7	Yes	Divorced	220k	No
8	No	Single	85k	Yes
9	No	Married	75k	No
10	No	Single	90k	Yes

10 L4
10 L4

- b) Describe general approach to solving a classification problem.

Unit – V

05 L2

9. a) Distinguish various types of clusterings.
b) 'Sum of squared error (SSE) is a most common measure to evaluating K-means clusters', discuss this with k-means algorithm.
c) Give graph-based definitions of cluster proximity.

10 L4
05 L3

10 L

10. a) Discuss supervised measures of cluster validity.
b) Give classification of points according to center-based density model.
c) Write basic Agglomerative hierarchical clustering algorithm.

05 L
05 L

USN

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NMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)
Fourth Semester M.C.A. (Credit System) Degree Examinations
April - May 2017

Duration: 3 Hours

15MCA401 – ENTERPRISE JAVA

Max. Marks: 100

Note: Answer **Five full questions choosing One full question from each Unit.****Unit – I****Marks BT***

1. a) Write a client/server program using socket programming to accept a number on the client side and pass it to the server where you find the factorial of the number. Display the factorial on the client side. Provide validation on the server side to check if the number is between 2 and seven. Else display error. 10 L*6
1. b) Write a note on
 - i) InetAddress 10 L2
 - ii) URL 10 L2
2. a) Describe DatagramSocket and DatagramPacket with an example. 10 L4
2. b) Illustrate with an example the use of RMI in Java. 10 L4

Unit – II

3. a) Write a Java program using Swing API to accept empno, ename, job(manager/analyst/clerk in a combobox) and basic. When you press ENTER key on basic, calculate commission as follows.
 15% of basic if job=manager
 10% of basic if job=analyst
 5% of basic if job=clerk 10 L6
 10 L4
- b) Illustrate with a suitable example the use of Jtree and Jtable.
4. a) Discuss the difference between Statement, PreparedStatement and CallableStatement with examples. 10 L4
- b) Add items to Item table (icode, name, rate) while the answer is “yes” from the user. When the user enters “no”, commit the transaction. Use batch process. 10 L6

Unit – III

5. a) Describe the steps to create a component in Java. Give a suitable example.
 b) Discuss Bean Introspection. How do you achieve this in Java? Explain with an example. 10 L4
6. a) Illustrate with suitable examples, the different types of properties a Java Bean can have. 10 L2
 b) Explain with a suitable example, the use of Bound property. 10 L4

Unit – IV

7. a) Discuss the features available in Java for server side programming in a web application. How do they differ?
 b) Write a Http servlet to accept a color from the client and change the background color of the page in a servlet. 6 L4
 8 L6
 6 L2
- c) Discuss the life cycle of a Servlet. 10 L4
8. a) Describe the use of session object with suitable example.
 b) Explain the use of Cookies. Illustrate with an example the use of Cookies in a web application. 10 L4

15MCA401

SEE - April - May 2017

Unit - V

Compare and contrast between Session Bean and Entity Bean. Give an example for Stateful session bean.

a) Discuss the use of Entity Manager in the context of EJB. Give an example.

b) Describe the states of a J2ME application with a suitable example.

a) Write a note on configurations and profiles.

Bloom's Taxonomy, L* Level

10 L4
10 L4
10 L4
10 L4

USN | | | | | | | |

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester M.C.A. (Credit System) Degree Examinations

May 2017

16MCA205 – PROBABILITY STATISTICS AND QUEUING

Duration: 3 Hours

Max. Marks: 100

*Note: 1) Answer Five full questions choosing One full question from each Unit.
2) Statistical Tables are permitted.*

Unit - I

Marks BT*

- a) $P(A) = 0.2, P(B) = 0.5, P(A \cap B) = 0.1$. Find $P(A \cup B), P(A \cup B^c), P(A \cap B^c), P(A^c \cap B)$ and $P(A \cap B^c)$. 5 L3
- b) A problem is given to 3 students A, B, C whose chances of solving the problem are $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ respectively. Find the probability that the problem is solved. 7 L3
- c) Suppose one of 3 men, a politician, a businessman, and an educator will be appointed as chancellor of a University. The probability of their appointment is 0.5, 0.3, and 0.2 respectively. The probabilities that research activities are promoted by these are 0.3, 0.7, 0.8 respectively. What is the probability that research will be promoted by the new chancellor? 8 L3
- a) Two dice are rolled independently. Define A: odd number with first dice; B: odd number with second dice; C: Sum of numbers on dice is odd. Are the events mutually independent? 7 L4
- b) In an exam, two reasoning problems, 1 and 2, are asked. 35% of the students solved problem 1 and 15% of the students solved both the problems. How many students who solved the first problem will also solve the second one? 5 L3
- c) A box contains 10 coins of which 5 are two headed, 3 coins are two tailed, 2 are normal. A coin is randomly selected and tossed. If head turns up find the probability that it is normal coin. 8 L3

Unit - II

The weights of 40 students in a class are recorded. Construct a frequency distribution .

- 138 164 159 132 144 125 149 157 146 158 140 147 136 148 152 144 164 126
138 176 163 129 154 165 146 173 142 147 135 153 140 135 161 145 135 161
142 150 156 145
- b) Four group of students consisting of 15, 20, 10 and 18 individuals have mean weights of 162, 148, 153 and 140. Find the mean weight of all students. 5 L
- c) Find the first, second, third and fourth moments about the mean for the numbers 2, 3, 7, 8, 10. 8

16MCA205

- a) Find the mean, median and mode for the set of numbers 3,5,2,6,5,9,5,2,8,6.
 b) Weight of 100 students is given in the following table. Find the mean deviation of weights.

Class Interval	Frequency
60-62	5
63-65	18
66-68	42
69-71	27
72-74	8

8 L3
5 L3

- c) Find the standard deviation of set of values 12,6,7,3,15,18,18,5.

Unit - III

5 L3

- a) Find the mean and variance of outcomes of single roll of a die.

- b) Let X be a random variable with PDF given by

$$f(x) = cx^2, 0 \leq x \leq 1$$

Find c , $P(X \geq \frac{1}{2} | X < 3/4)$ and $E(X)$

7 L3

- c) A coin is tossed twice. X denote number of heads and Y denote number of tails.

8 L5

- Find the correlation coefficient between X and Y .

- a) The joint probability mass function of (X,Y) is given by

10 L3

$$P(X,Y) = k(2x+3y), X = 0,1,2 Y = 1,2,3$$

Find k and correlation coefficient between X and Y .

- b) The following table represents the joint probability distribution of the discrete random variable (X, Y)

		1	2	3
		1	2	3
X	1	1/12	1/6	0
	2	0	1/9	1/5
		1/18	1/4	2/15

10 L3

- i) Evaluate the marginal distribution of X and Y

10

- ii) Find the conditional distribution X given $y=2$

- iii) Find $P(X \leq 2, Y=3)$

- iv) Find $P(X+Y < 4)$

Unit - IV

7. a) The probability that a syringe manufactured by certain company is defective with probability $1/10$. If 12 syringes are selected at random, find the probability that

- i) Exactly one is defective
 ii) At least one is defective
 iii) None will be defective

- b) In a test on 200 electric bulbs, it was found that the life of a particular make was normally distributed with average life of 2040 hours, and S. D of 60 hours. Estimate the number of bulbs likely to burn for
 i) More than 2150 hours
 ii) Less than 1950 hours

8 L3

- c) A population consists of five numbers 2, 3, 6, 8, 11. Consider all possible samples of size 2 which are drawn with replacement from the population. Find the mean of the population, mean of the sampling distribution of means.

5 L3

- a) In a certain examination the percentage of candidates passing and getting distinction are 45 and 9 respectively. Estimate the average marks obtained by the students if the minimum pass and distinction marks are 40 and 75 respectively.

8 L3

- b) Assume that heights of 3000 students at a university are normally distributed with mean 68 inches and S.D = 8 inches If 80 samples of size 25 each is taken, in how many samples would you expect to find the mean between 66.8 and 68.8 inch?

6 L3

- c) The electric light bulb of manufacturer A have a mean life time of 1400 hours with a S.D = 200 hours while those of manufacturer B have a mean life time of 1200 hours with a S.D = 100 hours. If random samples of 125 bulbs of each brand are tested, what is the probability that the brand A bulbs will have a mean life time which is 160 hours more than brand B ?

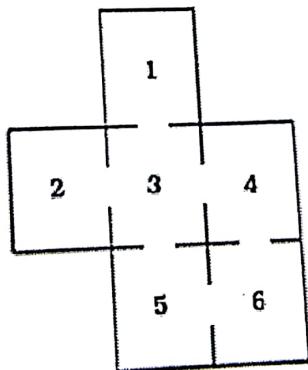
6 L4

Unit - V

- g. a) Suppose Harvard, Dartmouth and Yale admit only male students. Assume that 80% of sons of Harvard men went to Harvard and rest to Yale. 40% of sons of Yale went to Yale and rest split evenly to Harvard and Dartmouth. Sons of Dartmouth men, 70% went to Dartmouth, 20% to Harvard and 10% to Yale.
 Find i) transition probability matrix
 ii) Probability that Grand son of a man from Harvard went to Harvard.

6 L

- b) A rat runs through the maze shown below. At each step it leaves the room it is in by choosing one of the doors out of that . Find the transition diagram.



4

- c) Vehicles arrive at a toll booth at an average rate of 300 per hour and average waiting time at the toll booth is 10 sec per vehicle. Both arrival and departure are exponentially distributed. Find
 i) Average number of vehicles in the system
 ii) Average queue length
 iii) Average delay per vehicle
 iv) Average time a vehicle is in the system

1

SEE – May 2017

- 16MCA205
- a) A Student's study habits are as follows: If he studies one night he is 70% sure not to study the next night; on the other hand, if he does not study one night, he is 60% sure not to study next night. Supposing that he studies on Monday night, find the probability that he does not study on Friday night .
- b) A computer lab has a help desk to assist students to work on their assignments. Students form a single line and wait for help. On an average 15 students per hour arrive according to Poisson distribution and help desk server takes an average of 20 students per hour with service rate following exponential distribution. Calculate
- i) the average utilization of the help desk server
 - ii) average number of students in the system
 - iii) average number of students waiting in the queue
 - iv) average time a student spends in the system
 - v) probability that there are more than 4 students in the system
- c) A process moves on the integers 1, 2, 3, 4 and 5. It starts at 1 and, on each successive step, moves to an integer greater than its present position moving with equal probability to each of the remaining integers. State 5 is absorbing state. Find the transition probability matrix.

8 L5

10

Bloom's Taxonomy, L* Level

3 Hours

Note: 1) Answer Five full questions choosing One full question from each Unit.
 2) Use of Statistical Tables is permitted.

Max. Marks: 100

Unit – I

With an example explain probability of an event and write Axioms of probability. A fair die is thrown twice. Find the probability that (i) even numbers occur on both throws (ii) an even number occurs in at least one throw.

Marks 5 BT*
5 L*2

In a survey of 120 passengers, an airline found that 48 preferred ice cream with their meals, 78 preferred fruits and 66 preferred coffee. In addition, 36 preferred any given pair of these and 24 passengers preferred them all. If two passengers are selected at random from survey sample of 120, what is the probability that (i) they both preferred only coffee with their meals, (ii) they both preferred exactly two of the three offerings.

5 L2

If Dillon rolls a fair die, what is the probability he gets (i) a 5 or a 6 (ii) an even number?

6 L3
4 L2

Three balls are drawn successively from the box containing 6 red balls, 4 white balls, and 5 blue balls. Find the probability that they are drawn in the order red, white, and blue if each ball is (i) replaced, (ii) not replaced.

6 L3

Consider drawing five cards from a standard deck of 52 cards. Suppose that Tanya draws five cards, at random, from a standard deck. What is the probability she gets

(i) Three aces and two jacks (ii) three aces and a pair (iii) a full house (that is, three of one kind and a pair)?

8 L3

If Charles tosses a fair coin four times, what is the probability that he gets two heads and two tails?

6 L2

Unit – II

) What are the general rules for forming frequency distributions? Explain Histograms.

10 L2

) Explain arithmetic mean, median and mode. Considering 10 numbers, compute arithmetic mean, median and mode.

10 L1

) Find the standard deviation of each of the following set of numbers.

10 L

(i) 12, 6, 7, 3, 15, 10, 18, 5 (ii) 9, 3, 8, 8, 9, 8, 9, 18

10 L

) Find the (i)first (ii) second (iii) third (iv) fourth moments of the set 2, 3, 7, 8, 10

Unit – III

) A random variable X has the density function $f(x) = cx^2, 0 \leq x \leq 1$.

5

(i) Find the value of the constant c. (ii) Find the probability that X lies between 1/3 and 1.

b) The joint density function of two continuous random variable X and Y is

$$f(x, y) = cxy \quad 0 < x < 4, 1 < y < 5$$

0 otherwise

(c) Find $P(X \geq 3, Y \leq 2)$

9

(i) Find the value of the constant c.

(ii) Find $P(1 < X < 2, 2 < Y < 3)$

P.T.O.

A continuous random variable X has probability density given by

$$f(x) = \begin{cases} 2e^{-2x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Make up / Supplementary – July 2017

Find (a) $E(X)$, (b) $E(X^2)$

Define Mathematical Expectation for Discrete and continuous random variable X . 6 L3

- a) Suppose that a game is to be played with a single die assumed fair. In this game a Player wins \$20 if 2 turns up, \$40 if 4 turns up; loses \$30 if 6 turns up; while the player neither wins nor loses if any other face turns up. Find the expected sum of money to be won.

- b) Define variance and standard deviation. Find (i) the variance, (ii) the standard deviation of the sum obtained in tossing a pair of fair dice.

- c) The joint density function of two random variables X and Y is given by

$$f(x,y) = \begin{cases} \frac{xy}{96} & 0 < x < 4, 1 < y < 5 \\ 0 & \text{otherwise} \end{cases}$$

Find (i) $E(X)$ (ii) $E(Y)$

Unit – IV

- a) Find the probability that five tosses of a fair die, 3 will appear (a) twice, (b) at most once, (c) at least two times. 6 L2
- b) If the probability that an individual will suffer a bad reaction from injection of a given serum is 0.001, determine the probability that out of 2000 individuals, (i) exactly 3 (ii) more than 2 individuals will suffer a bad reaction. 6 L3
- c) Write the density function of Uniform distribution in the interval $a \leq x \leq b$. Also find mean and variance of Uniform distribution. 8 L3
- a) In Sampling theory, what do you mean by population and sample, sampling with and without replacement? 4 L2
- b) Assume that the heights of 3000 male students at a university are normally distributed with mean 68.0 inches and standard deviation 3.0 inches. If 80 samples consisting of 25 students each are obtained, what would be the mean and standard deviation of the resulting sample of means if sampling were done. (i) with replacement, (ii) without replacement? 8 L3
- c) It has been found that 2% of the tools produced by a certain machine are defective. What is the probability that in a shipment of 400 such tools (i) 3% or more (ii) 2% or less will prove defective. 8 L3

Unit – V

- a) What are transition probabilities? A ladder climbing game has 5 levels. Level 1 is lowest & level 5 is highest. A player starts at the bottom. Each time, a fair coin is tossed, if head turns up the player moves one level up and moves one level down if tail comes up. Once at the top level, the player moves to very bottom if tail comes up and stays at the top if head turns up. Find the transition probability matrix. 8 L2
12 L3
- b) Explain state classifications.
- a) A student's study habits are as follows. If he studies one night he is 65% sure not to study next night; on the other hand, if he does not study one night, he is 60% sure to not to study next night. Suppose he studies on Monday night, find the problem that he does not study on Friday night. 10 L4
- b) Vehicles arrive at a toll booth at an average rate of 300/hr and average waiting time at the toll booth is 10 sec/vehicle. Both arrival and departure are exponentially distributed. Find i) average number of vehicles in the system ii) average queue length iii) average delay per vehicle iv) average time a vehicle in the system 10 L3

NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Third Semester M.C.A. (Credit System) Degree Examinations
Supplementary Examinations – July 2017**15MCA302 – OPERATING SYSTEMS**

Max. Marks: 100

Duration: 3 Hours

Note: Answer Five full questions choosing One full question from each Unit.

Unit – I

- Explain the operating system services.
- Explain evolution of operating system in detail with suitable diagrams.
- Explain multiprocessor systems.
- What is process scheduling? Differentiate between different types of Schedulers.
- What are tradeoffs inherent in handheld systems?

Marks	BT
08	L1
12	L2
06	L1
08	L4
06	L2

Unit – II

- Consider the following set of processes with length of CPU burst time given in milliseconds.

Process	Burst Time	Priority
P1	10	5
P2	1	1
P3	2	3
P4	1	4
P5	5	2

Assume arrival order as: P1, P2, P3, P4, P5 at time 0,1,2,3,4 respectively and a smaller priority number implies a higher priority. Draw the Gantt charts for preemptive and non-preemptive priority scheduling. Calculate Average Turnaround Time and Average Waiting Time.

12	L4
08	L2
06	L1

- Discuss the Peterson's solution for the critical section problem with algorithm.
- What is Deadlock? Describe conditions that lead to deadlock.
- Consider the following snapshot of the system

	Allocation				Max			Available				
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Is the system safe? If process P1 requests for (0, 4, 2, 0), can it be granted?

14	L4
12	L2

Unit – III

- Explain the structure of page table.
- Given the five memory partitions of 100KB, 500KB, 200KB, 300KB and 800KB, how would the first fit, best fit and worst fit algorithms place processes of 212KB, 417 KB, 112KB and 426 KB? Which algorithm makes most efficient use of memory?
- Assume that we have paged memory system with associative registers (TLBs) to hold the most active page table entries. If the page table is held in memory and access time is 200 nanoseconds. What could be effective access time if 80% of memory references are found in the TLB. Assume that TLB access takes zero time.

04	L4
04	L3

P.T.O.

15MCA302

Supplementary – July 2017

- i) With a neat diagram explain steps in handling page fault. 08 L2
- ii) Consider the following page reference string:
1 2 3 4 2 1 5 6 2 1 2 3 7 6 3 2 1 2 3 6. How many page faults would occur for LRU, FIFO and optimal replacement algorithms assuming 3 and 4 frames? Compare the efficiencies. 12 L4
- i) Explain different file access methods. 06 L1
- ii) Explain any two file allocation methods with neat diagram. 08 L2
- iii) List and explain file attributes. 06 L1
- i) Write short notes on Boot block and Bad blocks. 08 L1
- A disk drive has 5000 cylinders, numbers 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at 125. The queue of pending request is 86, 1470, 913, 1774, 948, 1509, 1022, 1750 and 130. Determine the total distance the disk arm moves to satisfy the request for the following disk scheduling algorithms: FCFS, SSTF, SCAN, LOOK, C-SCAN and C-LOOK. 12 L4

Unit – V

- i) Write a note on user authentication. 08 L1
- ii) Explain how process is managed on Linux platform. 12 L2
- i) Explain the four levels of security measures. 06 L1
- ii) Explain System and network threats. 08 L1
- iii) Explain block and character devices. 06 L2

loom's Taxonomy, L* Level

NMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)**Third Semester M.C.A. (Credit System) Degree Examinations**
Supplementary Examinations – July 2017**15MCA303 / 13MCA402 – DATA COMMUNICATION AND COMPUTER NETWORKS**

Duration: 3 Hours

Max. Marks: 100

*Note: Answer Five full questions choosing One full question from each Unit.***Unit – I**

	Marks	BT*
Discuss the characteristics of Optical fiber and coaxial cables.	10	L*4
Explain the TCP/IP reference model.	5	L4
Explain the uses of computer networks with respect to home applications.	5	L4
Define the term 'noise' in communication. Briefly describe the different categories of noise	5	L2
Define Computer Network. Elaborate on the design issues for the layers.	10	L2
Define channel capacity? What are the factors that affect the channel capacity?	5	L2

Unit – II

Briefly explain the HDLC frame structure	10	L4
What is the design goal of scrambling technique? Explain two techniques of scrambling techniques with examples.	10	L6
Compute CRC for given data $M=1101001011$ $P=11011$ using polynomials.	10	L4
For bit stream 0101011100001 sketch the wave for the following encoding i). NRZ-I ii). Bipolar AMI iii). Pseudo ternary iv). Manchester v). Differential Manchester	10	L6

Unit – III

What is multi cast routing?	4	L2
Discuss Fiber Distributed data interface.	10	L4
Discuss distance vector routing.	6	L4
Compare virtual circuit subnet with datagram subnet.	10	L4
Write a short note on following network layer design issues. i. services provided to the transport layer ii. store-and-forward packet switching	10	L4

Unit – IV

Briefly describe the following i) inter networking ii) tunneling	10	L4
Write a note on jitter control.	6	L4
Discuss load shedding in network.	4	L4
Explain leaky bucket and token bucket algorithm with neat diagram.	10	L6
Describe different congestion reactive techniques used in virtual-circuits and in the datagram subnet.	10	L4

Unit – V

Write a short note on i) UDP protocol ii). Remote procedure call	10	L4
Describe the fields of the TCP segment Header with suitable diagram.	10	L4
Explain the TCP congestion control.	10	L4
Write a note on Domain Name Space and Name Servers.	10	L4

INSTITUTE OF TECHNOLOGY, NITTE

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Fourth Semester M.C.A. (Credit System) Degree Examinations
Supplementary Examinations – July 2017

15MCA401 – ENTERPRISE JAVA

Duration: 3 Hours

Note: Answer Five full questions choosing One full question from each Unit.

Max. Marks: 100

		Marks	BT*
1. a)	Define URL. Briefly explain the methods defined by URL connection class.	10	L*2
b)	What is Datagram? Write a program that implements communications between client and server using data grams.	10	L6
2. a)	Briefly explain the following in RMI. i) stub ii) skeleton iii) naming class iv) bind v) rebind	5	L2
b)	Describe the code snippet for RMI at client side and server side.	10	L2
c)	What are the uses of remote interface and remote object in RMI? Write the code for remote interface.	5	L4
Unit – II			
3. a)	Explain why Java swings are called light weight components and also list the difference between light weight and heavy weight components.	8	L2
b)	Explain the following with an example for each. i) JTextField class ii) JButton class iii) JComboBox class	12	L2
4. a)	Explain the different JDBC drivers.	8	L2
b)	Explain the following. i) Statement objects ii) Prepared Statement objects iii) Callable Statement objects	6	L2
c)	What are transactions? Explain.	6	L2
Unit – III			
5. a)	List the advantages of Java Beans.	4	L1
b)	Briefly explain the following variations with respect to standard properties supported by Java Beans model. i) Bound properties ii) Constrained properties iii) Persistence	6	L2
c)	Design a java bean component with properties and methods to implement student information	10	L6
6. a)	Discuss Bean introspection. How do you achieve this in Java? Explain with an example.	10	L4
b)	Illustrate with suitable examples, the different types of properties a Java Bean can have.	10	L2
Unit – IV			
a)	Briefly explain the API for servlet.	6	L2
b)	Write a program using servlet which contains HTML page to accept user name and display greeting message as "Welcome User" in browser window.	10	L6
c)	Briefly explain the uses of Tomcat for the development of servlet.	4	L2
a)	Briefly discuss the advantages of JSP over the servlets.	4	L1
b)	List and explain the types of directive tags in JSP.	6	L2
c)	How cookies are created in JSP? Explain with an example. And also list the advantages of cookies.	10	L2
Unit – V			
a)	What are the different kinds of Enterprise Java Beans? Explain.	10	L2
b)	What is a deployment descriptor? List the deployment descriptor for EJB 1.1	10	L1
a)	Discuss the implementation of session bean in EJB.	10	L6
b)	Explain CLDC and CDC in J2ME.	6	L2
c)	Briefly explain the Alert class in J2ME.	4	L2

Note: Answer Five full questions choosing One full question from each Unit.

Unit – I

- a) Differentiate the following
 - i. Data warehouse and Data Mining
 - ii. OLAP and OLTP
- b) Give three tier architecture for the data warehouse.
- c) Explore the steps involved in building data warehouse.
- d) With example, describe data cube operations.
- e) What are the schemas used to construct a data warehouse? Explain.

Unit – II

- a) Data Mining is an integral part of knowledge discovery. Justify.
- b) Differentiate between missing data and inconsistent data.
- c) Discuss any five important Data preprocessing approaches.
- d) Analyze different types of record based data.
- e) The properties of numbers are typically used to describe attributes. Illustrate.
- f) Compute cosine similarity for the following two data objects.
 $X=(3,2,0,5,0,0,0,2,0,0)$
 $Y=(1,0,0,0,0,0,0,1,0,2)$

Unit – III

- a) What is Apriori Principle? Explain frequent item set generation method of the Apriori algorithm.
- b) With example discuss Brute-force approach for mining association rules.
- c) Define association rule. Why are support and confidence used in association analysis?
- d) With example, discuss how FP growth algorithm generates frequent item sets from an FP-tree in bottom - up fashion.
- e) Illustrate an FP tree representation with example.

Unit – IV

- a) Consider the database shown below where cheat is categorical attribute. Develop the decision tree via the attributes – refund, marital status and taxable income.

Tid	Homeowner	Marital status	Taxable income	Cheat
1	Yes	Single	125k	No
2	No	Married	100k	No
3	No	Single	70k	No
4	Yes	Married	120k	No
5	No	Divorced	95k	Yes
6	No	Married	60k	No
7	Yes	Divorced	220k	No
8	No	Single	85k	Yes
9	No	Married	75k	No
10	No	Single	90k	Yes

- b) How does Rule based classification work? Illustrate with example.

AIMO-AI1

Supplementary - July 2017

- a) *Describe general approach to solving a classification problem.*
b) *In what way Bayes' theorem can be used for classifying data?*

Unit - V

a) *Define exclusive, overlapping and fuzzy clustering.*

b) *Discuss different types of clusters.*

c) *How do you validate clustering using classification oriented measures?*

d) *Write an algorithm for K-means clustering and explain it with an example.*

e) *Address the key issues in hierarchical clustering algorithm.*

10
10
10
10
10

L4
L4
L4
L4
L4

Bloom's Taxonomy, L⁺ Level

knowledge