

**Computer Engineering Department, S V N I T, Surat.  
Mid-Semester Examinations, September 2017**

*UJSCO 097*

**B Tech III (CO) - Fifth semester  
Course: CO303 - Design and Analysis of Algorithm**

Dated: 18 Sep 2017

Time: 02:00 pm to 03:30 pm

Max Marks: 30

**Instructions:**

1. Write your B Tech Admission No/Roll No and other details clearly on the answer books while write your BTech Admission No on the question paper, too.
2. Assume any necessary data but give proper justifications.
3. Be precise and clear in answering the questions.

**Q.1**

(a) Consider the recurrence  $T(n) = 2T(n - 1) + 1, n \geq 1$ , with initial condition  $T(0) = 0$ . [2]  
Obtain the solution using substitution method.

(b) Give asymptotic bound as tight as possible for the following recurrence by master method. [4]  
Assume that  $T(n)$  is constant for  $n \leq 2$ .

a)  $T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$

b)  $T(n) = 7T\left(\frac{n}{3}\right) + n^2$

(c) Give asymptotic upper bound for  $T(n)$  in the following recurrences by recursion tree. [4]  
Assume that  $T(n)$  is constant for sufficiently small  $n$ . Make your bounds as tight as possible.

$$T(n) = 2T\left(\frac{n}{2}\right) + \frac{n}{\lg n}$$

(d) Suppose that we have a set of activities (marriage, birthday party, etc.) to schedule among a large number of halls, where any activity can take place in any hall. We wish to schedule all the activities using as few halls as possible. Give an efficient greedy algorithm to determine which activity should use which hall. [5]

OR

(d) Give an example to show that the approach of selecting the activity of least duration from among those that are compatible with previously selected activities does not work. Do the same for the approaches of always selecting the compatible activity that overlaps the fewest other remaining activities and always selecting the compatible remaining activity with the earliest start time. [5]

Q.2 (a) Using coefficient based representation multiply the polynomials  $A(x) = 7x^3 - x^2 + x - 10$  [9] and  $B(x) = 8x^3 - 6x + 3$ .  
(b) Using point value representation multiply the same polynomials.  $\times$   
(c) Write a pseudo-code for recursive-FFT and demonstrate with necessary steps that the solution to (b) can be derived using the  $\Theta(n \lg n)$  time.

Q.3 Using dynamic programme approach derive the longest monotonically increasing [6] subsequence of integers from a given sequence of integers.

Sardar VallabhBhai National Institute of Technology, Surat  
Computer Engineering Department  
Mid Semester Examination, September-2017

B.tech- V Semester

Course: Computer Network (CO307)

Dated: 20<sup>th</sup> September 2017

Time: 14:00 to 15:30 hrs

Max Marks: 30

**Instructions:**

1. Write your Admission No/Roll No and other details clearly on the answer books while write your Admission No on the question paper, too.
2. Be precise and clear in answering the questions.
3. Support your answer with necessary diagrams and examples.

**Q-1 Answer the following questions (Any Five)**

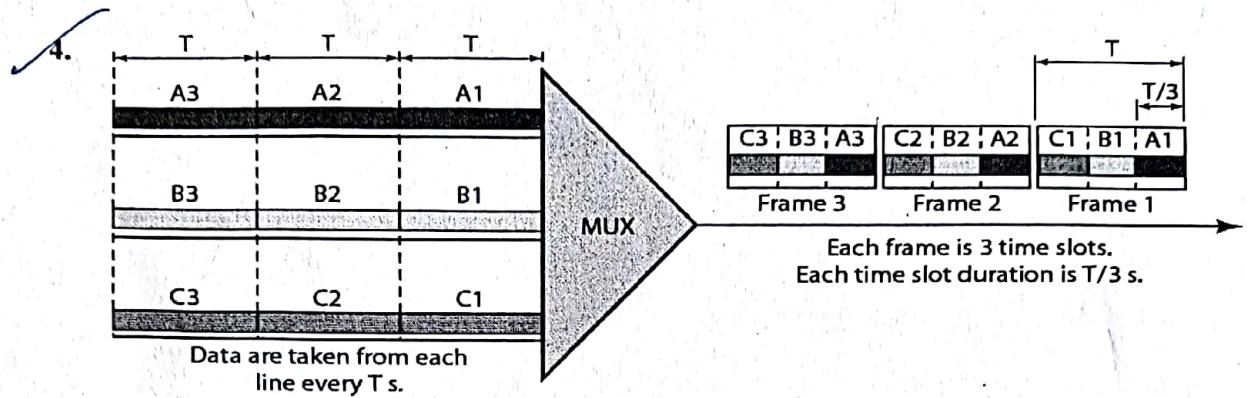
10

1. What are the various transmission impairments explains any two in brief.
2. Three stations share a 1 Mbps pure ALOHA channel. The average bit rate transmitted from each of the three stations is  $R_1=150$  kbit/s,  $R_2=200$  kbit/s and  $R_3=400$  kbit/s. The size of each packet is 2000 bits/packet. Assume that the arrival process is Poisson.
  - a) What is the normalized total traffic on the channel?
  - b) What is the normalized throughput?
3. Sketch the Manchester encoding and differential Manchester encoding for the bit stream: 0001110101. (For differential Manchester, assume the line is initially in the low state)
4. Draw digital signal of data stream 101011100 for 1) Unipolar 2) NRZ-L.
5. What is CSMA? Explain P-Persistent CSMA in brief.
6. Station A needs to send a message consisting of 9 packets to Station B using a siding window (window size 3) and go-back-n error control strategy. All packets are ready and immediately available for transmission. If every 5<sup>th</sup> packet that A transmits gets lost (but no acks from B ever get lost), then what is the number of packets that A will transmit for sending the message to B?

**Q-2 Answer the following Questions.**

20

1. Explain the principle of operation of CRC error detection method. Suppose a bit stream 10011101 is transmitted using the standard CRC method. Suppose the third bit from the left is inverted during transmission.  
Through an example show how:
  - a) What is the actual bit string transmitted?
  - b) How error is detected at the receivers end?
2. Use the generator polynomial  $X^3+1$ .
3. Explain Selective Repeat ARQ?
4. Assume that a voice channel occupies a bandwidth of 4 kHz. We need to combine three voice channels into a link with a bandwidth of 12 kHz, from 20 to 32 kHz. Show the configuration, using the frequency domain. Assume there are no guard bands between the channels to prevent interference.



What is Multiplexing? What is drawback of synchronous TDM? What is Pulse stuffing in TDM? In Figure, the data rate for each one of the 3 input connections is 1 kbps. If 1 bit at a time is multiplexed (a unit is 1 bit), what is the duration of (a) each input slot, (b) each output slot, and (c) each frame?

Dated: 21<sup>st</sup> Sep 2017

Time: 14:00 to 15:30 hrs.

Max Marks: 30

**Instructions:****B Tech Admission No:**

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3. Be precise and clear in answering the questions.

**Q.1 Answer the following (Any Four)**

16

- 1 Explain the best suitable statistical learning model with necessary equations for following two different datasets.
- A For 50000 training instances, to predict whether the sales will increase or decrease by spending money in different advertisement media such as TV, Radio, Newspaper. Sampled dataset is following

TV (In Lakhs)	Radio (In Lakhs)	Newspaper (In Lakhs)	Sales Increase
230.1	37.8	69.2	Yes
44.5	39.3	45.1	No
17.2	45.9	69.3	No
151.5	41.3	58.5	Yes
180.8	10.8	58.4	Yes
8.7	48.9	75	No
57.5	32.8	23.5	No

- B For 100000 training instances, to predict the ERP: estimated relative performance (value range is 0 to 5000) of computer hardware from the different parameters such as MYCT: machine cycle time in nanoseconds (value range is 0 to 150), MMIN: minimum main memory in kilobytes (value range is 128 to 64000), MMAX: maximum main memory in kilobytes (value range is 128 to 64000), CACH: cache memory in kilobytes (value range is 16 to 1024), CHMIN: minimum channels in units (value range is 1 to 64), CHMAX: maximum channels in units (value range is 16 to 256), from the following dataset. Sampled dataset is following

MYCT	MMIN	MMAX	CACH:	CHMIN	CHMAX	ERP
125	256	6000	256	16	128	199
29	8000	32000	32	8	32	253
29	8000	32000	32	8	32	253
29	8000	32000	32	8	32	253
29	8000	16000	32	8	16	132
26	8000	32000	64	8	32	290
23	16000	32000	64	16	32	381
23	16000	32000	64	16	32	381
23	16000	64000	64	16	32	749
23	32000	64000	128	32	64	1238

- 2 "As the dimensionality increases, the classifier's performance increases" Justify the statement with suitable example.
- 3 Formulate and explain the Bayes theorem. Also mention the limitation of Bayes theorem.
- 4 Write predicates for knight tour problem.
- 5 Write predicates to find the last element of a given list.

**Q.2** Build the best suited prediction model for following competition dataset predicting the Profit. Mention the stopping criteria of the model and prepare the optimum model. Justify your model selection compared to other atleast one technique. 08

Age	Competition	Type	Profit
Old	Yes	Software	No
Old	No	Software	No
Old	No	Hardware	No
Mid	Yes	Software	No
Mid	Yes	Hardware	No
Mid	No	Hardware	Yes
Mid	No	Software	Yes
New	Yes	Software	Yes
New	No	Hardware	Yes
New	No	Software	Yes

**Q.3** The 8 puzzle consists of eight numbered, movable tiles set in a 3x3 frame. One cell of the frame is always empty thus making it possible to move an adjacent numbered tile into the empty cell. Draw a complete search tree for given Start and Goal state, up to depth level 3 (where Start state is at depth 0) and give unique ID to each node of the tree. 06

Give the Node Traversal sequence for the following search approaches

- 1) Brute-Force Approach
- 2) Depth-First Search (DFS)
- 3) Depth-First Iterative Deepening (DFID) Search
- 4) Hill Climbing (where heuristic function  $h = \text{number of tiles that are not in the correct place (not counting the blank)}$ )

Start state			Goal state		
1	2	3			
4	8	5			
7	6		1	2	3
			4	7	6

Also comment on the performance of all the search techniques.

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S. V. National Institute of Technology, Surat  
B. Tech. III (All Branches) Sem. V - End Sem Examination  
November - December - 2017  
Marketing Management

V15C0 091

Time : 3 Hours ]

[Total Marks : 50]

Instructions: - Figures to the right indicates marks  
- Write your answer point wise and to the point

Qus 1  A Enlist criteria to segment Consumer market. 05  
 B Discuss components of Promotion Strategy in detail and derive Promotion Strategy by taking example of Technology product of your choice. 15

Qus 2 Answer any three: (10X3) 30  
 A How can companies attract and retain customers and cultivate strong customer relationship?  
 B How does a company adapt prices to meet varying circumstances and opportunities?  
 C Discuss Business to Business buying process in detail.  
 D Discuss New Product Development Process in detail.  
 E Write Short Notes: (1) Maslow's Hierarchy of need (2) Product and Service quality

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Time: 12:00 pm to 03:00 pm

Dated: 27 Nov 2017

**Instructions:**

1. Write your B Tech Admission No/Roll No and other details clearly on the answer books while write your BTech Admission No on the question paper, too.
2. Assume any necessary data but give proper justifications.
3. Be precise and clear in answering the questions.

**Q.1** Answer the following.

Use a recursion tree to give an asymptotically tight solution so the recurrence  $T(n) = T(\alpha n) + T((1 - \alpha)n) + cn$ , where  $\alpha$  is a constant in the range  $0 < \alpha < 1$  and  $c > 0$  is also a constant. [2]

(a) Find the solution to the recurrence  $T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + cn$ , where  $c$  is a constant, by applying recursion tree. [2]

(b) Solve the following recurrence relation using master method. [6]

$$T(n) = 3T\left(\frac{n}{4}\right) + n \lg n$$

$$T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$$

$$T(n) = 2T\left(\frac{n}{4}\right) + n^2$$

**Q.2**

Consider the following variation on the Interval Scheduling Problem. You have a processor that can operate 24 hours a day, every day. People submit requests to run daily jobs on the processor. Each such job comes with a start time and an end time; if the job is accepted to run on the processor, it must run continuously, every day, for the period between its start and end times. (Note that certain jobs can begin before midnight and end after midnight; this makes for a type of situation different from what we saw in the Interval Scheduling Problem). Given a list of  $n$  such jobs, your goal is to accept as many jobs as possible (regardless of their length), subject to the constraint that the processor can run at most one job at any given point in time. Provide an algorithm to do this with a running time that is polynomial in  $n$ . You may assume for simplicity that no two jobs have the same start or end times. [9]

Example. Consider the following four jobs, specified by (start-time, end-time) pairs.

(6 P.M., 6 A.M.), (9 P.M., 4 A.M.), (3 A.M., 2 P.M.), (1 P.M., 7 P.M.).

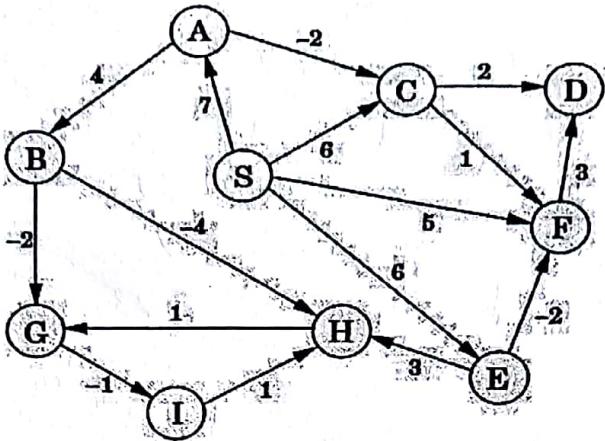
The optimal solution would be to pick the two jobs (9 P.M., 4 A.M.) and (1 P.M., 7 P.M.), which can be scheduled without overlapping.

**Q.3**

Suppose you're a consultant for the networking company CluNet, and they have the following problem. The network that they're currently working on is modeled by a connected graph  $G = (V, E)$  with  $n$  nodes. Each edge  $e$  is a fiber-optic cable that is owned by one of two companies—creatively named X and Y—and leased to CluNet. Their plan is to choose a spanning tree  $T$  of  $G$  and upgrade the links corresponding to the edges of  $T$ . Their business relations people have already concluded an agreement with companies X and Y stipulating a number  $k$  so that in the tree  $T$  that is chosen,  $k$  of the edges will be owned by X and  $n - k - 1$  of the edges will be owned by Y. CluNet management now faces the following problem. It is not at all clear to them whether there even exists a spanning tree  $T$  meeting these conditions, or how to find one if it exists. So this is the problem they put to you: Give a polynomial-time algorithm that takes  $G$ , with each edge labeled X or Y, and either (i) returns a spanning tree with exactly  $k$  edges labeled X, or (ii) reports correctly that no such tree exists. [9]

**Q.4**

Suppose Bellman-Ford algorithm is run on the following graph, starting at node A. [9]



- a) Draw a table showing the intermediate distance values of all the nodes at each iteration of the algorithm.  
 b) Show the final shortest-path tree.

**Q.5** The following table gives the frequencies of the letters of English language (include the blank for separating words) in particular corpus. [9]

Blank	P	C	I	X	G	R	T	V
18.3%	1.6%	2.6%	5.8%	0.2%	1.7%	4.8%	7.7%	0.9%
M 2.1%	S 5.1%	Z 0.1%	Y 1.6%	L 3.4%	O 5.9%	J 0.2%	F 1.8%	E 10.2%
B 1.3%	U 2.4%	N 5.5%	Q 0.1%	D 3.5%	A 6.8%	K 0.6%	W 1.9%	H 4.9%

- a) What is the optimum Huffman encoding of this alphabet?  
 b) What is the expected number of bits per letter?

**(b)** Show the reduction of SAT to 3-SAT and 3-SAT to independent set with an example. [4]

**Q.6** For language translation, formulate the problem for constructing optimal binary search tree. Derive a solution with detailed steps using Dynamic Programming approach. Write an algorithm and perform computational analysis. [9]

**Q.7** For computerized typesetting, derive a solution for separating a sequence of words into series of lines that comprise a paragraph using Dynamic Programming technique. The objective is to avoid a lot of extra spaces on any line. Write an algorithm and perform computational analysis. [9]

**Q.8** Analyze worst case scenario for Quick-sort using substitution method. For randomized version of Quick-sort algorithm perform probabilistic analysis with all steps in detail. [9]

**(a)** For birthday paradox problem, perform probabilistic analysis using random indicator variable with all steps in detail. How many candidates are required in a room to have two pairs of candidates having same birthday? [5]

**(b)** Using branch and bound technique provide a solution for traveling sales person. Also provide a solution for an instance with the following cost matrix. [9]

$\infty$	7	3	12	8
3	$\infty$	6	14	9
5	8	$\infty$	6	18
9	3	5	$\infty$	11
18	14	9	8	$\infty$

**Q.10** Using least cost branch and bound technique devise a solution for integer knapsack problem for maximize the profit by selecting a set of object subjected to weight of selected object should be less than or equal to capacity m. Draw solution tree generated by LCBB for the following instance where number of objects n = 5, weight capacity m = 12 with weights  $(w_1, w_2, \dots, w_5) = (4, 6, 3, 4, 2)$  and profit assigned to each weight value  $(p_1, p_2, \dots, p_5) = (10, 15, 6, 8, 4)$ . [9]

1  $\rightarrow$  8      6  $\rightarrow$  0  
 2  $\rightarrow$  0      7  $\rightarrow$  0  
 3  $\rightarrow$  7      8  $\rightarrow$  0  
 4  $\rightarrow$  9      9  $\rightarrow$  9  
 5  $\rightarrow$  7      20  $\rightarrow$  4

Dated: 29<sup>th</sup> Nov 2017

Time: 12:00 hrs to 15:00 hrs

Max Marks: 50

**Instructions:**

1. Write your Admission No/Roll No and other details clearly on the answer books while write your Admission No on the question paper, too.
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3. Support your answer with necessary diagrams and examples.

**Q-1 Answer the following questions (Any ten)**

20

1. Sketch the Bipolar and NRZI encoding for the bit stream 0001110101. Assume that the NRZI signal starts out low.
- ✓ 2. What is switching? Compare switching techniques with example.
- ✓ 3. Calculate the Shannon channel capacity in the following cases:
  - a)  $\rightarrow$  i) Bandwidth = 20Khz SNRdb=40
  - b) A file contains 3 million bytes. How long does it take to download this file using 100 kbps. *[Kilo bits]*
- ✓ 4. Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? Justify your answer.
- ✓ 5. Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.
  - a. How much data is in the first segment?
  - b. Suppose the first segment is lost but the second segment arrives at B. In the acknowledgement that Host B sends to Host A, what will be the acknowledgement number?
- ✓ 6. Suppose you are sending an email from your Hotmail account to your friend, who reads his/her e-mail from his/her mail server using IMAP. Briefly describe how your email travels from your host to your friend's host. Also, what is the application layer protocols involved?
- ✓ 7. For the following error detection methods discuss the case in which they fail to detect errors.
  - a) Byte stuffing b) VRC
- ✓ 8. Draw a timeline diagram (up to frame 7) that for the sliding window algorithm with SWS=4 frames and RWS=3 frames, when the third frame (frame 2) is lost. The receiver use cumulative ACKs. Use a timeout interval of about  $2 \times RTT$ . Assuming that the transmit time (insertion delay) of a frame is equal to  $0.25 RTT$  and the frames can be processed instantaneously if they arrive in order. On each data frame and ACK frame, you need to indicate the sequence number (start from 0). In addition, you need to indicate what action is taken by the receiver when it is received, for example, processed, buffered, and discarded.
- ✓ 9. Consider a token ring network like FDDI in which a station is allowed to hold the token for some period of time (the token holding time, or THT). Let Ring Latency denote the time it takes the token to make one complete rotation around the network when none of the stations have any data to send.
  - a) In terms of THT and Ring-Latency, express the efficiency of this network when only a single station is active.
  - b) What setting of THT would be optimal for a network that had only one station active (with data to send) at a time?
- ✓ 10. Differentiate between: a) ARP and RARP b) TCP and UDP

11. In a CDMA system the four chip sequences are:

$$A = (-1 -1 -1 +1 +1 -1 +1 +1) \quad B = (-1 -1 +1 -1 +1 +1 +1 -1)$$

$$C = (-1 +1 -1 +1 +1 +1 -1 -1) \quad D = (-1 +1 -1 -1 -1 -1 +1 -1)$$

If the received sequence is  $(-1 +1 -3 +3 +1 -1 -1 +1)$  what is the data transmitted by the four stations.

**Q-2 Answer the following Questions. (Any Six)**

30

1. Explain AAL reference structure. *ATM adopted Layer*

2. What is Congestion? Explain Congestion control in TCP and Frame Relay.

3. What is the purpose of a subnet mask? Is the subnet mask 255.255.0.255 valid for a Class A address? Justify. Suppose you have sub-netted your class C network 192.168.1.0 with a subnet mask of 255.255.255.240. Please list the following: number of networks, number of hosts per network, the full range of the first three networks, and the usable address range from those first three networks.

4. Solve these with help of Polynomials.

Given the data word 1010011110 and the divisor 10111.

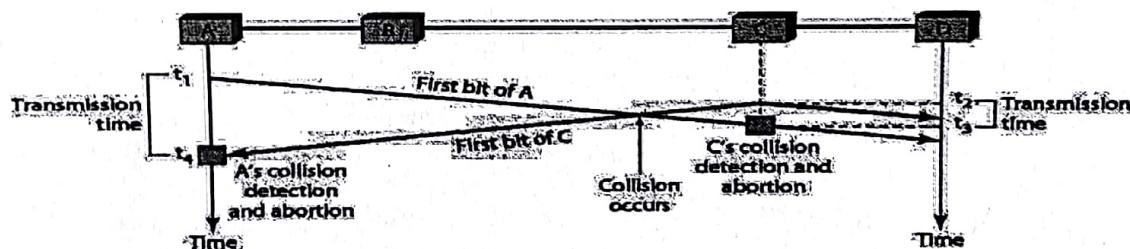
- a) Show the generation of the code-word at the sender site using binary division.  
 b) Show the checking of the code-word at the receiver site assuming no error has occurred.  
 c) What is the syndrome at the receiver end if the data-word has an error in the 5th bit position counting from the right? Namely: data-word 1010001110 is received.

5. Explain 802.4 priority schemes with example.

6. Figure, the data rate is 10 Mbps, the distance between station A and C is 2000 m, and the propagation speed is  $2 \times 10^8$  m/s. Station A starts sending a long frame at time  $t_1 = 0\mu s$ ; station C starts sending a long frame at time  $t_2 = 3\mu s$ , if the size of the frame is long enough to guarantee the detection of collision by both stations. Repeat same for data rate 100 Mbps.

Find the following.

- a. The time when station C hears the collision ( $t_3$ ).  
 b. The time when station A hears the collision ( $t_4$ ).  
 c. The number of bits station A has sent before detecting the collision.  
 d. The number of bits station C has sent before detecting the collision.

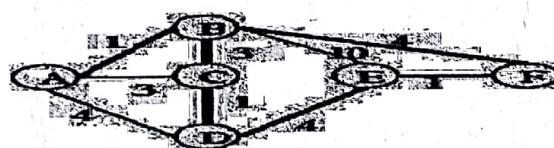


Collision of the first bit in CSMA/CD

7. Consider the network shown below.

- (a) Show the operation of Dijkstra's (Link-State) algorithm for computing the least-cost path from F (the rightmost node in the figure below) to all destinations. Also explicitly list all the shortest path routes from F to all destinations that are the result of the algorithm's computation.

- (b) Show the distance table that would be computed by the distance vector algorithm in B.



Dated: 30<sup>th</sup> Nov 2017

Time: 12:00 to 15:00 hrs.

Max Marks: 100

B.Tech Admission No:

## Instructions:

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## Q.1 Answer the following

[50]

12

## 1. Compare the followings (Any three)

1. Linear Regression vs Logistic Regression  
 2. Mean Value Replacement vs Constant Value Replacement vs Average Value Replacement  
 3. Overfitting vs Underfitting  
 4. ID3 vs C4.5

## 2. Construct by hand a neural network that computes the given below functions of two inputs. (initialize weight and bias = 0, for activation function use sigmoid function and learning rate = 0.5, perform at least three epochs)

10

1. NOR

2. AND

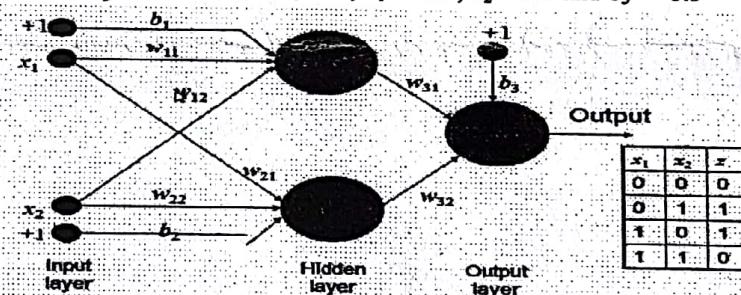
3. Consider the following Multi-Layer feed-forward Neural Network with two input, 1 Hidden layer and 1 output layer where  $x_1$  and  $x_2$  are input vector and  $z$  output. Verify that the network shown in the figure solves an XOR problem for the following two different set of weights and bias. (for activation function use sigmoid function) $\tau \approx 0.5 \geq 1$ 

10-0

1.  $W_{11} = W_{12} = W_{21} = W_{32} = -1$ ,  $W_{31} = -1$ ,  $b_1 = +1.5$ ,  $b_2 = b_3 = -0.5$   
 2.  $W_{11} = W_{12} = W_{22} = W_{31} = +1$ ,  $W_{32} = -3$ ,  $b_1 = -1.5$ ,  $b_2 = 0.5$  and  $b_3 = -0.5$

 $\tau \approx 0.5 \geq 1$ 

CO



## 4. Answer the following (Any three)

18

## 1. Discuss an Ensemble Model in detail. What are the benefits of ensemble model?

## 2. Explain the following machine learning algorithm and point out their pros and cons

- SVM
- K-Mean

## X 3. Write PCA algorithm for dimensionality reduction. Suggest drawbacks to improve the working of PCA algorithms. X

## 4. Clustering has been popularly recognized as an important machine learning technique with broad applications. Give one application example for each of the following cases:

- An application that takes clustering as a major data mining function
- An application that takes clustering as a preprocessing tool for data preparation for other data mining task

**Q.2 Answer the following(Any Six)**

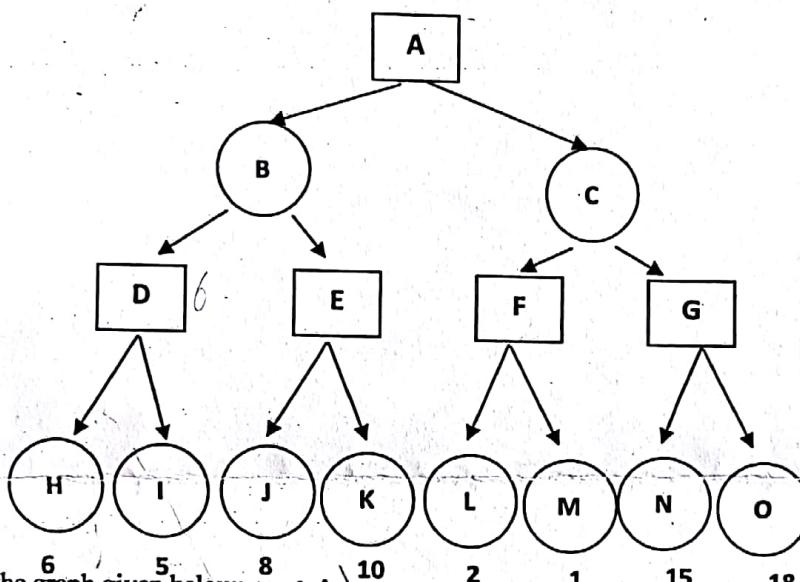
[30]

- ✓ 1. Explain two approaches used by regression to perform classification?
- ✓ 2. Give the Algorithm for BFS and DFS and explain it in detail.
- ✓ 3. Describe A\* search and give the proof of optimality of A\*.
- ✓ 4. Explain in detail about problem solving approaches.
- ✓ 5. How to improve the effectiveness of a search based problem solving technique?
- ✓ 6. Describe the Min-Max Algorithm and Alpha -beta Pruning
- ✓ 7. Differentiate between prepositional versus first order logic

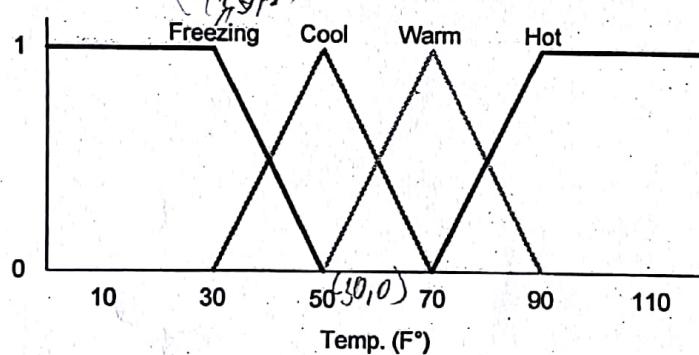
**Q.3 Answer the following**

[20]

- ✓ 1. Given the following search tree, apply the alpha-beta pruning algorithm to it and show the search tree that would be built by this algorithm. Make sure that you show where the alpha and beta cuts are applied and which parts of the search tree are pruned as a result.



- ✓ 2. Consider the graph given below:



- Write the membership functions corresponding to the fuzzy sets. Hence answer the question: How cool is 36°F?
- Explain the methods of defuzzification.
- Elaborate on Fuzzy Inference Systems.