राष्ट्रीय प्रौद्योगिकी संस्थान, उत्तराखण्ड

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND

Department of Computer Science & Engineering

End-Term Exam (Even Semester 2021) **(Open Book)**

Computer Networks (CSL-255)

Time: 02:00 Hrs. (Including scanning and emailing). **MM:40**

Important instructions:

1) All questions are compulsory.
2) Solve the question paper on A4 size or blank sheets of pages.
3) Each page should be bear Name, Enrolment No./Roll No., Course Name, and Course Code on top of each page along with page numbers.
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Q1. An organization is granted the class B network 130.34.0.0. The organization need to have 6 subnets. Compute the following: **[4]**

a) First and last valid IP address of each subnet.
b) Number of host address in each subnet.

Q2. Explain Hamming code in brief. What will be the redundant bits added by the sender to the Data Word as per Hamming code requirements? consider that during transmission bit position 6 got inverted assuming LSB at position 1. Explain how the receiver will check the possibility of error in the transmission. (Consider Data Word: 1001101). **[6]**

Q3. Explain IP protocol header fields in details with diagram. **[6]**

Q4. If the IP address of the system is 132.169.149.129 and subnet mask is 255.255.255.220, then calculate the subnet id to which this host belongs to, total number of subnetworks, 15^{th} host of 4^{th} subnetwork, and broadcast address of last subnetwork. **[6]**

Q3. Briefly explain 3-way handshake for connection establishment in transport layer along with flags used for this purpose. **[5]**

Q4. Consider a system is transmitting frames of length 64 bytes and channel transmission speed is 512 kbps. Compute the number of frames successfully reached to the destination for ALOHA and slotted ALOHA if system transmits 1000 frames/sec. **[5]**

Q5. A frame X7 + X6 + X4 + X2 + X is to be transmitted using CRC with the generator code X4 + X + 1, to protect it from error, what is the transmitted frame in polynomial form. **[4]**

Q6. A 1000 km long cable operates at 1 MB/sec. with delay of 10 microsec/km and the frame size is 1 KB. How many bits are required to represent the sequence number? **[4]**

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Department of Computer Science & Engineering

Mid-Term-II Exam (Even Semester 2021) **(Open Book)**

Computer Networks (CSL-255)

Time: 01:00 Hrs. (Including scanning and emailing). **MM:20**

Important instructions:

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Q1. Each station in IEEE 802.5 with 01-bit delay and 46 meters apart from its neighboring station. Token is 03 bytes and propagation speed are 2.3×10^8 m/sec. To avoid overlapping the 04 Mbps token ring is used, and the monitor must insert 15 bits of artificial delay in the ring. How many stations are there in the ring? **[5]**

Q2. Compute the sequence number if packet size is 53 bytes and round-trip time is 60 msec. and bandwidth is 155 Mbps. **[3]**

Q3. Briefly explain FDDI mechanism and calculate number of asynchronous packets sent in 5^{th} round by station 01, if target token rotation time is 30 and each station is transmitting 04 synchronous packet in each round. **[8]**

Q4. The code 11110101101 was received. Using the Hamming encoding algorithm, what is the original code set? **[4]**

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Department of Computer Science & Engineering

Mid-Term-I Exam (Even Semester 2021) **(Open Book)**

Computer Networks (CSL-255)

Time: 01:00 Hrs. (Including scanning and emailing). **MM:20**

Important instructions:

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Q1. Assume Host A is sending data to Host B over a full duplex link. The Hosts A and B are using sliding window protocol for flow control. The sender and receiver window sizes are 5 packet each data packet sent only from A to B and the size of packet is 1000 bytes. The transmission time of each packet is 50μsec. and acknowledgment packets send only from B to A are very small in size, which needed negotiable time. The propagation time or delay over the link is 200μsec. what is the total time required in this communication and maximum throughput of the communication? [5]

Q2. Computer A uses stop-and-wait ARQ protocol to send packets to computer B. If the distance between A and B is 4000 Km, how long does it take computer A to receive acknowledgment for a packet? Use the speed of light for propagation speed and assume the time between receiving and sending the acknowledgment is zero. [5]

Q3. Explain the bit stuffing process in detail with flow diagram and calculate bit stuffing for the following data. [5]

00011111101111100111100111111001

Q4. Explain sliding window ARQ protocol in detail and why the window size is not equals to the modulo value, justify your answer? [5]

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Department of Computer Science & Engineering

Mid-Term-I Exam (Even Semester 2021) **(Open Book)**

Computer Organization (CSL-258)

Time: 01:00 Hrs. (Including scanning and emailing). **MM:20**

Important instructions:

1) All questions are compulsory.
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Q1. Write the 3, 2, 1, and zero instructions for the following arithmetic instruction. **[2+2+4+4=12]**

$$X = \frac{\frac{A}{B} + \left(C * \frac{D}{E}\right) - \left(\frac{F}{G} * H\right)}{I * \left(\frac{J}{K}\right) + L}$$

Q2. Assume a machine has 16-byte architecture with two-word instruction. It has 32 registers, and each of which is 16 bit long. It needs to support 52 instructions which have an immediate operand in addition to one operand register. Assuming that the immediate operand is an unsigned integer. What is the maximum value of immediate operand? **[3]**

Q3. Explain Booth Algorithm concept and solve the multiplication of **(23 × -32)** using Booth Algorithm. **[5]**

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NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND

Department of Computer Science & Engineering

Mid-Term-II Exam (Even Semester 2021) **(Open Book)**

Computer Organization (CSL-258)

Time: 01:00 Hrs. (Including scanning and emailing). **MM:20**

Important instructions:

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Q1. Consider a 3-level memory system with the hit ratios 0.8, 0.9, and 01. The access time are 20nsec., 100nsec., and 1000nsec. If there is a miss of level-1, a 4-word block is to be moved from level-2 to level-1 and it is handed over to the processor to level-1. If the referred word is not present in level-2 then 08-word block is first moved from level-3 to level-2, then concerned block is move from level-2 to level-1. Ignore the placement time and compute average access time. What is the throughput of this memory system? **[6]**

Q2. Consider the number P is represented in 2's complement notation and the P value is FA73H. what will be the value denoted by P*8? **[4]**

Q3. Fond out at-least one number which is exactly divisible by 111011 and assume that the numbers are denoted in 2's complement notations. **[5]**

Q4. The micro-instruction stored in the cache memory of a processor have a word of 26 bits, each micro-instruction is divided into 3 fields. If there are 08 states conditions with multiprocessor then how many bits are in X and Y fields and what is the size of control memory in the number of words. If a micro-instruction field is having 13 bits, then calculate the followings: **[5]**

a) Number of bits in next address field (X)?
b) Number of bits in multi-processor field (Y)?

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Department of Computer Science & Engineering

End-Term Exam (Even Semester 2021) **(Open Book)**

Computer Organization (CSL-258)

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Q1. A cache of 80% hit was made to increase its average access time by 40% from 60nsec. It was found that cache is 10 time faster than main memory:

a) What is the access time for cache and main memory?
b) What is the new hit ratio?
c) What was the percentage of change in hit ratio? **[6]**

Q2. Consider a memory system which is byte addressable, the system contains 02 MB words main memory, 02 KB word cache memory. Each tag comparator consumes K/10 nsec time (k = no. of tag bits). The 2 * 1 MUX consume 15 nsec. Delay. **[6]**

a) What is the actual size of the cache in byte for direct mapping?
b) What is the hit time for direct mapping? (When block size = 32 words)

Q3. Briefly explain the memory organization (each levels) with the help of memory hierarchy diagram. **[5]**

Q4. Explain Booth Algorithm concept and solve the multiplication of **(12 × -24)** using Booth Algorithm. **[5]**

Q5. Write the 3, 2, 1, and zero addresses instructions for the following arithmetic instruction. **[8]**

$$Y = \frac{\left(J * \left(\frac{K}{L}\right) + M\right) \% N}{(A * B) + \left(C * \frac{D \% E}{F}\right) - \left(\frac{G}{H} * I\right)}$$

Q6. Consider the memory is byte addressable with a size of 64 bites, and the program is loaded from location 4000. If an interrupt occurred during 4th instruction, the return address saved in the stack will be? **[2]**

Q7. Write the short note on the followings: **[8]**

a) Locality of reference in cache memory.
b) Address mapping (Direct, fully associate, and Set associate)

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
MTE-I (Even Semester 2021)

DESIGN AND ANALYSIS OF ALGORITHMS (CSL254)

Time : 1Hr. **M.M. : 20**

Note : All questions are compulsary.

Q1. Find the solution and time complexity of the following recurrence equation using Tree Method. **(05)**

$$T(n) = 2T\left(\frac{n}{2}\right) + nlog_2 n$$

Q2. Find the solution and time complexity of the following recurrence equation using Substitution Method. **(05)**

$$T(n) = 2T(n-1) + n, \qquad n \geq 2$$
$$T(n) = 1, \qquad n = 1$$

Q3. $f(n) = \frac{3}{4}n^4 + 3n^3 - 2n^2 + 1$, find the least values of C_1, C_2, g(n) and n_0 using Big Theta notation. **(05)**

Q4. Find the time complexity for the following program. **(05)**

a.

```
Sum=0;
for(i=1; i≤n; i=i×3)
{
        for(j=n;j>0; j=j-j/2)
        {
                Sum=sum+j;
        }
}
```

b.

```
for(i=1; i≤n; i=i+1)
{
  for(j=1;j≤i^3; j=j+1)
  {
        for(k=1;k≤n/3; k=k+1)
        {
        Printf("Hello");
        }
  }
}
```

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
MTE-II (Even Semester 2021)

DESIGN AND ANALYSIS OF ALGORITHMS (CSL254)

Time : 1Hr. **M.M. : 20**

Note : All questions are compulsary.

Q1. Construct a 3-ary min heap tree by inserting following keys one after another in the given order *35, 33, 10, 14, 19, 8, 6, 26, 31, 9, 7, 2*. Also write the detailed worst case time complexity analysis of heap sort algorithm. **(04)**

Q2. Find the space complexity of following recursive program. **(04)**

```
fun(int n)
{
        if(n==0)
        {
                return 1;
        }
        else
        {
                fun(n-1);
                printf(n);
                fun(n-1);
        }
}
```

Q3. Answer the following: **(12)**

a. Let O(C) time required to find the median of an unsorted array, where C is a constant. Consider a Quicksort algorithm, first it finds the median in O(C) time, then it uses median as pivot element. Write the recurrence relation of this Quicksort algorithm and find the worst case time complexity?.

b. Let A[n] be an array of 'n' elements in increasing order where $n \in (2^{(k-1)}, 2^k]$. In worst case, how many comparisons are required interms of k by using most efficient searching algorithm?

c. In a binary tree, for every node the difference between the number of nodes in the left and right subtrees is at most 3. If the height of the tree is h=5, then what is the minimum and maximum number of nodes in the tree?

d. In a 4-ary tree, each node has exactly either zero or four children. What is the maximum and minimum height of the given tree with n nodes?

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
End Semester Exam (Even Semester 2021)

DESIGN AND ANALYSIS OF ALGORITHMS (CSL254)

Time : 2Hr. **M.M. : 40**
Note : All questions are compulsary.

Q1. If the function $f(n)=3n^3+4n^2-8n-11$. Bound the function f(n) with another function g(n) with constant c and n_0 by using Big-Omega asymptotic notation. **(05)**

Q2. Write the detailed best and worst case time complexity analysis of insertion sort algorithm. Is there any possibility to minimize the no. of comparisons or swappings in insertion sort? **(05)**

Q3. Let *S* be a string of *n* bits, each string contains either *0 or 1*. Further, there are no two consecutive *1's* in *S(n),* where S(n) is the number of solutions with input size as n. Construct the recurrence relation for S(n) and find the time and space complexity of S(n). **(05)**

Q4. Suppose the message contains the characters with their frequencies are: A=20, B=8, C=6, D=10, E=30, F=6, G=4, H=2. **(05)**

a. Find the no. bits required to encode the letters A, B, C, D, E, F, G, H using fixed lengh and Huffman encoding?
b. What is the average length of letters using fixed length and Huffman encoding?

Q5. Find the time complexity for the following program. **(05)**

A	b

Sum=0;
for(i=1; i≤n; i=i+3)
{
for(j=1;j≤i; j=j*4)
{
Sum=Sum+j;
}
}
	Sum=0;
	for(i=n; i>0; i=i/2)
	{
	for(j=0;j≤n; j=j+i)
	{
	Sum=Sum+j;
	}
	}

Q6. Consider 9 jobs, each job having deadline and their profits are given below. All jobs are arrived at same time. Only one job can process at a time and only one CPU is available for processing all jobs. CPU can take only one unit of time for processing any job. Answer the following: **(05)**

a. How many jobs are completed or left out?
b. What is the maximum profit?

Jobs	**J1**	**J2**	**J3**	**J4**	**J5**	**J6**	**J7**	**J8**	**J9**
Deadline	9	4	7	5	6	7	4	9	5
Profit	18	23	33	21	21	13	26	19	28

Q7. You are given a knapsack that can carry a maximum weight of 18. There are 4 items {I1, I2, I3, I4} with weights {4, 6, 8, 10} and profits {2, 4, 10, 12}. Find the maximum profit using greedy approach i.e. fractional knapsack. Construct the table and find the maximum profit using dynamic programming i.e. 0/1 knapsack. **(10)**

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NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
Mid Term-II Examination, Even Semester-(2021)

Subject: Probability & Numerical Methods **Code: SCL253** **Time: 1 Hour** **M.M.: 20**

Note: Attempt all questions.

Q1.	If X represents the number of times one must throw a die until the outcome 2 has occurred 5 times then find the expected value of X^2 i.e. $E(X^2)$.	3
Q2.	Buses arrive at a specified stop at 15-minutes intervals starting at 7:00AM i.e. they arrive at 7:00AM, 7:15AM, 7:30AM, 7:45AM and so on. If a passenger arrives at the stop at a time that is uniformly distributed between 7:00AM and 7:30AM, find the probability that he waits (i) less than 5 minutes for a bus (ii) more than 10 minutes for a bus.	4
Q3.	You call the IRS (Internal Revenue Service) hotline and you are told that you are the 16th person in line, excluding the person currently being served. Callers depart according to a Poisson process with a rate of 2 per minute. How long will you have to wait on the average until your service starts, and what is the probability you will have to wait for more than 30 seconds?	3
Q4.	Can we write the matrix $A = \begin{bmatrix} 1 & 1 & 5 \\ 3 & 3 & 4 \\ 1 & 2 & 0 \end{bmatrix}$ into Crout's LU decomposition form? If yes, then write L and U matrices and if not, then explain the reasons for that.	2
Q5.	Let $AX = B$ represents the system of equations, where $A = \begin{bmatrix} 0.25 & 0 \\ 0 & -0.5 \end{bmatrix}$ & $B = \begin{Bmatrix} 1 \\ 2 \end{Bmatrix}$. Then find the condition number of the matrix A using $\|A\|_1$. Based on this, what can you say about the system of equations (Well posed or ill-conditioned)?	2
Q6.	If the spectral radius of the matrix A i.e. $\rho(A) > 1$ then what can you say about $\|A\|_\infty$? Explain your answer.	1
Q7.	For the following system of equations $(AX = B)$, $$\begin{bmatrix} 2 & -3 & 5 \\ 3 & 4 & -1 \\ 5 & 1 & -2 \end{bmatrix} \begin{Bmatrix} x \\ y \\ z \end{Bmatrix} = \begin{Bmatrix} 10 \\ -2 \\ 2 \end{Bmatrix}$$ (i) Check whether the matrix A is diagonally dominant or not. If yes, then set up the Gauss-Seidel iteration scheme in matrix form. If not, then make it diagonally dominant by using suitable elementary operations and hence set up the Gauss-Seidel iteration scheme in matrix form. (ii) Find the rate of convergence of the said scheme. (iii) Starting with initial approximation $\begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix}$, iterate one time only.	5

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National Institute of Technology, Uttarakhand

B. Tech. (Mid Term-I Examination), Even Semester- 2021

Course Title:	**Probability And Numerical Methods**	**Time:**	**01 Hr.**
Course Code:	**SCL 253/SCL203**	**M.M.:**	**20**

SET-4

Note: Attempt all questions

Q.1 Evaluate the following:		
(a)	Find the round-off the following nos. correctly to four decimal places (i) **0.0090038** (ii) **0.093485**	**[1]**
(b)	Write any two disadvantages of ***Newton-Raphson's*** method.	**[1]**
(c)	If X has the probability mass function $f(x) \equiv \frac{k}{x!}, x \equiv 0, 1, 2, \ldots \ldots \infty$ then find (i) The value of k and (ii) $P(X \geq 3)$.	**[3]**
(d)	A player throwing an ordinary dice is to receive $Rs. \frac{1}{2^n}$, where n is the number of throws that he takes to throw an ace. Find his expectation for receiving the rupees.	**[3]**
(e)	In a bombing attack there is a **40%** chance that any one bomb will strike the target. One direct hit is required to destroy the target completely. How many bombs must be dropped to give a **99%** chance or better for completely destroying the target ?	**[4]**
(f)	Find the approximate value of the root for the equation $x^2 + 4sinx = 0$ correct to two decimal places by using Newton-Raphson's method.	**[4]**
(g)	If the following numerical scheme has been implemented for finding the $(a)^{\frac{1}{2}}, a > 0$ then determine the rate of convergence of the scheme: $$x_{n+1} = \frac{x_n(3a - x_n^2)}{2a}$$	**[4]**

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NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
End Term Examination, Even Semester-(2021); Date: 04.05.2021

Subject: Probability and Numerical Methods Code: SCL253 Time: 2 Hours M.M.:40

Note: (i) Attempt all questions.

(ii) z-table is given at the end of the question paper.

Q1.	Check whether the following can define the probability mass function, and explain your answer: $$P(X=x)=\frac{x^2}{30} \quad \text{for } x=0,1,2,3 \text{ and } 4.$$	**1**
Q2.	Let X and Y be two independent random variables with moment generating functions, $M_X(t)=\frac{1}{1-\frac{t}{4}}$ and $M_Y(t)=1-2t$, then what is the moment generating function of $Z=4X+\frac{1}{2}Y+2$.	**2**
Q3.	The joint probability density function of two random variables X and Y is given by $$f(x,y)=\frac{1}{\pi\sqrt{3}}e^{-\frac{2}{3}(x^2-xy+y^2)} \text{ for } -\infty<x<\infty \text{ and } -\infty<y<\infty.$$ Determine the marginal probability density functions $f(x)$ and $f(y)$.	**3**
Q4.	If families are selected at random in a certain thickly populated area and their annual income in excess of **Rs.4000** is treated as a random variable having an exponential distribution for $x>0$, $$f(x)=\frac{1}{2000}e^{-\frac{x}{2000}}$$ what is the probability that **3** out of **4** families selected in the area have income in excess of **Rs.5000** ?	**4**
Q5.	On a day particular professor has office hours, the times between student visits to his office have been found to be exponentially distributed with a mean of **10** minutes. What is the probability that the time between the arrival of the second student and the arrival of the sixth student is greater than **20** minutes?	**3**
Q6.	If joint cumulative distribution function $F(x,y)$ is given as $$F(x,y)=\begin{cases}k\left(\frac{x^2y^2}{4}+\frac{xy^3}{3}\right) & for\ 0\le x\le 1, 0>0, 0\le y\le 2\\ 0, & elsewhere\end{cases}$$ Then, find (i) The probability density function $f(x,y)$ (ii) Value of k (iii) $P\left(X>\frac{1}{2}, Y<1\right)$ and (iv) $P(X+Y\le 1)$.	**5**
Q7.	If $x=1.1111116\times10^{-1}, y=0.11111115\times10^{0}$ are accurate to eight significant digits, then find the number of significant digits in $z=x-y$.	**1**
Q8.	Find the iterative scheme based on the Newton-Raphson's method for finding the abscissa of the point of intersection of the following curves $f_1(x)=3x+4$ and $f_2(x)=cosx+5$.	**3**

Q9.	If $A = \begin{bmatrix} 1 & \alpha \\ 2\alpha & 1 \end{bmatrix}, \alpha \neq \frac{1}{\sqrt{2}}$, find the value of α for which **Gauss Jacobi** method converges.	3
Q10.	Let $p(x)$ be the polynomial of degree atmost 2 that interpolates the data $(-1, 2), (0, 1)$ and $(1, 2)$. If $q(x)$ is a polynomial of degree atmost 3 such that $p(x) + q(x)$ interpolates the data $(-1, 2), (0, 1), (1, 2)$ and $(2, 11)$ then find the value of $q(3)$.	4
Q11.	If the **Simpson's 1/3** rule with double interval $[0, 1]$ is exact for approximating the integral $\int_0^1 (x^3 - cx^2)dx$ then find the value of c.	3
Q12.	Write the following initial value problem into three first order simultaneous differential equations: $$x^3y''' - 2xy' + y = 2,\ y(0) = 0, y'(0) = 1 \ \& \ y''(0) = 1.$$ If the reduced system of first order simultaneous differential equations is solved by RK4 method at $y(1) = y_1 = y_0 + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$;...;... considering $h = 1.0$ and where $K_i's$ are as defined in RK4 method for system of first order simultaneous equations. Then find the value of K_2.	4
Q13.	Using Finite difference method, find the solution of the following BVP: $y'' + xy' + \frac{1}{2} = 0$ with $y(0) = 0,\ y(3) = 1$. Consider the step size $h = 1$ for finding the solution.	4

Note: z-table is given on the next page.

Standard Normal Probabilities

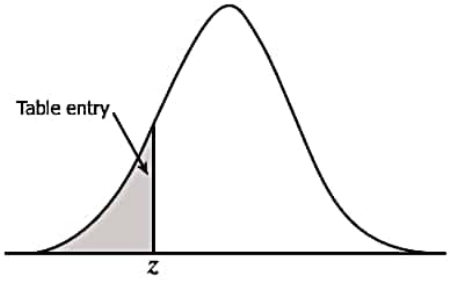


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Standard Normal Probabilities

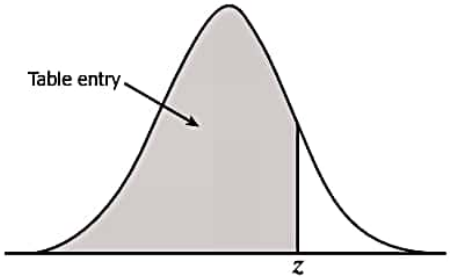


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
Mid Term-I Examination (Even Semester 2021)

SOFTWARE ENGINEERING (CSL256)

Time : 1 hr. **M.M. : 15**

Q1. Explain the major differences between the exploratory and modern software development practices. (3mks)

Q2. Identify and explain the important factors that influence the choice of a suitable SDLC model for a software development project. (2mks)

Q3. Compare the advantages and disadvantages of the agile model with iterative waterfall and the exploratory programming model. (3mks)

Q4. Identify the basic questions pertaining to the project that should be clearly understood by the analyst before carrying out analysis. (3mks)

Q5. Suppose you wish to develop a word processing software that would have features similar to Microsoft word. Give the outline of the SRS document for this word processing software by mentioning three functional and three nonfunctional requirements in detail. (4mks)

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
MTE-II (Even Semester 2021)

SOFTWARE ENGINEERING (CSL307/256)

Time : 1Hr. **M.M. : 15**

Note : All questions are compulsary.

Q1. For the given scenario for course registration during the start of a semester develop the use case diagram.
"At the beginning of each semester, each professor shall register the courses that he is going to teach. A student can select up to five-course offerings. During registration a student can request a course catalogue showing course offerings for the semester. Information about each course such as professor, department and prerequisites would be displayed. The registration system sends information to the billing system so the students can pay fees for the semester. For each semester, there is a period of time during which dropping and audit/withdrawal of courses is permitted. Professors must be able to access the system to see which students registered for each of their course offerings". **(4mks)**

Q2. The function units for number of external outputs, number of external inputs, number of enquiries, number of external interfaces and number of files are 70, 40, 33, 12 and 18 respectively. Assume that the complexity weighting factors are average. Further for the fourteen values adjustment factors that influence the development effort, five factors are not applicable, each of the other six factors have value 04 and each remaining factor have value 03. Calculate the value of function point? **(3mks)**

Q3. Suppose a software to be developed has two parts. In first part the team members are experienced and already involved in past in developing such applications whereas the second part to be developed is strongly coupled to complex hardware. Find out the total development time and Effort required to develop the software. Lines of code required are 75,000 and 30,000 for first and second part respectively. Also there is an adjustment factor of 1.25 for the second part. **(4mks)**

Q4. Software is to be developed for a Shoppers Stop (department store) which will help it in the automation of its plan to motivate the regular customers to purchase more products. In this plan, initially a customer has to register him/her by providing his/her details like name, address, mobile number. A unique customer-id(CID) is provided to all the customers that register's in this scheme. When a customer purchases a new product he shows his CID to the billing staff and one point is credited to his/her CID against the purchase of every 500 rupees. During the end of the year, Shoppers Stop announces gifts to the first 100 customers who are having the maximum points to their credit and a gold coin of 2gms to all the customers who's total points are more than 100. Entries in the CID are reset on every 31st December. Draw the structure chart for the given scheme of Shoppers Stop. **(4mks)**

NATIONAL INSTITUTE OF TECHNOLOGY, UTTARAKHAND
DEPT. OF COMPUTER SCIENCE & ENGINEERING
End Term Examination (Even Semester 2021)

SOFTWARE ENGINEERING (CSL307/256)

Time : 2 hr. **M.M. : 40**

Q1. Suppose you are the project manager of a software project requiring the following activities. **(8mks)**

Activity No.	Activity Name	Duration (weeks)	Immediate Predecessor
1.	Obtain requirements	4	-
2.	Analyse operations	4	-
3.	Define subsystems	2	1
4.	Develop database	4	1
5.	Make decision analysis	3	2
6.	Identify constraints	2	5
7.	Build module 1	8	3,4,6
8.	Build module 2	12	3,4,6
9.	Build module 3	18	3,4,6
10.	Write report	10	6
11.	Integration and test	8	7,8,9
12.	Implementation	2	10,11

a) Draw the Activity Network (using activity on edge) representation of the project.
b) Determine the critical path of the project.
c) Determine the ES(Early Start,EF and LS, LF for every task.

Q2. Consider the following C function named bin-search: **(5mks)**

```
int bin_search(int num){
int min, max;
min=0;
max=100;
while(min!=max){
 if(arr[(min+max)/2]>num)
    max=(min+max)/2;
 else if(arr[(min+max)/2]<num
 min=(min+max)/2;
 else return((min+max)/2);
}
```

```
return(-1);

}
```

Design a test suite for the function bin-search that satisfies the following white box testing strategies. Show the steps how the test suite satisfies the given test strategy.

a) Statement coverage
b) Branch coverage
c) Condition coverage

Q3. Draw the control flow graph for the following function named find-maximum. From the control flow graph, determine its cyclomatic complexity. **(6mks)**

```
int find-maximum(int i, int j, int k) {
int max;
if(i>j) then
  if(i>k) then max=i;
                else max=k;
  else if(j>k) max=j;
        else max=k;
return(max);
}
```

Q4. Consider the following Newspaper Shop Automation (NSA) Software required by a small newspaper delivery shop to automate various book-keeping activities associated with its business. **(6mks)**

- This software is to be used by the manager of the news agency and his delivery persons.
- For each delivery person, the system must each day print the list of publications to be delivered to each address.
- At the beginning of every month bills are printed by the system to be delivered to the customers. These bills should be computed by the system automatically. The system should also print a summary information for the customer for the current month showing which publications were delivered for which dates.
- The customers may ask for stopping the deliveries to them for certain periods when they go out of station. Customers may request to subscribe new newspapers/magazines, modify their subscription list, or stop their subscription altogether.
- Customers usually pay their monthly dues either by cheques or cash. Once the cheque number or cash received is entered in the system, receipt for the customer should be printed.

Draw the context diagram (level 0 DFD) and level 1 DFD for the NSA software.

Q5. If some software organization A is working at level 5 of CMM whereas organization B is working at level 4 of CMM, then what is the difference in the working of the two organizations. **(5mks)**

Q6. Design the equivalence class test cases for a program that reads two integer pairs (m_1, c_1) and (m_2. c_2) defining two straight lines of the form y=mx+c. The program computes the intersection point of the two straight lines and displays the point of intersection. **(5 mks)**

Q7. How does the degree of independence between two modules does is measured. Explain in detail. **(5mks)**

राष्ट्रीय प्रौद्योगिकी संस्थान, उत्तराखण्ड

National Institute of Technology Uttarakhand

Mid Term Examination – I

Even Semester-2021

Theory of Computations (CSL 259)

Total Marks: 20 **Max. Time: 1 hour**

1.Choose the most suitable option for the questions I to III **[3]**

I. The deterministic finite automata accepting the language L= $\{0^m 1^n \mid m \geq 2,\ n \geq 0\}$ over $\Sigma = \{0, 1\}$ must have at least:

(A) 5 states (B) 4 states (C) $m+n$ states (D) m states

II. How many 3 state DFA can be constructed with designated initial state over the alphabet $\Sigma = \{a, b\}$:

(A) 512 (B) 5832 (C) 1024 (D) None of these.

III. The range of the transition function of an NFA (Q, Σ , δ, q_0, F) is described as

(A) $Q \times \Sigma$ (B) Q (C) $Q \times \Sigma \cup \{\epsilon\}$ (D) 2^Q

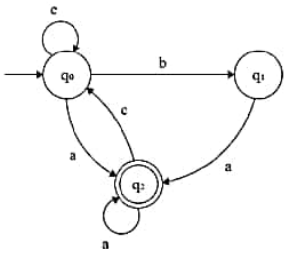
2. Design a DFA which accept set of all strings over $\Sigma = \{0, 1\}$ where the third symbol from the right end is same as the first symbol from the begning **[5].**

3. Justify wether the following language is regular or not **[3+4=7]**.

$$L_1 = \{a^p \mid p \text{ is a prime}\}$$

$$L_2 = \{ w \in \{0,1\}^* \ s.t.\ w \text{ has } (\text{even no of } 0s \text{ and odd no of } 1s) \ OR (\text{ even no. of } 1s \text{ and odd no. of } 0s) \}$$

3. Write the language accepted by the following finite automaton **[2]**



4.Convert the NFA given in Question **3** into equivalent DFA **[3]**

– × –

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National Institute of Technology Uttarakhand

Mid Term Examination – II

Even Semester-2021

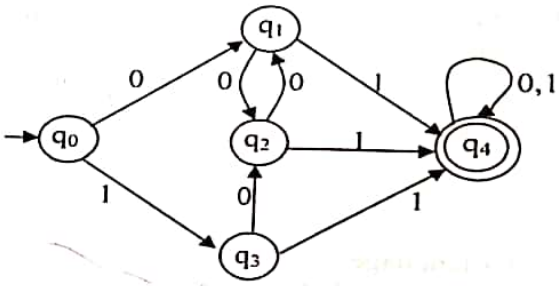
Theory of Computations (CSL 259)

Total Marks: 20 **Max. Time: 1 hour**

1.Choose the most suitable option for the questions I to IV **[4]**

I. How many states are there in the minimized DFA of the following DFA?

(A) 2 (B) 4 (C) 3 (D) 5



II. The language represented by the regular expression [00+11+(01+10)(00+11)* (01+10)] is:

(A) All strings in which there is always a double zero or double 1 in between two strings from (01+10)*

(B) All binary strings divisible by 3.

(C) All binary srings having even no. of 0s and even no. of 1s

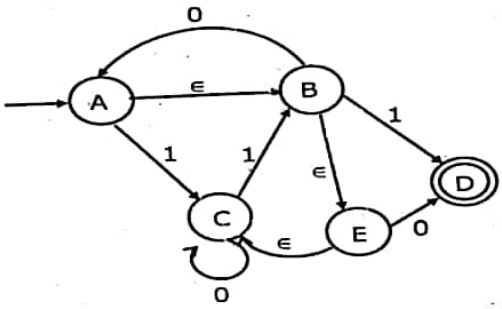
(D) All binary strings where 0s and 1s can only alternate each other for a number of times that is not more than the number of double 0s or double 1s

III. Pick the odd one out :

(A) (011((11)* + (01)*)*)*011 (B) 011(((1+0)1)*011)*

(C) 011(((11)*(01)*)*011)* (D) 011(((1+0)*1*)*011)*

IV. What will be the value of $\hat{\delta}$ (A, 01) for the following automata?



(A) {D} (B) {B, D} (C) {B, C, D} (D) {B, C, D, E}

2. Justify wether the following language is regular or not: **[3]**

$$L_2 = \{ w \in \{0,1\}^* \ s.t. \ the \ no. of \ 0s \ in \ w \ is \ different \ from \ the \ no. of \ 1s \ in \ w \}$$

3. Write the regular expression for the following languages: **[3]**

$$L_5 = \{ w \in \{a,b,c\}^* \ s.t. \ w \ contains \ not \ more \ than \ 3 \ as \}$$

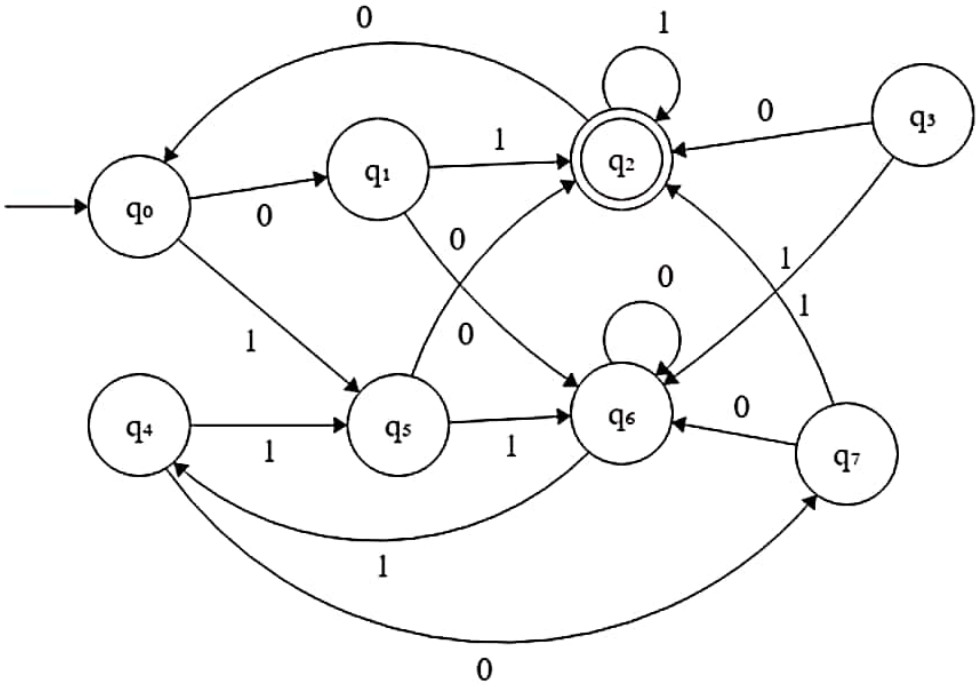
$$L_6 = \{ w \in \{a,b,c\}^* \ s.t. \ w \ contains \ exactly \ one \ a \}$$

$$L_7 = \{ w \in \{a,b,c\}^* \ s.t. \ w \ contains \ at \ least \ one \ occurance \ of \ each \ symbol \}$$

4. Identify the language represented by the following regular expressions: **[4]**

a) (1111+10+0)* (over $\Sigma = \{0,1\}$) **b)** $c^*(a + bc^*)^*$ (over $\Sigma = \{a,b,c\}$)

5. Minimize the following DFA **[6]**



राष्ट्रीय प्रौद्योगिकी संस्थान, उत्तराखण्ड

National Institute of Technology Uttarakhand

End Semester Examination, Even Semester-2021

Theory of Computations (CSL 259)

Total Marks: 50 **Max. Time: 2 hours**

1. Choose the **most suitable** option for the questions I to X. **[10]**

I. The set of all strings over {0,1} where the 10^{th} symbol from the write end is a 1 and 10^{th} symbol from the left end is a 0 and the 20^{th} symbol from the right end is a1 is best described as:

(A) Regular set (B) CFL (C) CSL (D) RE set

II. Pick the odd one out

(A) (0*+1*0*)* (B) (0*1*+1*0*)*(0*1*)* (C) ((01)*+0*)* (D) (0+1)*0*1*0*1*

III. The following CFG generates

$A \rightarrow aAb|ab$
$B \rightarrow b|bB$
$C \rightarrow a|aC$
$S \rightarrow B|C|AB|CA$

(A) Set of all strings with an unequal number of a's and b's
(B) Set of all strings with equal number of a's and b's
(C) Set of all strings with more number of a's than b's
(D) Set of all strings with more number of b's than a's

IV. If, G={{S},{a, b},{ S → b|Sa|aS |SS, S} } , which of the following is / are true?

i. $aabbaa \in G$ ii. G is ambiguous iii. G is equivalent to the R.E. $a^*b^*a^*$

(A) (i) and (ii) only (B) (ii) and (iii) only (C) (i) and (iii) only (D) All three

V. Which of the following language are context free?

$L_1 = \{ a^m b^n c^p d^q \mid m+p = n+q, where\ m,n,p.q \geq 0\}$ $L_2 = \{ a^m b^n c^p d^q \mid m = n\ and\ p = q, where\ m,n,p,q \geq 0\}$

$L_3 = \{ a^m b^n c^p d^q \mid m = n = p\ and\ p \neq q, where\ m,n,p.q \geq 0\}$ $L_4 = \{ a^m b^n c^p d^q \mid mn = p+q, where\ m,n,p.q \geq 0\}$

(A) L_1 and L_4 only (B) L_1 and L_2 only (C) L_2 and L_3 (D) L_2 and L_4

VI. Let N be an NFA with n states. Let k be the number of states of a minimal DFA, which is equivalent to N. Which one of the following is necessarily true?

(A) $k \geq 2^n$ (B) $k \geq n$ (C) $k \leq n^2$ (D) $k \leq 2^n$

VII. The smallest finite automaton, which accepts the language L= {x | |x| is divisible by k where k is a positive integer constant} has (assume the empty string is divisible by k)

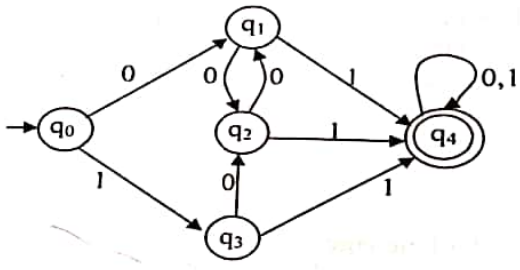
(A) $k+1$ states (B) k states (C) 2^{k+1} states (D) 2^k states

VIII. The language L= { 0^n1^n | 1 ≤ n ≤ k, where k is a positive integer constant} is:

(A) Regular (B) Context free (C) Neither regular nor context free (D) both (A) and (B)

IX. How many states are there in the minimized DFA of the following DFA

(A) 2 (B) 4 (C) 3 (D) 5



X. The deterministic finite automata accepting the language L= $\{0^m1^n \mid m \geq 2,\ n \geq 0\}$ over $\Sigma = \{0,1\}$ must have at least:

(A) 5 states (B) 4 states (C) $m+n$ states (D) m states

2. Design a minimal deterministic finite automaton over $\sum = \{a,b\}$ that accept all the string w start with aba and $|w| \not\equiv 3(mod\ 5)$. **[5]**

3. Justify whether the following language is regular or not **[4+3+3+4=14].**

$$L_1 = \{ w \in \{0,1\}^* \ s.t. w = 0^n 1^n ; n \geq 0 \}$$

$$L_2 = \{ w \in \{0,1\}^* \ s.t. \ the \ no. of \ 0s \ in \ w \ is \ different \ from \ the \ no. of \ 1s \ in \ w \}$$

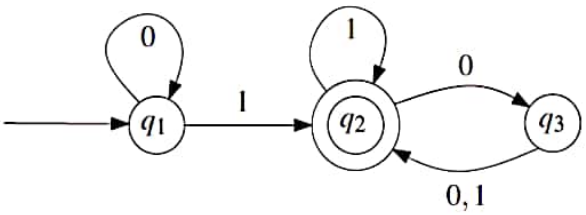
$$L_3 = \{ a^{i^2} \ s.t. \ i \geq 1 \}$$

$$L_4 = \left\{ \begin{matrix} w \in \{0,1\}^* \ s.t. \ w \ has \ (even \ no \ of \ 0s \ and \ no \ of \ 1s \ is \ not \ divisible \ by \ 3) \ OR \\ (even \ no. of \ 1s \ and \ no \ of \ 0s \ is \ not \ divisible \ by \ 3 \end{matrix} \right\}$$

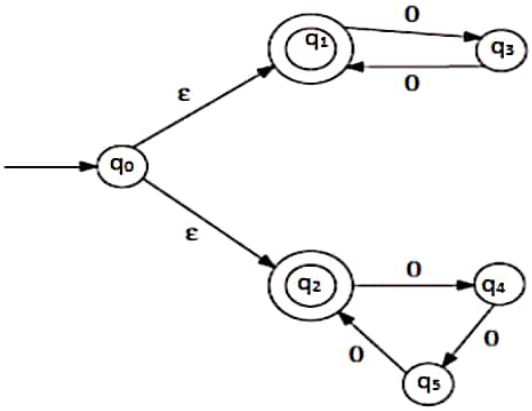
4. State and prove pumping lemma for regular language **[3]**

5. Design a finite automaton that accepts decimal numbers consisting of: an optional + or – sign, a string of digits (0, 1, ..., 9), a decimal point (.), and another string of digits. Either this string of digits or the previous one can be empty, but at least one of two strings of digits must be nonempty.**[8]**

6. Find the simplified regular expression corresponding to the following finite automata **[5]**



7. Convert the following ∈-NFA to its equivalent DFA and identify the language accepted by it: **[4+1=5]**



(***All the best***)

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