RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-22)

Computer Science and Engineering

B181500

Subject Name: Analog Electronic Circuits
Date: 30-04-2022
Exam: E2-S1-EST-Regular

Subject Code: EC2105
Max Marks: 60
Time: 120Min

SECTION –A (30M)
Objective Part

Note:

i) **This section consists of 30 bits, these could be multiple choice, fill in the blanks, or a combination of both, and each carries one mark.**

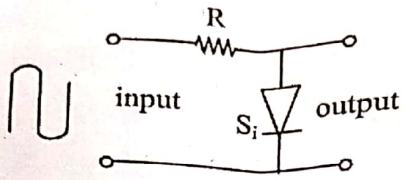
ii) **All 30 bits are compulsory, there is NO Choice in Section-A.**

1. Which of the following elements acts as donor impurities ( )

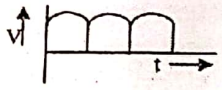
1. Gold 2.Phosphorous 3.Boron 4.Antimony 5.Arsenic 6.Indium

(A).1,2&3 (B).1,2,4&6 (C).3,4,5&6 (D).2,4&5

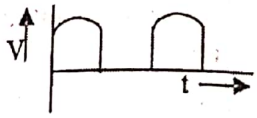
2. For the given input,the output waveform across the diode shown in the figure will be ( )



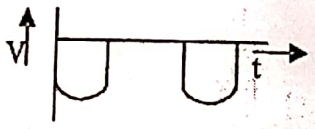
(A).



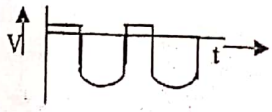
(B).



(C).



(D).

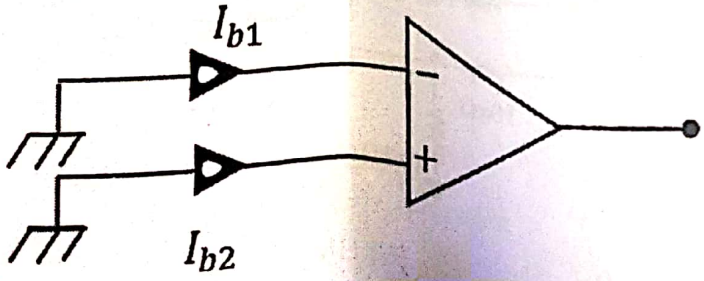


3. In a PN junction when the applied voltage overcomes the..... Potential, the diode current is large, which is known as.....

(A).Depletion, negative bias (B).Reverse, reverse bias

(C).Resistance, reverse bias (D).Barrier, forward bias

4. For the OP-amp Shown in figure, the bias currents are I_{b1}=450 nA, I_{b2}=350 nA.the values of input bias current (I_B) and the input off set currents (I_f) are ( )



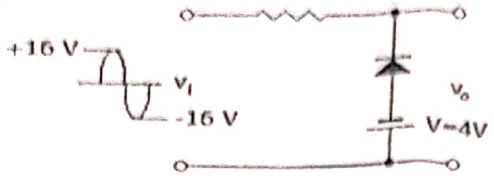
(A). I_B =400nA, I_f =50 nA

(B). I_B =400nA, I_f =100nA

(C). I_B =800nA, I_f =50 nA

(D). I_B =800nA, I_f =100nA

5. Determine the peak for both half cycles of the output waveform ( )

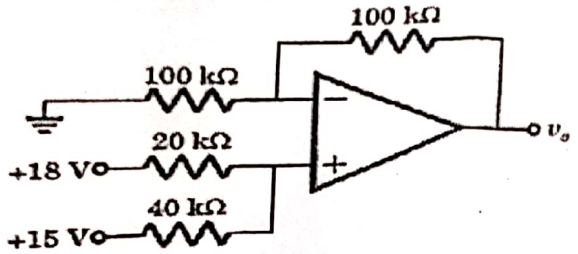


(A).16V,-4V (B).16V,4V (C).-16V,4V (D).-16V,-4V

6. The maximum efficiency of a half-wave rectifier ( )
(A).33.3% (B).40.6% (C).66.6% (D).72.9%

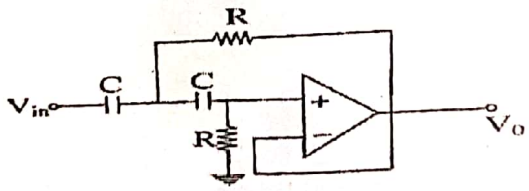
7.The order of doping concentration of the following regions of a BJT are related by ( )
P.Base Q.Collector R.Emitter
(A).P=Q=R (B).P>Q>R (C).P<Q=R (D).P<Q<R

8 .Determine output voltage V_o?( )



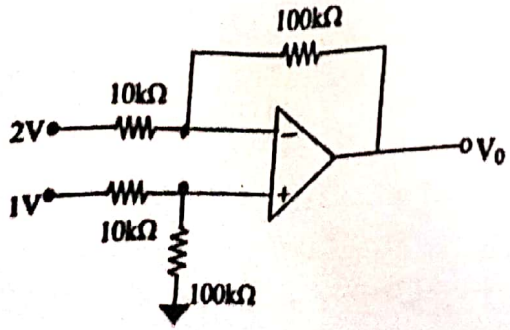
(A).-17V (B).34V (C).32 V (D).-32 V

9 . Recognize the type of filter ( )



(A).Band stop filter (B).Band pass filter (C).High pass filter (D).Low pass filter

10. Consider the following Op-Amp circuit, What is the output voltage Vo in the below Op-Amp circuit?( )



(A).10V (B).-10V (C).11V (D).-11V

11. The value of input impedance of common collector configuration of BJT is ( )

(A).High (B).Low (C).Medium (D).Zero

12.A transistor has a current gain of 0.99 in CB mode.its current gain in CC mode is ( )

(A).99 (B).100 (C).1.01 (D).0.99

13. The phase difference between the input and output ac voltage signals of a common-emitter amplifier is.....

(A).0^0 (B).90^0 (C).180^0 (D).360^0

14. V_{CE} approximately equals .....when a transistor switch is cut off.

(A).V_B (B).V_{cc} (C).0.2 V (D).0.7V

15. When drain voltage equals the pinch-off-voltage, then drain current ..... with the increase in drain voltage

(A).Decrease (B).Increases (C).Remains Constant (D). None of the above

16. A FET is .....

(A).Very high input resistance
(B).Very low input resistance
(C).High connection Emitter junction
(D).Toward biased P-N junction

17. N-channel FETs are superior to P-channel FETs, because ( )

(A).They have a higher input impedance (B).They have high switching time
(C).They consume less power (D).Mobility of electrons is greater than that of holes

18. A common source (CS) amplifier has a voltage gain of ( )

(A).$g_m r_d$ (B). $g_m r_s$ (C). $g_m r_s / (1+g_{m\,rs})$ (D). $g_m r_d / (1+g_m r_d)$

19. Negative feedback ....

(A).Increases the input and output impedances
(B).Increases the input impedance and bandwidth
(C).Decreases the output impedance and bandwidth
(D).Does not affects impedance or bandwidth

20. The Ideal Op-Amp has the following characteristics ( )

(A).$R_i=\infty$, $A=\infty$, $R_o=0$ (B).$R_i=0$, $A=\infty$, $R_o=0$
(C).$R_i=\infty$, $A=\infty$, $R_o=\infty$ (D).$R_i=0$, $A=\infty$, $R_o=\infty$

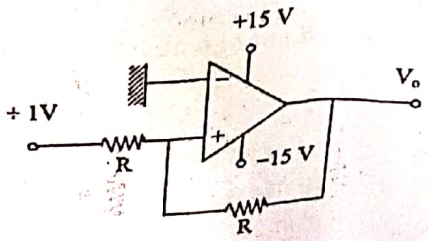
21. A forward biased pn junction diode has a resistance of the order of ( )

(A).0Ω (B).KΩ (C).MΩ (D).None of the above

22. A zener diode when biased correctly ( )

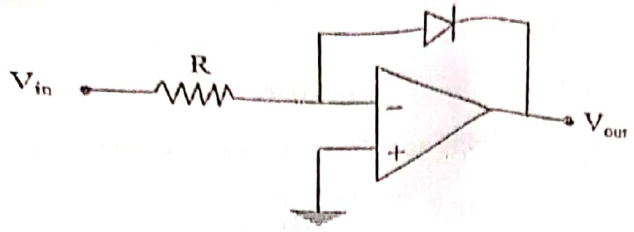
(A).Acts as a fixed resistance (B). Never overheats
(C). Has a constant voltage across it (D). Has a constant current passing through it

23. In the circuit of the figure V_o is( )



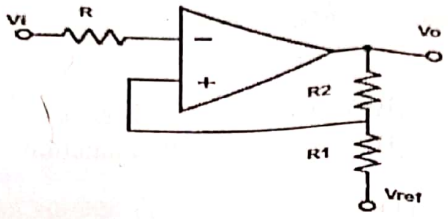
(A).-1V (B).2V (C).+1V (D).15V

24. The circuit of fig.uses an ideal OP-AMP small positive values of Vin,the circuit works as( )



(A).A half wave rectifier (B).A differentiator
(C).A logarithmic amplifier (D).A.expontial amp[lifier

25. Calculate the hysteresis voltage for the Schmitt trigger from the given specification: R_2 =56kΩ , R_1 = 100Ω ,V_{ref} = 0v & V_{sat} = ±14v.( )



(A).0mV (B).25mV (C).50mV (D).-25mV

26. The transconductance curve of a JFET is a graph of ..... vs .....
(A).I_S versus V_{DS} (B).I_C versus V_{CE} (C). I_D versus V_{GS} (D).$I_D \times R_{DS}$

27 .One input terminal of high gain comparator circuit is connected to ground and a sinusoidal voltage is applied to the other input.the out put of the comparator will be ( )
(A) .A sinusoid (B).A full rectified sinusoid
(C).A half rectified sinusoid (D).A square wave

28. CMRR for an OP-AMP should be ( )
(A).As small as possible (B).As large as possible (C).Close to zero (D).Close to unity

29. To use FET as a voltage controlled resistor, in which region it should operate?( )
(A). Ohmic region (B).Cut off (C). Saturation (D).Cut off and Saturation

30. Slew Rate is defind as the.....
(A).Maximum rate of change of output voltage with time
(B).Minimum rate of change of output voltage with time
(C).Moderate rate of change of output voltage with time
(D).None of the above

SECTION –B (30M)
Descriptive Part:

Note:
- i) **This section carries 30 Marks.**
- ii) **Three Questions need to be answered out of 6 questions asked, Each Question carries 10 Marks.**

Question No 1 (10 Marks)

(A). Draw the circuit diagram for a half wave rectifier and derive the expression for (i)The DC output current (ii).R.M.S value of output current.**[6 Marks]**

(B). Draw the basic circuit diagram of Negative clamper circuit and explain its operation. **[4 Marks]**

Question No 2 (10 Marks)

(A). What is a bipolar junction transistor? Explain the operation of NPN transistor. **[5 Marks]**

(B). Draw the h-parameters equivalent circuit for a common emitter amplifier and derive the Expression for A_i ,R_i, A_v **[5 Marks]**

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES,
BASAR
AY 2020-2021
COMPUTER SCIENCE AND ENGINEERING

Subject Name: AEC **Subject Code: EC2105**
Date: 05-10-2021
Exam: E2_S1_MT **Max. Marks: 20**

Objective Part

Note:

This section consists of 10 bits multiple choice **10X2=20**
All 10 bits are compulsory,there is NO Choice

1) An N-type semiconductor is negatively charged
a) Positively charged b) negatively charged c) electrically neutral d) none of the above

2) With forward bias to an P-N junction the width of depletion layer
a) decreases b) increases c) remains the same d) none of the above

Reverse → Increase
For → Decrease

3) The most widely used rectifier is
a) HWR b) BFWR c) center tap -FWR d) none of the above

FD
FAP
RLC.

4) A transistor has _____
a) one P-N junction b) two P-N junction c) three P-N junction d) four P-N junction

5) In an n-p-n transistor _____ are minority carriers
a) free electrons b) holes c) donor ions d) acceptor ions

npn - m - holes
pnp - m - electrons

6) In a transistor Ic = 100 m A and Ie = 100.5 m A the value of beta is _____
a) 100 b) 50 c) about one d) 200

$\beta = \frac{I_C}{I_B}$ $I_B = I_E - I_C$
$= 100.5 - 100$
$= 0.5$

7) The collector-base junction in a transistor has_____
a) forward bias at all times b) reverse bias at all times c) low resistance d) none

8) In the common mode ___
a) both i/p grounded b) o/p connected together c) identical signal on both i/p d) the o/p signal are in phase

9) If ADM =3500 and ACM = 0.35 the CMRR is _____ $\frac{A_{dm}}{A_{cm}} = \frac{3500}{0.35}$ 10
a) 1225 b) 10,000 c) 80dB d) both a and c

10) The common mode gain is _____
a) Very high b) very low c) always unity d) unpredictable

8/10

THE END

B181500

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2020-2021)
BRANCH: CSE

Subject Name: Analog Electronic circuits **Subject Code: EC2105**
Exam: MT 1 PAPER **Date: 24/02/2022**
Max Marks: 30 **Time: 60 minutes**

SECTION-A

NOTE: Answer any ALL questions and each question carries two marks 2X10=20marks

1. the correct way to operate a transistor is with the ..... diode FB and ..... diode RB
   a.emitter,collector
   b.collector, emitter
   c.collector, base
   d.base, emitter
2. as compared to a CB amplifier, the CE amplifier has
   a. high current amplification
   b. low current amplification
   c. high input resistance
   d. low input resistance
3. in center tapped FWR 100v is the peak voltage between center tap and one end of the secondary. The maximum voltage across reverse biased diode is
   a. 200 V
   b.141.4 V
   c.100 V
   d.86 V
4. for a P-N junction, the junction current will be zero when
   a. the two junctions are short circuited
   b. either minority carrier or majority carriers disappear
   c. the number of minority carriers crossing the junction equals the number of majority carriers
   d. holes and electrons get neutralized by equal numbers
5. which transistor configuration has the highest input impedance
   a.CC
   b.CB
   c.CE
   d.all the above
6. for a transistor to have larger beta it must have an alpha
   a. close to zero
   b.close to 0.5
   c.close to unity
   d.nearly infinite
7. higher value of ripple factor indicates
   a. poor rectification
   b. ideal rectification
   c. r.m.s value equal to peak value
   d.none of the above
8. what are the charge carriers in N type semiconductor
   a. holes
   b. electrons
   c. both a and b
   d. none of the above
9. The disadvantage of HWR is
   a.dc saturation of transformer secondary winding
   b.low transformer utilization
   factor
   c.excess ripple
   d.all the above
10. Which of the following is not a semiconductor
    a.lead telluride
    b.selenium
    c.silicon carbide
    d.tungsten carbide

SECTION-B

NOTE: Answer any TWO questions and each question carries five marks

1. Explain the construction of PN diode & its characterstics [5M]
2. Derive the parameters of HYBRID model of BJT [5M]
3. Explain about N-channel FET construction [5M]
4. Draw and explain about CMC [5M]

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2021-22)

Computer Science and Engineering

B18500

Subject Name: **Analog Electronic Circuits** Subject Code: **EC2105**

Date: 13/ 04 /2022 Max Marks: 30

Exam: **E2_S1_MT2** Time: 60 Min

Note:

SECTION –A (20M) Objective Part

i) **This section consists of 20 bits, these could be multiple choice, fill in the blanks, or a combination of both, and each carries one mark.**

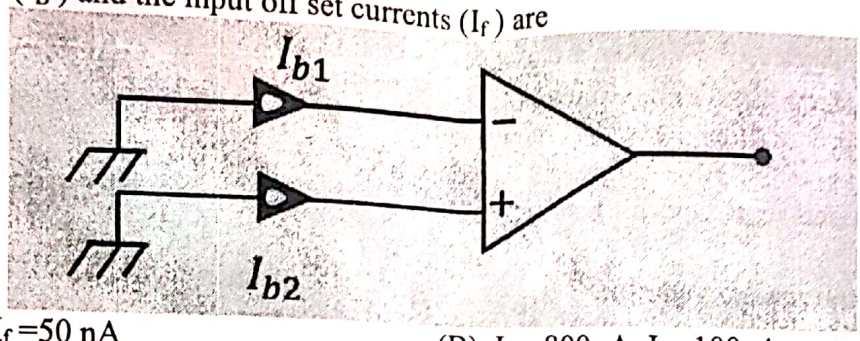
ii) **All 20 bits are compulsory, there is NO Choice in Section-A.**

1. The OP-amp can amplify …

(A).A.C signals only (B).D.C signals only

(C).Both A.C. and D.C. signals (D).Neither D.C. nor A.C. signals

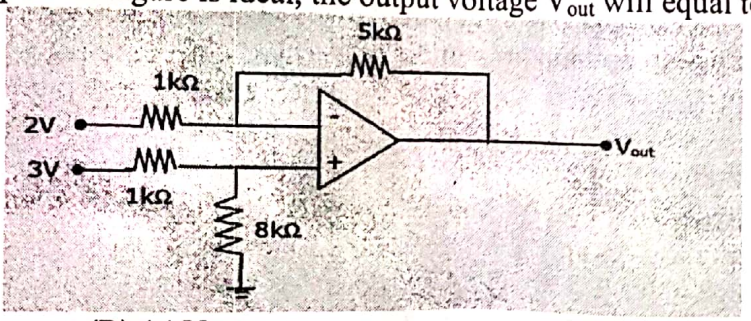
2. For the OP-amp Shown in figure, the bias currents are I_{b1}=450 nA, I_{b2}=350 nA.the values of input bias current (I_B) and the input off set currents (I_f) are



(A). I_B =800nA, I_f =50 nA (B). I_B =800nA, I_f =100nA

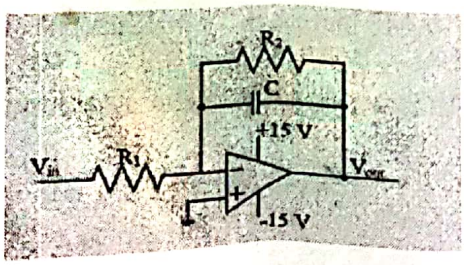
(C). I_B =400nA, I_f =50 nA (D). I_B =400nA, I_f =100nA

3. If the Op-Amp in the figure is ideal, the output voltage V_{out} will equal to



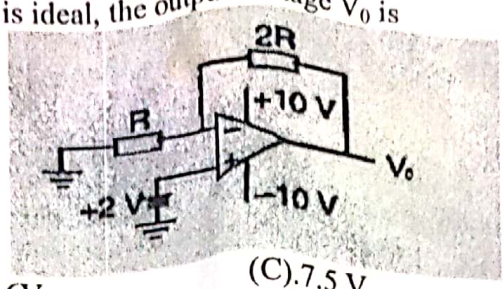
(A).17V (B).14 V (C).9V (D).6V

4. The circuit shown below is an example of a



(A).Low pass filter (B).High pass filter (C).Band pass filter (D).Band stop filter

5. Given that the op-amp is ideal, the output voltage V_0 is



(A). 4V (B).6V (C).7.5 V (D).12.12 V

6. The input stage of an OP-amp is usually a ….
(A).CE amplifier (B).Class B push-pull amplifier
(C).Differential amplifier (D).Swamped amplifier

7. Negative feedback ….
(A).Increases the input and output impedances
(B).Increases the input impedance and bandwidth
(C).Decreases the output impedance and bandwidth
(D).Does not affects impedance or bandwidth

8. OP-AMP is a
(A). Voltage controlled voltage source (C). Current controlled voltage source
(B). Voltage controlled current source (D). Current controlled current source.

9. Virtual ground of an op-amp means
(A).Terminal is grounded directly
(B).The terminal is not physically grounded but terminal voltage is zero due to the other terminal is connected to the ground due to op-amp properties.
(C).Both A and B
(D).None of the above

10. CMRR of practical OP-amp is
(A).75dB (B).80 dB (C).85 dB (D).90dB

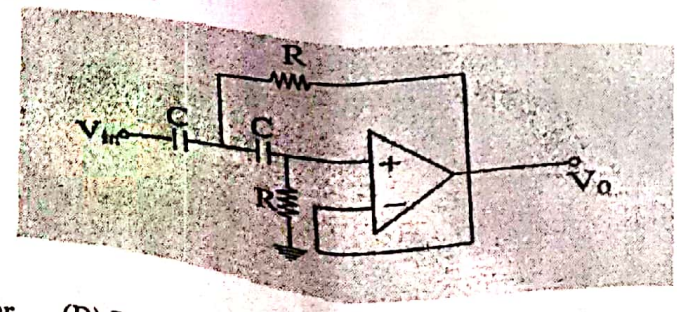
11. Output impedance of an ideal op-amp is
(A).Infinite (B).Very high (C).Low (D).Very Low

12. Calculate the cut-off frequency of a first-order Low pass filter for R1=2.5 KΩ and C1=0.05μF ( )
(A).1.273 KHz (B).12.73KHz (C).127.3 KHz (D).127.3 Hz

13. The output of a particular OP-AMP increases 8V in 12μs.The slew rate is
(A).90V/μs (B).0.67V/μs (C).1.5V/μs (D).None of the above

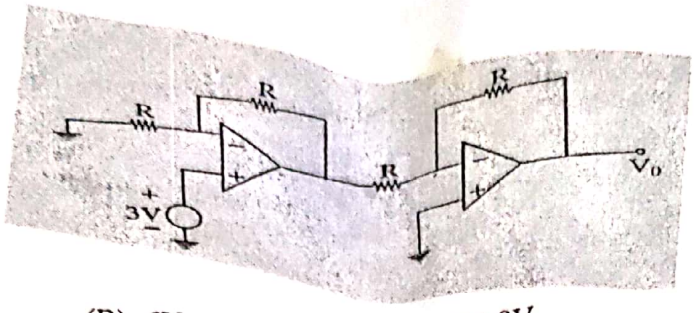
14. For Adder-subtractor, which theorem is applicable to determine the expression for output voltage?
(A).Thevenin's (B). Norton's (C). Superposition (D) .Miller

15. Recognize the type of filter



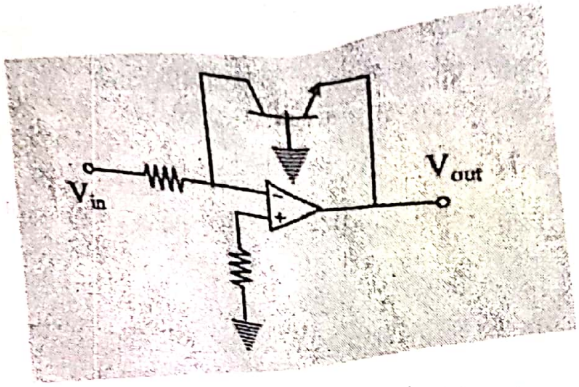
(A).Band stop filter (B).Band pass filter (C).High pass filter (D).Low pass filter

16. Find out output voltage V_o



(A) .6V (B).-6V (C).8V (D).-8V

17. The Op-Amp circuit shown in the given figure can be used for

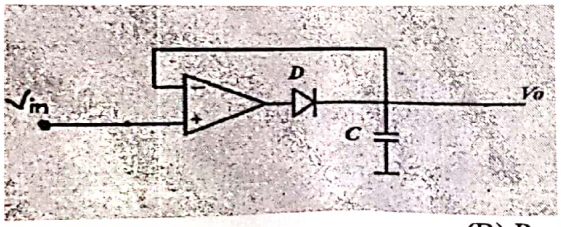


(A).Addition (B).Subtraction (C).Both A and B (D).Multiplication

18. If A_D= 3500 and A_C= 0.35, the CMRR is ....

(A).1225 (B).10,000 (C).80 dB (D).10,000 & 80 dB

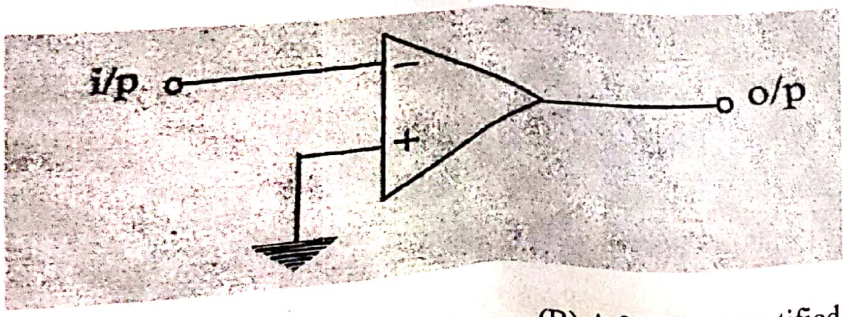
19. The circuit shown in the given figure can be used as



(A). Rectifier (B).Positive Peak Detector

(C).Negative Peak Detector (D).Logarithmic Amplifier

20. If the input to the circuit of figure is a sine wave the output will be ?



(A). A half wave rectified sine wave (B).A full wave rectified sine wave

(C) .A triangular wave (D). A square wave

SECTION –B (10M) Descriptive Part:

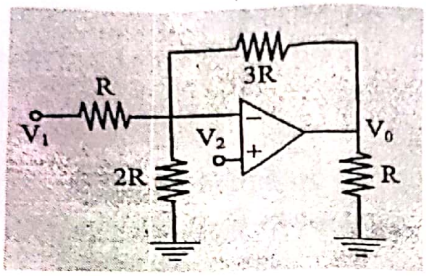
Note:

i) **This section carries 10 Marks.**

ii) **Two Questions need to be answered out of 4 questions asked, Each Question carries 5 Marks.**

1.(A).Explain the basic internal block diagram of a typical operational amplifier **[3 Marks]**

(B).Assuming that the op-amp in the circuit shown is ideal, determine output Voltage (V_o) if V_1=3V and V_2=5V **[2 Marks]**



2.(A).Define and explain the significance of following terms: (i).Slew rate (ii).Thermal Drift (iii).PSRR **[3 Marks]**

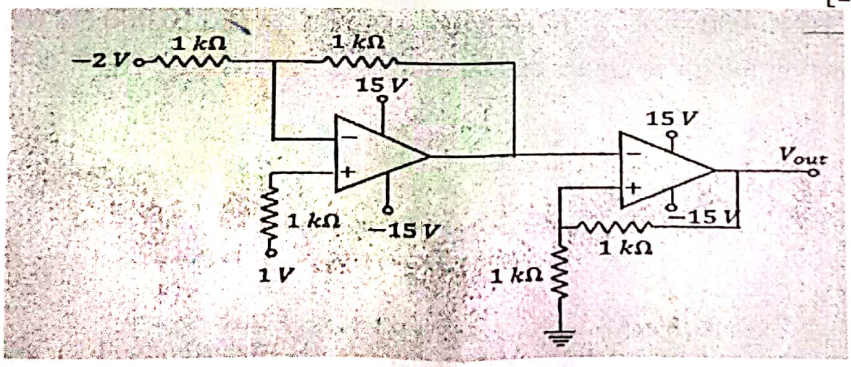
(B). The input signal to an op-amp is 0.03 sin ($1.5x10^5$ t).What can be the maximum gain of an op-amp with the slew rate of 0.4V/μs? **[2 Marks]**

3.(A).Draw the circuit diagram of Non-inverting High pass filter and its frequency response. Derive the expression for gain. **[3 Marks]**

(B).Derive the closed loop gain of the ideal inverting amplifier. **[2 Marks]**

4. (A).Explain the operation of Inverting Schmitt trigger circuit with input and output waveforms. **[3.5 Marks]**

(B).In the circuit shown below the op-amp are ideal, then determine the output voltage(V_{out}). **[1.5 Mark]**



----------THE END ----------

Question No 3 (10 Marks)

(A). With neat sketches explain the construction, principle of operation,and characteristics of an n-channel enhancement MOSFET.**[6 Marks]**

(B). With the help of a neat circuit diagram describe the working of a Current Mirror Circuit. **[4 Marks]**

Question No 4(10 Marks)

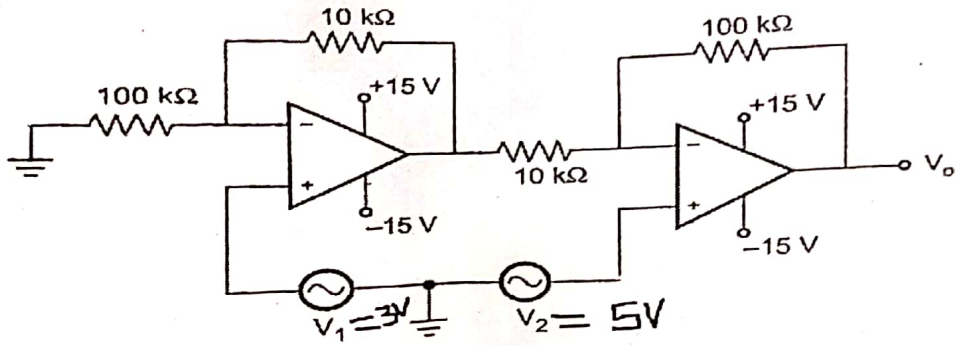
(A). Define and explain the significance of following terms: **[6 Marks]**
(i).Input off set voltage (ii).Input off set current (iii). Thermal Drift

(B). An inverting amplifier using the 741C must have a flat response up to 40KHz.The gain of the amplifier is 10 and slew rate is 0.5V/μs.What maximum peak-to- peak input signal can be applied without distorting the output? **[4 Marks]**

Question No 5(10 Marks)

(A). Draw the multiplier block diagram and derive its output voltage in detail .**[5 Marks]**

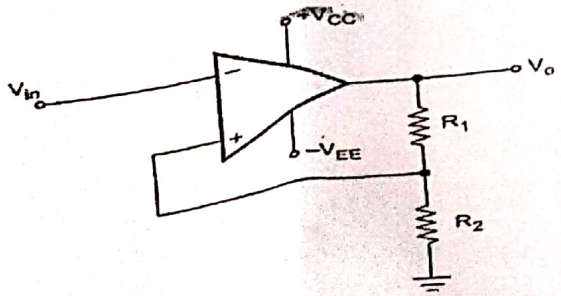
(B). In the circuit shown below the op-amps are ideal, then determine the output voltage (V_o). **[5 Marks]**



Question No 6 (10 Marks)

(A). What is Comparator? With the help of a neat circuit diagram and waveforms, explain the working of Inverting Comparator? **[6 Marks]**

(B). For the circuit shown in the figure.Calculate the values of R1 and R2 if saturation voltages are +12 V and -12V.Assume hysteresis width=6V **[4 Marks]**



THE END

7

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2020-2021)

Computer Science and Engineering

Subject Name: Data Structures
Date: 11/10/2021

Subject Code: CS2101
Time: 2hrs
Max Marks: 60

SECTION –A (30 M)

Answer any **THREE** questions.

1. Write an algorithm to implement stack and queue(insertion, deletion, find).(10 M)
2. Write algorithm to insert at the end ,count of the total nodes in linked list(10 M)
3. 7,8,4,3,5,6,9,10,14,2 using the elements construct max heap. (10 M)
4. Write an algorithm to implement merge sort(10 M)
5. Write an algorithm to implement deletion operation in BST(Binary search tree)(10 M)
6. Write an algorithm to implement DFS and BFS.(10 M)

SECTION –B (30 M)

Answer all the questions.

1. Array is data structure of type
   a. Linear
   b. Non linear
   c. Both a and b
   d. None of the above
2. Every item is attached to its previous and next item in----- DS
   a. Linear
   b. Non linear
   c. Both a and b
   d. None of the above
3. Linked list is ------ DS
   a. Linear
   b. Non linear
   c. Both a and b
   d. None of the above
4. How much memory is required to store array than linked list
   a. More
   b. Less
   c. Equal
   d. None of the above
5. Searching is difficult in ….
   a. Array
   b. Linked list
   c. Both a and b
   d. None
6. A tree such that each node has exactly two child nodes or no nodes is called as….tree
   a. Binary
   b. Binary search tree
   c. Full binary tree
   d. Strict binary tree
7. In-order visiting order
   a. Root ,left ,right
   b. Left ,right ,root
   c. Left ,root,right
   d. Right ,root, left
8. To represent a hierarchical relation between elements , which data structure is useful
   a. Array
   b. Structure
   c. Tree
   d. Queue
9. Linked list doesn't allow
   a. Random access
   b. Insertion at middle
   c. Deletion in middle
   d. Above all

10. Array passed as an argument to a function is interpreted as
    a. Address of an the array
    b. Value of the first element of the array
    c. Address of the first element of the array
    d. Number of elements of the array

11. In the ----- traversal we process all of the descendant vertexes before we process adjacent ones
    a. Depth first
    b. Widths first
    c. Pre order
    d. Post order

12. In ---- search start at the beginning of the list and heck every element in the list
    a. Linear search
    b. Binary search
    c. Hash search
    d. Binary Tree search

13. State true or false
    i. Binary search is used fro searching in a sorted array
    ii. The time complexity of binary search is O(logn)
        a. True, False
        b. True , True
        c. False, True
        d. False, False

14. Which of the following is not a internal sort
    a. Insertion sort
    b. Bubble sort
    c. Merge sort
    d. Heap sort

15. In a circular queue the value of r will be
    a. r=r+1
    b. r=(r+1)%[QUEUE_SIZE-1]
    c. r=(r+1)%[QUEUE_SIZE]
    d. r=(r-1)%[QUEUE_SIZE]

16. ------ is not the operation that can be performed in queue
    a. Insertion
    b. Deletion
    c. Retrieval
    d. Traversal

17. Which are the applications of stack
    a. Function calls
    b. Paranthesis evaluation
    c. Evaluation of arithmetic expressions
    d. All the above

18. Which of the following data structure are indexed structure
    a. Array
    b. Linked list
    c. Queue
    d. Stack

19. A data structure where elements can be added or removed at both ends not in midlle
    a. Linked list
    b. Stack
    c. Tree
    d. Double ended queue

20. Arrays are best data structures
    a. For the relatively permanent collections of data
    b. For the size of the structure and the data in the structure are constantly changing
    c. For both of above situations
    d. None of the above

21. Which of the following statement is false
    a. Arrays are dense list and static data structures
    b. Data elements in linked list need not be stored in adjacent space in memory
    c. Pointers store the next data element of a list
    d. Linked list are collection of the nodes that contain information part and next pointer

22. The disadvantage of using circular linked list is
    a. It is possible to get into infinite loop
    b. Last node points to the first node
    c. Time consuming
    d. Requires more memory space

23. Time complexity of finding an element in binary search tree
    a. O(log n)
    b. O(nlogn)
    c. O(n)
    d. O(n2)

24. Time complexity of quick sort
    a. O(log n)
    b. O(nlogn)
    c. O(n)
    d. O(n2)

25. Which sorting is slowest sort
    a. Bubble sort
    b. Merge sort
    c. Quick sort
    d. Heap sort

26. Breadth First Search is equivalent to which of the traversal in the Binary Trees?
    a. Pre-order Traversal
    b. Post-order Traversal
    c. Level-order Traversal
    d. In-order Traversal

27. Depth first search result into
    a. Linked list
    b. Tree
    c. Graph with backward edges
    d. Arrays

28. In BFS, how many times a node is visited?
    a. Once
    b. Twice
    c. Equivalent to number of in degree of the node
    d. Thrice

29. The Data structure used in standard implementation of DFS is?
    a. Stack
    b. Queue
    c. Linked List
    d. Tree

30. Time Complexity of Breadth First Search is? (V – number of vertices, E – number of edges)
    a. O(V + E)
    b. O(V)
    c. O(E)
    d. O(V*E)

Subject Name: Data structures

Date: 11/10/21
Exam: E2S1MT

Time: 30 Min
Max Marks: 20

1. Which of the following statement is not true about linked lists?
   a. Element in a linked list, if it is sorted, can be quickly searched by applying binary search technique
   b. Elements are not necessarily stored in contiguous locations
   c. Insertions and deletions can be performed efficiently as compared to arrays
   d. Linked list is a dynamic structure
2. Which of the following is not a linear data structure?
   a. Stack
   b. Queue
   c. Linked list
   d. Binary tree
3. Which of the following data structure can be used to represent many-to-many relation?
   (A) B-tree
   (B) Binary tree
   (C) Graph
   (D) All of above
4. To create a linked structure, each node must have one member, which is ____
   a. A pointer to the head of the list
   b. A pointer to NULL
   c. A pointer to the node type
   d. A reference to the element type
5. Which of the following data structure is more appropriate to represent a heap?
   a. Two-dimensional array
   b. Doubly linked list
   c. Linear Array
   d. Linked list
6. A graph is a tree if and only if graph is
   a. Directed graph
   b. Non cyclic
   c. Planar
   d. Completely connected
7. The elements of a linked list are stored
   a. In a structure
   b. In an array
   c. Anywhere the computer has space for them
   d. In contiguous memory locations
8. To perform level-order traversal on a binary tree, which of the following data structure will be required?
   a. Hash table
   b. Queue
   c. Binary search tree
   d. Stack
9. Which of the following data structure is required to convert arithmetic expression in infix to its equivalent postfix notation?
   a. Queue
   b. Linked list
   c. Binary search tree
   d. None of above
10. average case complexity of quick sort for sorting n numbers is
    a. $O(n\log_2 n)$
    b. $O(n)$
    c. $O(\log_2 n)$
    d. $O(n^2)$

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-2022)
Computer Science & Engineering

Subject Name: Data structure & Algorithms
Date: 12-04-2022
Exam: MT-II

Subject Code : CS2101
Time: 60 Min
Max Marks: 30

SECTION – I

[20 Marks]

NOTE :

i. **All questions need to be answered.**
ii. **Questions numbered from 1 to 10 carries ONE mark each.**
iii. **Questions numbered from 11 to 15 carries TWO marks each.**
iv. **Select the most appropriate answer from the given options.**

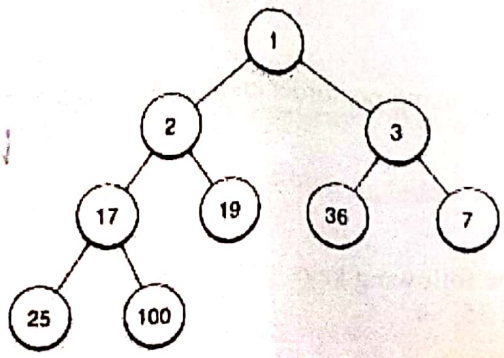
1. Which of the following is the linear data structure.
a. Array
b. AVL Tree
c. Binary Tree
d. Graph

2. Which of the following represents the Postorder Traversal of a Binary Tree?
a. Left -> Right -> Root
b. Left -> Root -> Right
c. Right -> Left -> Root
d. Right -> Root- > Left

3. Which of the following statements is true about AVL Trees?
a. The difference between the heights of left and right sub trees cannot be more than 1.
b. The height of an AVL Tree always remains of the order of O(logn)
c. AVL trees are a type of self balancing Binary search trees.
d. All of the above are true.

4. In a max-heap, element with the greatest key is always in the which node?
a) Leaf node
b) First node of left sub tree
c) Root node
d) First node of right sub tree

5. If we implement heap as min-heap, deleting root node (value 1)from the heap. What would be the value of root node after heapify, if leaf node (value 100) is chosen to replace the root at start:

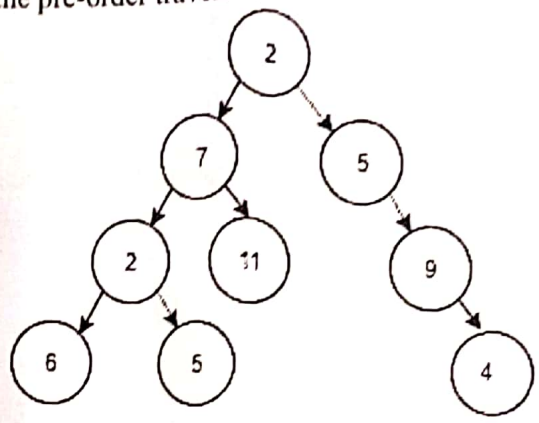


a) 2
b) 100
c) 17
d) 3

6. What is the maximum height of an AVL tree with p nodes?
a) p
b) log(p)
c) log(p)/2
d) p/2

7. When it would be optimal to prefer Red-black trees over AVL trees?
a) when there are more insertions or deletions
b) when more search's are needed
c) when tree must be balanced
d) when log(nodes) time complexity is needed

8. For the tree below, write the pre-order traversal.



a) 2, 7, 2, 6, 5, 11, 5, 9, 4
b) 2, 7, 5, 2, 6, 9, 5, 11, 4
c) 2, 5, 11, 6, 7, 4, 9, 5, 2
d) 2, 7, 5, 6, 11, 2, 5, 4, 9

9. What is a full binary tree?
a) All the leaves are at the same level
b) Each node has exactly two children
c) Each node has exactly zero or two children
d) Each node has exactly one or two children

10. What is the average case time complexity for finding the height of the binary tree?
a) h = O(loglogn)
b) h = O(nlogn)
c) h = O(n)
d) h = O(log n)

11. Construct a binary tree by using postorder and inorder sequences given below.
:_____
Inorder: N, M, P, O, Q
Postorder: N, P, Q, O, M

h, R, L

12. Construct B-Tree for the following keys, with order 4 : _____
Keys: 22, 12, 9, 8, 2, 3, 13, 35, 59

13. Construct B+ Tree for the following keys, with order 3 : _____
Keys: 50, 40, 30, 20, 10, 65, 55, 45

14. A hash table of length 10 uses open addressing with hash function h(k)=k mod 10, and linear probing. After inserting 6 values into an empty hash table, the table is as shown below.

0	
1	
2	42
3	23
4	34
5	52
6	46
7	33
8	
9	

possible order in which the key values could have been inserted in the table is :

_____

15. Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function x mod 10, which of the following statements are true: _____

i. 9679, 1989, 4199 hash to the same value
ii. 1471, 6171 hash to the same value
iii. All elements hash to the same value
iv. Each element hashes to a different value

SECTION- II

NOTE:

1. Answer any Two questions, each question carries 5 Marks
2. Do not write narrative english statements for expressing algorithm, use pseudo code instead. However comments can be included with narration.
3. Use only C programming language.
5*2=10 Marks

1. Create a binary search tree (BST) for the following elements (23, 12, 45, 36, 5, 15, 39, 2, 19). Write the Pseudo code to search for the key in the BST.

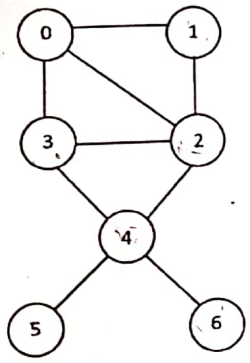
2. Write the pseudo code for heapify, Create max heap for the following elements
33, 14, 65, 02, 76, 69, 59, 85, 47, 99, 98.

3. Write a psuedo code for Breadth First Search in a Graph, explain with an example. ___

4. What is Hashing, explain any Two collision resolution techniques with an example for each.

3) What is Hashing, explain atleast 4 collision resolution techniques in detail.
Given the values {36, 18, 72, 43, 6, 10, 5} a hash table of size 7 and a hash function h(x) = x mod 7, show the resulting table after inserting the values in the given order with each of the following collision resolution strategies.
(i) separate chaining
(ii) Quadratic probing

4) Answer the following
i) Write the pseudo code's / program's for DFS and BFS traversal's on the given graph.
ii) Write the output of DFS and BFS traversals on the following graph considering starting vertex as 1.



5) Write the Pseudo code/program for the insert(), delete() and search() opeartions on the Binary search tree, and explain with an example.

6) Write a program / Pseudo code to perform following operations on linked lists.
i) Given TWO singly linked lists, Reverse the SECOND singly linked list and append it at the end of FIRST singly linked list.
ii) Delete a NODE from a singly linked list (based on the given value of the NODE) and append it at the FRONT of the list.

B181500

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-2022)
Computer Science & Engineering

Subject Name: Data structure & Algorithms | **Subject Code : CS2101**
Date: 23-02-2022 | **Time: 60Min**
Exam:MT-I | **Max Marks: 30**

SECTION - I

NOTE : All questions need to be answered, each question carries TWO marks.
10 * 2 = 20 M
Instructions:

1. Do not write narrative english statements for expressing algorithm, use pseudo code instead. However comments can be included with narration.
2. Use only C programming language.

Answer the following : In an Array(S) of size 'm' there are 'n' stacks.
The initial configuration is given below

for 0<=i<n
Bottom[i]=Top[i]=i*(m/n)-1;

if i==n
Bottom[i]=m-1;

It uses the following code to push(), pop() elements into stacks.

```
void push(int i, int x)// i: stack number, x: element to insert
{
if(Q1)
printf("stack overflow");
else
S[++Top[i]]=x;
}

int pop(int i) // i: stack number
{
if(Q2)
{ printf("Stack underflow");
return 0; }
else
return S[Top[i]--];
```

}

1. Fill up the following blank, Q1 is _____

2. Fill up the following blank, Q2 is _____

3. Suppose a circular queue of capacity (n-1) elements is implemented with an array of n elements. Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variables, respectively.
Initially, REAR = FRONT = 0. The conditions to detect queue full is _____

4. Which among the below specified condition is applicable if the Queue(Linear) is non - empty?
a. rear > front
b. rear < front
c. rear = front
d. Unpredictable

5. Output for the following program : _____

```
#include<stdio.h>
void ds(int x)
{
if(x>0)
{
ds(x-1);
printf("%d",x);
ds(x-1);
}
}

void main()
{
ds(3);
}
```

6. Consider the following singly linked list

```
struct Node
{
char data;
struct Node *link;
};
struct Node *f=NULL;
```

The list has been updated as follows, 6 Nodes has been inserted, the data of those 6 Nodes in sequence is 'a', 'b', 'c', 'd', 'e', 'f', where as the starting node address(with data 'a') is stored inside f;

what is the output after following sequence of steps :_____

struct Node *p;

i. p=f->link->link;
ii. f->link=p->link->link;
iii. p->link->link->link=p;
iv. printf("%d",f->link->link->link->link->data);

7. The following code counts the number of nodes in the above singly linked list (Question number :6)
what is Q1: _____

```
int count()
{
struct Node *q=f; // f: pointer holds the address of Head of linked list
int counter=0;

while(Q1)
{
++counter;
q=q->link;
}

return counter;
}
```

8. When the input sequence order is 1,2,3,4,5 identify the valid and invalid stack permutations. valid permutations of the following are : _____
Note: the elements are pushed and popped out at any instance, the following are popped out sequence's.

a. 3,5,4,2,1
b. 5,4,3,2,1
c. 4,3,5,2,1
d.3,2,4,1,5
e. 4,3,5,1,2

9. What is the corresponding postfix expression for the given infix expression?

Infix expression :a+(b*c(d/e^f)*g)*h)
postfix expression :_____

10. The maximum number of symbols that appeared on the stack at one point of time during the infix to postfix conversion (in question number 9) is :
_____

SECTION- II

NOTE:1. Answer any Two questions, each question carries 5 Marks
5*2=10 Marks

1. Write pseudo code/ program for the following.
You are given a Stack data structure that supports standard operations like push() and pop(). You need to **implement a Queue data structure** using only instances of Stack and stack operations are allowed on the instances.

2. Write an algorithm/ program to convert an infix expression into its equivalent postfix expression, explain with an example.

3. Let L1 be a singly linked list in memory. Every Node consisting of a data element whose value can be -ve (or) 0 (or) +ve. Write an algorithm/ program to
i) Find the number of Nodes with +ve valued element in L1
ii) Add a value to each of -ve valued elements /Nodes in L1 to make them +ve.

4. Given a doubly linked list, write an algorithm/program that removes a node with a particular value from the list and inserts it in the front.

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES,
BASAR
(A.Y. 2021-2022)
Computer Science & Engineering

B181500

Subject Name: Data structures & Algorithms **Subject Code : CS2101**
Date: 23-04-2022 **Time: 120 Min**
Exam: E2S1-EST **Max Marks: 60**

SECTION – I

[15 * 2= 30 Marks]

NOTE :

i. **All questions need to be answered.**
ii. **Each Question carries TWO marks.**
iii. **Select the most appropriate answer from the given options.**
iv. **If you make any assumptions while answering, mention them.**

1. What is the output of following function if start pointing to first node of following linked list : _____
11->25->49->87->36->9

```
void fun(struct node* start)
{
  if(start == NULL)
      return;
   printf("%d ", start->data);

   if(start->next != NULL )
   fun(start->next->next);
   printf("%d ", start->data);
}
```

2. What is the correct postfix expression for the following expression is :

_____

a+b*(c^d-e)^(f+g*h)-i

3. A hash table with ten buckets with one slot per bucket is shown in the following figure. The symbols A1 to A7 initially entered using a hashing function with linear probing.The maximum number of comparisons needed in searching an item that is not present is : _____

Hash value	key
0	A1
1	A2
2	A3
3	
4	A4
5	A5
6	
7	
8	A6
9	A7

4. The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. What is the postorder traversal sequence of the same tree :

_____

5. What is the maximum height of any AVL-tree with 7 nodes? height of a tree is the number of edges in the longest path from root to the leaf node :

_____

6. Consider the following code. What does the function display() do in general? The function display() receives root of a Binary Search Tree (BST) and a positive integer x as arguments.

```
// A BST node

struct node {
        int data;
        struct node *left, *right;
};

int count=0;

void display(struct node *root, int x)
{
    if(root !=NULL && count <= x)
    {
        print(root->right, x);
        count++;

        if(count==x)
            printf("%d",root->data);
        print(root->left, x);
    }
}
```

a. Prints the xth smallest element in BST.
b. Prints the xth largest element in BST.
c. Prints the leftmost node at level x from root.
d. Prints the rightmost node at level x from root.

7. Consider a graph G. Let a breadth-first traversal of G be done starting from a node r. Let d(r, u) and d(r, v) be the lengths of the shortest paths from r to u and v respectively, in G. If u is visited before v during the breadth-first traversal, which of the following statements is correct?

a. d(r, u) < d (r, v)
b. d(r, u) > d(r, v)
c. d(r, u) <= d (r, v)
d. None of the above

8. what will be the correct formation of redblack tree ?
a. 60-black root, 25-red left node, 90-red right node
b. 60-red root, 25-red left node, 90-red right node
c. 50-black root, 90-red left node, 100-red right node
d. 50-black root, 18-red left node, 100-black right node

9. Draw the simulation of B-Tree if the order is 3, and the keys inserted in sequence as : 78, 52, 81, 40, 33, 90, 85, 20, 38 .

10. Consider a B+-tree in which the maximum number of keys in a node is 5. What is the minimum number of keys in any non-root node is : _____

11. A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, a[0], nodes in the next level, from left to right, is stored from a[1] to a[3]. The nodes from the second level of the tree from left to right are stored from a[4] location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location a[n] and pushing it up the tree to satisfy the heap property. Which one of the following is a valid sequence of elements in an array representing 3-ary max heap?

a. 1, 3, 5, 6, 8, 9
b. 9, 6, 3, 1, 8, 5
c. 9, 3, 6, 8, 5, 1
d. 9, 5, 6, 8, 3, 1

12. Which of the following sorting algorithms in its typical implementation gives best performance when applied on an array which is sorted or almost sorted (maximum 1 or two elements are misplaced).

a. Quick sort
b. Heap sort
c. Merge sort
d. Insertion sort

13. Suppose we are sorting an array of eight integers using quicksort, and we have just finished the first partitioning with the array looking like this:
2 5 1 7 9 12 11 10
choose the correct statement of the following ?

a. The pivot could be either the 7 or the 9.
b. The pivot could be the 7, but it is not the 9.
c. The pivot is not the 7, but it could be the 9.
d. Neither the 7 nor the 9 is the pivot.

14. Consider the following C function

```
void display( int n)
{
  int i, j;
  for(i=1;i<=n;i++) {
    for(j=1;j<n;j+=i) {
        printf("%d %d",i,j);
    }
  }
}
```

The time complexity of display() in terms of asymptotic notations is:

a. $O(n^3)$
b. $O(n^2)$
c. $O(n^2 \log n)$
d. $O(n \log n)$

15. The worst case running times of Insertion sort, Merge sort and Quick sort respectively, are:

a. $\Theta(n \log n)$, $\Theta(n \log n)$ and $\Theta(n^2)$
b. $\Theta(n^2)$, $\Theta(n^2)$ and $\Theta(n \log n)$
c. $\Theta(n^2)$, $\Theta(n \log n)$ and $\Theta(n \log n)$
d. $\Theta(n^2)$, $\Theta(n \log n)$ and $\Theta(n^2)$

SECTION- II

NOTE:

1. Answer any THREE questions, each question carries 10 Marks
2. Do not write narrative english statements for expressing algorithm, use pseudo code instead. However comments can be included with narration.
3. Use only C programming language.

10*3=30 Marks

1. Answer the following.

i) What is a stack, write the program / pseudo code for push(), pop(), display() operations of stack using Linked list.

ii) Write the program / pseudo code to evaluate the postfix expression. Evaluate the following Postfix expression 7 3 4 + - 2 4 5 / + * 6 / 7 +.

2) Write an program/pseudocode to sort elements in ascending order using Heap sort technique? Illustrate the working of Heap sort (ascending order) algorithms on the following input with neat sketch of the Trees's simulation: 10, 4, 6, 28, 5, 68, 19, 31, 13, 30, 39,21.

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y.2021-22,Sem1)

Computer Science & Engineering

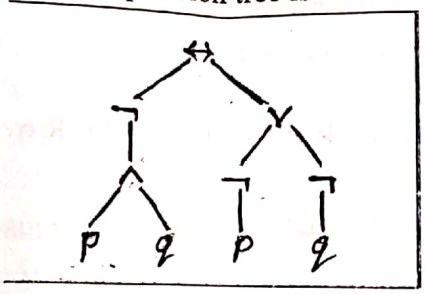
Subject Name: Discrete Mathematics — Subject code: CS2102

Date: 12/04/2022 — Duration : 60 Mins

Exam: E2S1_MT2 — Max. Marks: 30

Answer ALL — 20*1M= 20M

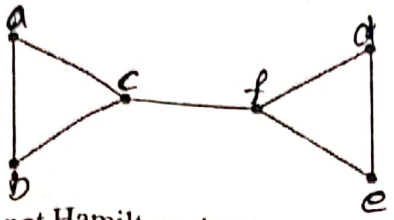
1. Which of the following is TRUE in directed graphs
   a. In degree = out degree = number of edges
   b. In degree + out degree = number of edges
   c. A loop contributes 2 to the 'in degree' of a vertex
   d. All of the above
2. Let Z be set of all integers, '+' represent arithmetic addition then the structure (Z, +) is
   a. Monoid but not group
   b. An abelian group
   c) Semi group but not monoid
   d) Only an algebraic structure but not semi group
3. Postfix expression of the following expression tree is



   a. pq∧¬ p¬q¬∨↔ b) ↔¬∧pq∨¬p¬q c) p∨q¬p↔¬q d) None
4. Chromatic number(Minimum No. of colors needed to color vertices where no two adjacent vertices get same color) of a complete bi-partite graph of *n* vertices is
   a. n-1 b) n c) n+1 d) 2
5. Which of the following laws holds good in Boolean algebra?
   a. x+yz = (x+y)(x+z)
   b. x+xy = x+y
   c. x+1=x
   d. All of the above
6. Consider the following incidence matrix. Which of the following represent the degree sequence of the represented graph?

$$\begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

   a. 1,2,3,4 b) 2,2,3,3 c) 2,2,3,4 d) 1,1,2,2
7. Consider the following graph. Which of the following is TRUE



a. It has Euler circuit but not Hamilton circuit
b. It has both Euler and Hamilton circuit
c. It has only Hamilton Circuit
d. It doesn't have both Euler and Hamilton circuits

8. A simple graph with 'n' vertices ($n \geq 3$) has Hamilton circuit if the graph
   a. is complete graph
   b. has vertices such that every vertex has degree at least 'n/2'
   c. both (a) and (b)
   d. has vertices of all even degree
9. Which of the following graphs contain Euler circuit
   a. A complete graph of 6 vertices
   b. A cycle graph of 6 vertices
   c. A Wheel graph of 6 vertices
   d. All of the above
10. Consider the following set $R = \{ x \mid 0 < x \leq 1 \}$. R over Multiplication operator is
   a. A group
   b. A monoid but not group
   c. Abelian group
   d. Not an algebraic structure
11. A graph with 'n' vertices is said to be a tree if and only if
   a. It is connected
   b. 'n-1' edges
   c. Connected and has no circuits
   d. Connected and has circuits
12. If Q^* represents set of all non-zero rational numbers, then $(Q^*, /)$ is {/ denote division }
   a. Monoid but not group
   b. Group
   c. Not an algebraic structure
   d. Semi group but not monoid
13. Which of the following is a finite group?
   a. {0,1} over addition
   b. {1,-1} over multiplication
   c. {0,1,-1} over addition
   d. {0,1,2} over congruence modulo 4
14. Which of the following is NOT a cyclic group over multiplication operator?
   a. {1,-1} b) $\{1, w, w^2\}$ c) {1,-1,i,-i} d){0,1}

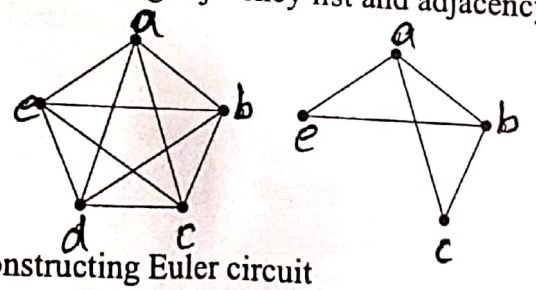
15. Which of the following is FALSE
    a. Set of natural numbers including zero is a free monoid
    b. The group ({1,-1,i, -i}, *) is a subgroup of group (Z, *)
    c. (Z, /) is not a group
    d. None of the above
16. Which of the following conditions are necessary for two graphs to be isomorphic
    a. Number of vertices and edges must be same
    b. Degree sequences of both the graphs must be same
    c. both (a) and (b)
    d. No such condition exist
17. Finding of a Hamilton circuit in a graph has applications of
    a. Molecular biology for sequencing DNA
    b. The traversal which covers each link in a communication network
    c. Connections in a utility grid
    d. Travelling salesman problem
18. If Q^* represents set of all non-zero rational numbers, and It is a group with respect to * where * is defined as a*b= ab/3 for all a,b ϵ Q^* then which of the following is FALSE
    a. Identity element is 3
    b. Inverse of a is 9/a
    c. Inverse of 2/3 is 3/2
    d. Inverse of 1=9
19. The maximum no. of spanning trees possible for a tree with 3 vertices is
    a. 3 b. 4 c. 5 d. 6
20. Which of the following degree sequences do NOT represent a graph
    a. (1,1,1,1,1,1) b. (2,2,2,2,2,2) c. (3,3,3,1,0,0) d.(3,2,1,1,1,0)

Section-B

Answer any TWO of the following

2*5M=10M

1. Represent the following graphs using adjacency list and adjacency matrix. (5M)



2. (a) Write algorithm for constructing Euler circuit (3M)
   (b) Construct the Euler circuit for the complete graph of 5 Vertices (K_5) (2M)
3. Define Prefix, Infix, and Post fix notations. Construct expression tree of the following expression and write prefix and postfix notation of it. (5M)
   ((x + 2) ↑ 3) * (y −(3 + x)) − 5
4. Define group, ring and field, Give suitable examples. (5M)

B181500

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-22,Sem1)
Computer Science & Engineering

Subject Name: Discrete Mathematics
Date: 23/02/2022
Exam: E2S1_MT1

Subject code: CS2102
Duration : 60 Mints
Max. Marks: 30

SECTION-A **20M**

Questions from 1-10 carry 1 mark each.

1. Consider the following set definition
   A={x | x is square of an integer and x<100}. What is cardinality (no. of elements) of A.
   a. 10 b. 9 c. 50 d. infinite
2. In which of the following sets, 2 is an element of the set
   a. {{{2}}} b. {{2}, {2}} c. {{2}, {2,{2}}} d. {2, {2}}
3. Let A={a,b,c,d}, B={y,z} which of the following is a member of A × B
   a. (a,z) b. {z,a} c. (y,b) d. (y,z)
4. Which of the following definition represents set difference A-B
   a. $\{x \mid x \in A \wedge x \notin B\}$
   b. $\{x \mid x \in A \vee x \notin B\}$
   c. $\{x \mid x \notin B \vee x \in A\}$
   d. $\{x \mid x \notin A \wedge x \notin B\}$
5. Which of the following are False where A and B are not empty sets
   a. $A - \emptyset = A$
   b. $A \cup \emptyset = A$
   c. $A \cap A = A$
   d. $A \cup (A \cup B) = A$
6. Consider a set A={1,2,3,4}, a relation R on A defined as {(1,4),(2,3),(1,3),(3,1),(3,2)} is
   a. Transitive b. Symmetric c. Reflexive d. None of the above
7. Which of the following is true about $f(x) = \sqrt{x}$
   a. Is a function from Z to R
   b. Is a function from R to R
   c. Is a function from Z^+ to R
   d. Is not a function from Z^+ to R
8. Consider a mapping defined from set of all bit strings to set of integers, then f(S) defined as the position of 0 in S. Then f is
   a. A function b. Not a function
9. Consider a function $f(x) = x^3$ then f from Z to Z is
   a. Only One-one b. Only On-to c. Bijection d. None
10. Consider the function f: Z×Z → Z defined as f(m,n) = m+n. function f is
    a. One-one and onto
    b. One-one but not Onto
    c. Onto but not one-one
    d. Neither one-one nor onto

The Questions from 11-15 carry 2 Marks each.

11. Consider the following relation R1= $\{(a,b)|\ (a+b) \bmod 3 = 0\}$ {note: x mod y= reminder when x is divided by y} The relation R1 is
    a. Reflexive but not symmetric
    b. Symmetric but not reflexive
    c. Both reflexive and symmetric
    d. Neither reflexive nor symmetric
12. Given the function f(x) = 2x+1, Then f(x) is
    S1: Bijective function over R to R and $f^{-1}(y) = (y-1)/2$
    S2: Inverse is not possible if f is from Z to Z
    a. S1 is true, S2 is false
    b. Both S1 and S2 are true
    c. S2 is true, S1 is False
    d. both S1 and S2 are false
13. Which of the following statements is TRUE
    a. Every relation is either symmetric or Anti symmetric
    b. A Reflexive relation can be Anti Symmetric but not Symmetric
    c. An empty relation over set A={1,2,3,4} is symmetric, Anti Symmetric and Transitive
    d. None of the above
14. Let R be a relation from A to B. Complementary relation R^c is defined as $\{(a,b)|\ (a,b) \notin R\}$ then
    a. If R is Symmetric R^c is also symmetric
    b. If R is reflexive R^c is also reflexive
    c. If R is symmetric R^c is not symmetric
    d. If R is anti symmetric R^c is also anti Symmetric
15. Number of reflexive relations on a set with number of elements n is
    a. 2^n b. 2^{2n} c. 2^m where m is $(n^2 - n)$ d. infinite

Section-B

Write any TWO of the following **2*5M=10M**

1. (a) Prove the following distributive laws using membership table (5M)
   $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
   $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$
2. (a) Prove DeMorgan's law using set builder notation (3M)
   (b) Define Symmetric relation and give an example (2M)
3. Consider a set A={0,1,2,3}, a relation R over A×A defined as $\{(a,b)|\ a+b \neq 3\}$ Represent the relation using digraph and determine the type of the relation (5M)
4. Define the following and give suitable examples. Onto function, bijective function, Inverse function (5M)

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2021-22,Sem1 Regular)

Computer Science & Engineering

B18150

Subject Name: Discrete Mathematics **Subject code: CS2102**

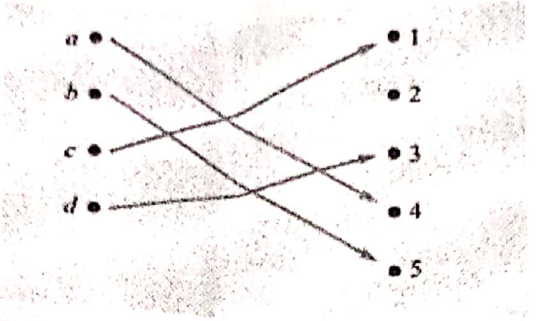
Date: 28/04/2022 **Duration : 120 Mins**

Exam: E2S1_EST_Regular **Max. Marks: 60**

SECTION-A

Answer all **30 * 1M= 30M**

1. The below mapping is



a) A one-one function
b) Onto function
c) Both (a) and (b)
d) Neither one-one nor onto

2. Which of the following is implied from the definition $\{x| x \notin A \wedge x \in B\}$
a) A-B b) $A \cap B$ c) B –A d) AU B
3. Consider a mapping from set of students in a class to final grade of that student in the class. The function is
a) A one-one function
b) Onto function
c) Not a Function
d) Neither one-one nor onto
4. Consider a relation R on set of all people where $(a,b) \in R$ if and only if a is taller than b. Then the relation R is
a) Reflexive b) Symmetric c) Transitive d) Equivalence
5. Number of reflexive relations on a set with number of elements n is
a) 2^n b) 2^{2n} c) 2^m where m is $(n^2 - n)$ d) infinite
6. Which of the following statements is TRUE
a) Every relation is either symmetric or Anti symmetric
b) A Reflexive relation can be Anti Symmetric but not Symmetric
c) An empty relation over set A={1,2,3,4} is symmetric, Anti Symmetric and Transitive
d) None of the above
7. Number of functions from a set with 'm' elements to a set with 'n' elements is
a) n^m b) m^n c) n! d) m*n
8. How many Boolean functions of degree *4* (number of Boolean variables) are there

a) 16 b) 4 c) 2^{16} d) 8

9. How many bit strings of length 8 contain exactly three 1's
a) 112 b) 48 c) 56 d) 24

10. How many cards must be selected from a standard deck of 52 cards to guarantee that at least three cards of the same suit are chosen?
a) 10 b)12 c) 9 d) 27

11. There are 8 different time periods during which classes at a university can be scheduled. If there are 60 different classes, how many different rooms are needed?
a) 5 b) 8 c) 4 d) 3

12. A palindrome is a string whose reversal is identical to the string. How many bit strings of length 5 are palindromes {note: bit strings are strings formed over{0,1}}
a) 32 b) 10 c) 4 d) 8

13. Consider the following proposition $(p \vee \neg q) \wedge (p \vee q) \wedge (\neg p \vee \neg q)$. it is
a) Satisfiable
b) Not satisfiable
c) Cannot be predicted

14. Which of the following equivalences hold good
a) $p \vee (p \wedge q) \equiv p$
b) $p \wedge (p \wedge q) \equiv q$
c) $p \vee (p \vee q) \equiv p$
d) all of the above

15. which of the following proposition is equivalent to $p \rightarrow q$
a) $\neg p \vee \neg q$ b) $\neg q \rightarrow \neg p$ c) $p \vee q$ d) $q \rightarrow p$

16. Which of the following is equivalent to the proposition $\neg ((p \vee q) \rightarrow r)$
a) $(p \vee q) \vee r$
b) $(p \vee q) \wedge \neg r$
c) $\neg (p \vee q) \wedge r$
d) $p \wedge q \wedge r$

17. "The automated reply cannot be sent when the file system is full" if *p* denote "The automated reply can be sent" and *q* denote "The file system is full." Which of the following represents the above statement in propositional logic?
a) $\neg p \vee \neg q$ b) $\neg q \rightarrow \neg p$ c) $p \vee q$ d) $q \rightarrow \neg p$

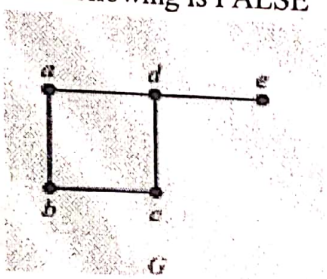
18. An actor hosts a party where guests from 5 different states, speaking 6 different mother tongues are invited. Each guest can be from only one state, and can have only one mother tongue. Two guests are comfortable with each other if they are from the same state, and have the same mother tongue. How many guests should the actor invite to ensure that at least 3 guests are comfortable with each other? (Note that different people from the same state can speak different mother tongues)
a) 31 b) 12 c) 61 d) 40

19. VIBGYOR game: The game contains 7 boxes and 7 balls. Both the boxes and balls having colors: Violet, Indigo, Blue, Green, Yellow, Orange and Red. The colors of the boxes will be hidden i.e., will not be visible to the person playing the game. A person must drop the colored balls into the seven boxes exactly one per box. Then, the color of the box will be revealed, and each match between the color of

ball dropped with the box will get a point to the person. In how many ways can the person get non-zero points?

a) 2084 b) 3186 c)4288 d) None

20. Consider the following set $R = \{ x \mid 0 < x < 1 \}$. R over multiplication operator is
    a) A group
    b) A monoid but not group
    c) A semi group but not monoid
    d) Not an algebraic structure
21. Which of the following is TRUE about a simple graph
    a) A simple graph cannot have a vertex with odd degree
    b) A simple graph can exist with 5 vertices with each of degree 3
    c) A simple graph with 'n' vertices can have at most 'nC_2' number of edges
    d) A simple graph can have multiple edges between two vertices
22. Which of the following graphs is bi-partite graph
    a) A complete graph with even number of vertices
    b) A wheel graph with even number of vertices
    c) A cycle graph with odd number of vertices
    d) A cycle graph with even number of vertices
23. Which of the following is TRUE about graphs
    a) A graph is said to be connected if there exists a path between every pair of vertices
    b) A Euler path can contain repeated vertices but edges only once.
    c) A Hamilton path may not contain all the edges of the graph but contains each vertex exactly once
    d) All of the above
24. Consider the following graph. Which of the following is FALSE



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    a) Euler path doesn't exist
    b) Hamilton path : a-b-c-d-e
    c) Hamilton circuit is a-b-c-d-a
    d) Euler circuit: a-b-c-d-a
25. Which of the following is a finite group?
    a) {0,1} over addition
    b) {1,-1} over multiplication
    c) {0,1,-1} over addition
    d) {0,1,2} over congruence modulo 4
26. Consider a group {0,1,2,3,4,5} with respect to the operator addition modulo 6. Which of the following is FALSE
    a) Inverse of 1 is 5
    b) Inverse of 4 is 2
    c) inverse of 3 is 3
    d) inverse of 2 is 3

27. A simple graph is called regular if every vertex of this graph has the same degree. A regular graph is called n-regular if every vertex in this graph has degree n. A complete graph (K_n) is _____, a cycle graph is_____

a) n-regular, n-regular
b) (n-1)-regular, 2-regular
c)n-regular, 2-regular
d)The above are not regular graphs

28. Which of the following graphs contain a Euler circuit.

a) A complete graph of 'n' vertices
b) A cycle graph of 'n' vertices
c) A wheel graph of 'n' vertices
d) Both (a) and (b)

29. Which of the following propositions is Tautology

a) p b) $\neg p \vee \neg q$ c) $(p \vee \neg q) \vee \neg p$ d) $\neg p \vee q$

30. Consider the following graph represented using adjacency list. Which of the following is TRUE about the graph

TABLE 1 An Adjacency List for a Simple Graph.

Vertex	Adjacent Vertices
a	b, c, e
b	a
c	a, d, e
d	c, e
e	a, c, d

a) The graph is complete graph
b) The graph has Euler Circuit
c) The graph has circuit so not a Tree
d) The graph is multi graph

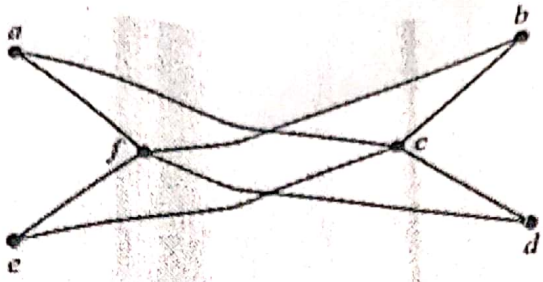
SECTION-B

Answer any THREE of the following 3*10M=30M

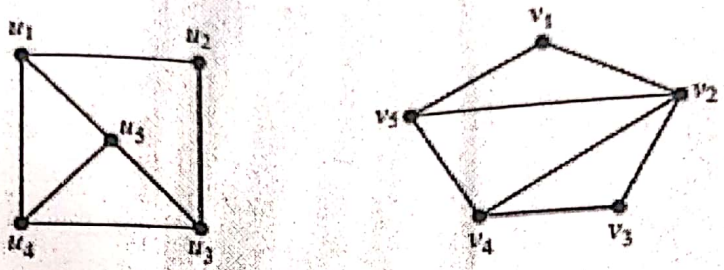
1. Define the following with suitable examples 5*2M=10M
   (a) Russell's paradox
   (b) Inverse Function
   (c) Pigeon-hole Principle
   d) Partial Ordering Relation
   e) Principle of Inclusion & Exclusion
2. (a) Explain the ways of representing a relation (4M)
   (b) Define Reflexive,Symmetric &Anti Symmetric relations with suitable examples (6M)
3. (a) Prove the following De Morgan's law by constructing truth table (4M)

$$\neg(p \wedge q) \equiv \neg p \vee \neg q$$

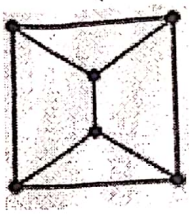
   (b) Discuss various rules of inference used in propositional logic (6M)
4. (a) Define cyclic group, free monoid with suitable examples (4M)
   (b) List the laws / identities of Boolean algebra (6M)
5. (a) Define Bipartite graph. Determine whether the following graph is bipartite or not (5M)



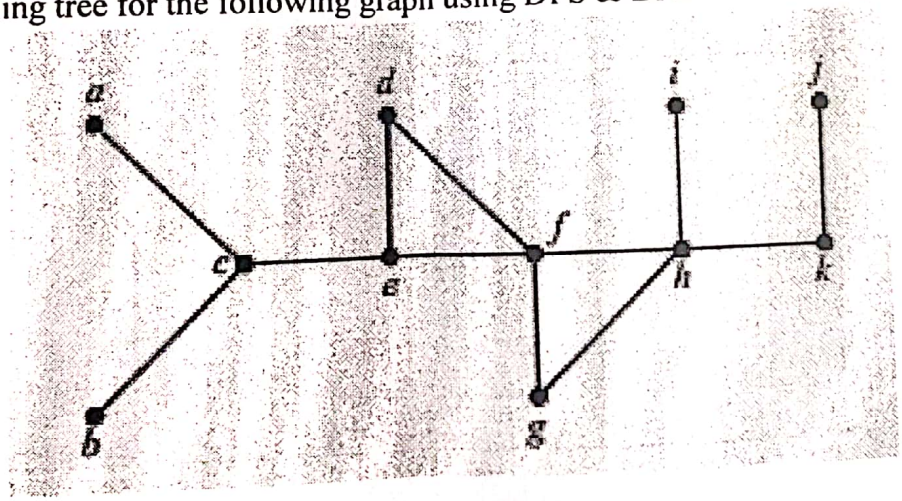
(b) Define graph isomorphism. Find whether the following graphs are isomorphic or not (5M)



6. (a) Define Hamilton circuit & Dirac's theorem. Find the whether the following graph contain the Hamilton circuit or not (4M)



(b) Construct Spanning tree for the following graph using DFS & BFS (6M)



----------END of the PAPER----------

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-22,Sem1 Regular)
Computer Science & Engineering

B182276

Subject Name: Discrete Mathematics
Date: 28/04/2022
Exam: E2S1_EST_Regular

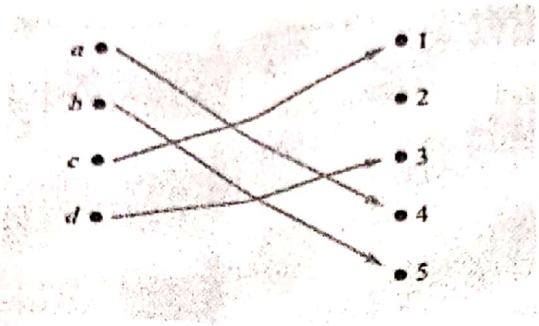
Subject code: CS2102
Duration : 120 Mins
Max. Marks: 60

SECTION-A

Answer all

30 * 1M= 30M

1. The below mapping is



a) A one-one function
b) Onto function
c) Both (a) and (b)
d) Neither one-one nor onto

2. Which of the following is implied from the definition $\{x| x \notin A \wedge x \in B\}$
a) A-B b) $A \cap B$ c) B –A d) AU B

3. Consider a mapping from set of students in a class to final grade of that student in the class. The function is
a) A one-one function
b) Onto function
c) Not a Function
d) Neither one-one nor onto

4. Consider a relation R on set of all people where $(a,b) \in R$ if and only if a is taller than b. Then the relation R is
a) Reflexive b) Symmetric c) Transitive d) Equivalence

5. Number of reflexive relations on a set with number of elements n is
a) 2^n b) 2^{2n} c) 2^m where m is $(n^2 - n)$ d) infinite

6. Which of the following statements is TRUE
a) Every relation is either symmetric or Anti symmetric
b) A Reflexive relation can be Anti Symmetric but not Symmetric
c) An empty relation over set A={1,2,3,4} is symmetric, Anti Symmetric and Transitive
d) None of the above

7. Number of functions from a set with 'm' elements to a set with 'n' elements is
a) n^m b) m^n c) n! d) m*n

8. How many Boolean functions of degree *4* (number of Boolean variables) are there

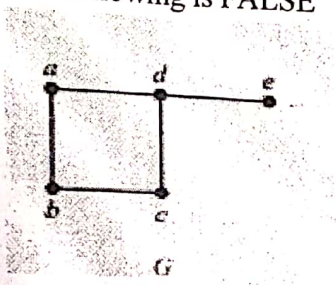
a) 16 b) 4 c) 2^{16} d) 8

9. How many bit strings of length 8 contain exactly three 1's
   a) 112 b) 48 c) 56 d) 24
10. How many cards must be selected from a standard deck of 52 cards to guarantee that at least three cards of the same suit are chosen?
    a) 10 b)12 c) 9 d) 27
11. There are 8 different time periods during which classes at a university can be scheduled. If there are 60 different classes, how many different rooms are needed?
    a) 5 b) 8 c) 4 d) 3
12. A palindrome is a string whose reversal is identical to the string. How many bit strings of length 5 are palindromes {note: bit strings are strings formed over{0,1}}
    a) 32 b) 10 c) 4 d) 8
13. Consider the following proposition $(p \vee \neg q) \wedge (p \vee q) \wedge (\neg p \vee \neg q)$. it is
    a) Satisfiable
    b) Not satisfiable
    c) Cannot be predicted
14. Which of the following equivalences hold good
    a) $p \vee (p \wedge q) \equiv p$
    b) $p \wedge (p \wedge q) \equiv q$
    c) $p \vee (p \vee q) \equiv p$
    d) all of the above
15. which of the following proposition is equivalent to $p \rightarrow q$
    a) $\neg p \vee \neg q$ b) $\neg q \rightarrow \neg p$ c) $p \vee q$ d) $q \rightarrow p$
16. Which of the following is equivalent to the proposition $\neg ((p \vee q) \rightarrow r)$
    a) $(p \vee q) \vee r$
    b) $(p \vee q) \wedge \neg r$
    c) $\neg (p \vee q) \wedge r$
    d) $p \wedge q \wedge r$
17. "The automated reply cannot be sent when the file system is full" if *p* denote "The automated reply can be sent" and *q* denote "The file system is full." Which of the following represents the above statement in propositional logic?
    a) $\neg p \vee \neg q$ b) $\neg q \rightarrow \neg p$ c) $p \vee q$ d) $q \rightarrow \neg p$
18. An actor hosts a party where guests from 5 different states, speaking 6 different mother tongues are invited. Each guest can be from only one state, and can have only one mother tongue. Two guests are comfortable with each other if they are from the same state, and have the same mother tongue. How many guests should the actor invite to ensure that at least 3 guests are comfortable with each other? (Note that different people from the same state can speak different mother tongues)
    a) 31 b) 12 c) 61 d) 40
19. VIBGYOR game: The game contains 7 boxes and 7 balls. Both the boxes and balls having colors: Violet, Indigo, Blue, Green, Yellow, Orange and Red. The colors of the boxes will be hidden i.e., will not be visible to the person playing the game. A person must drop the colored balls into the seven boxes, exactly one per box. Then, the color of the box will be revealed, and each match between the color of

ball dropped with the box will get a point to the person. In how many ways can the person get non-zero points?

a) 2084 b) 3186 c)4288 d) None

20. Consider the following set $R = \{ x \mid 0 < x < 1 \}$. R over multiplication operator is
    a) A group
    b) A monoid but not group
    c) A semi group but not monoid
    d) Not an algebraic structure
21. Which of the following is TRUE about a simple graph
    a) A simple graph cannot have a vertex with odd degree
    b) A simple graph can exist with 5 vertices with each of degree 3
    c) A simple graph with 'n' vertices can have at most 'nC_2' number of edges
    d) A simple graph can have multiple edges between two vertices
22. Which of the following graphs is bi-partite graph
    a) A complete graph with even number of vertices
    b) A wheel graph with even number of vertices
    c) A cycle graph with odd number of vertices
    d) A cycle graph with even number of vertices
23. Which of the following is TRUE about graphs
    a) A graph is said to be connected if there exists a path between every pair of vertices
    b) A Euler path can contain repeated vertices but edges only once.
    c) A Hamilton path may not contain all the edges of the graph but contains each vertex exactly once
    d) All of the above
24. Consider the following graph. Which of the following is FALSE



G

    a) Euler path doesn't exist
    b) Hamilton path : a-b-c-d-e
    c) Hamilton circuit is a-b-c-d-a
    d) Euler circuit: a-b-c-d-a
25. Which of the following is a finite group?
    a) {0,1} over addition
    b) {1,-1} over multiplication
    c) {0,1,-1} over addition
    d) {0,1,2} over congruence modulo 4
26. Consider a group {0,1,2,3,4,5} with respect to the operator addition modulo 6. Which of the following is FALSE
    a) Inverse of 1 is 5
    b) Inverse of 4 is 2
    c) inverse of 3 is 3
    d) inverse of 2 is 3

27. A simple graph is called regular if every vertex of this graph has the same degree. A regular graph is called n-regular if every vertex in this graph has degree n. A complete graph (K_n) is _____, a cycle graph is_____

a) n-regular, n-regular
b) (n-1)-regular, 2-regular
c) n-regular, 2-regular
d) The above are not regular graphs

28. Which of the following graphs contain a Euler circuit.

a) A complete graph of 'n' vertices
b) A cycle graph of 'n' vertices
c) A wheel graph of 'n' vertices
d) Both (a) and (b)

29. Which of the following propositions is Tautology

a) p b) $\neg p \vee \neg q$ c) $(p \vee \neg q) \vee \neg p$ d) $\neg p \vee q$

30. Consider the following graph represented using adjacency list. Which of the following is TRUE about the graph

TABLE 1 An Adjacency List for a Simple Graph.

Vertex	Adjacent Vertices
a	b, c, e
b	a
c	a, d, e
d	c, e
e	a, c, d

a) The graph is complete graph
b) The graph has Euler Circuit
c) The graph has circuit so not a Tree
d) The graph is multi graph

SECTION-B

Answer any THREE of the following 3*10M=30M

1. Define the following with suitable examples 5*2M=10M
   (a) Russell's paradox
   (b) Inverse Function
   (c) Pigeon-hole Principle
   d) Partial Ordering Relation
   e) Principle of Inclusion & Exclusion
2. (a) Explain the ways of representing a relation (4M)
   (b) Define Reflexive,Symmetric &Anti Symmetric relations with suitable examples (6M)
3. (a) Prove the following De Morgan's law by constructing truth table (4M)

$$\neg(p \wedge q) \equiv \neg p \vee \neg q$$

   (b) Discuss various rules of inference used in propositional logic (6M)
4. (a) Define cyclic group, free monoid with suitable examples (4M)
   (b) List the laws / identities of Boolean algebra (6M)
5. (a) Define Bipartite graph. Determine whether the following graph is bipartite or not (5M)

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2020-21,Sem1 Regular)
Computer Science & Engineering

Subject Name: Discrete Mathematics
Date: 29/09/2021
Exam: E2S1_EST_Regular

Subject code: CS2102
Duration : 120 Mins
Max. Marks: 60

SECTION-A

Answer all

30 * 1M= 30M

1. Consider the following set
   S= { x | x is a set}
   Which of the following is not a member of S?
   a. {}
   b. {1,1,2,2}
   c. {1,2,3}
   d. {{1,2}{2}{2,3}}
2. The cardinality of the following set is { a, {a}, {a, {a}}}
   a) 1 b) 2 c) 3 d) 4
3. Let A= {a,b,c} B ={x,y} C ={0,1} which of the following is not a member of A×B×C
   a. (a,x) b) (a,y,1) c) (b,x,0) d) (c,x,1)
4. Which of the following is a relation from set A to set B where A ={a,b,c}, B ={1,2}
   a. {(a,1),(b,2),(c)}
   b. {(a,1),(2,b),(2,c)}
   c. {(a,1)}
   d. {(a,a),(b,b),(c,c)}
5. Consider the following relation R ⊆ A×A where A={1,2,3,4},
   R={(1,1),(1,2),(2,1),(2,2),(3,3),(4,4). The relation R is
   a. Symmetric
   b. Reflexive
   c. Transitive
   d. Both (a) and (b)
6. In a Digraph representation of a relation, a loop is present on all the vertices of the graph, then the relation is said to be
   a. Symmetric
   b. Reflexive
   c. Anti symmetric
   d. Transitive
7. Which of the following about the equivalence relations is FALSE
   a. The Equivalence relation can partition a set into finite number of mutually disjoint equivalence classes
   b. Union of all the equivalence classes form the set
   c. An equivalence class can be empty
   d. Every relation cannot be an equivalent relation
8. Consider a function f: Z → Z where Z is set of integers, f= $n^2 + 1$ then f is
   a. One-one but not Onto
   b. One-one and onto
   c. Onto but not one-one
   d. Not one-one, not onto
9. How many bit strings of length 8 are there which either start with 0 or end with 11
   a) 128 b) 192 c) 32 d) 160
10. A multiple choice test contain 10 questions, there are 4 possible answers for each question. In how many ways can a student answers the questions on the test if the student attempts every question?
    a) 10^4 b) 5^{10} c) 40 d) 4^{10}

11. How many strings of 3 decimal digits begin with an odd digit
    a) 100 b) 500 c) 1000 d) 200

12. A palindrome is a string whose reversal is identical to the string. How many bit strings of length 5 are palindromes?
    a) 7 b) 32 c) 8 d) 4

13. A bowl contains 10 red balls and 10 blue balls; A woman selects the balls at random without looking at them. How many balls must she select to be sure of having at least three balls of the same color
    a) 10 b) 13 c) 3 d) 5

14. How many numbers must be selected from the set {1,2,3,4,5,6} to guarantee that at least one pair of these numbers add up to 7
    a) 15 b) 7 c) 13 d) 3

15. Which of the following is equivalent to the proposition $\neg ((p \vee q) \rightarrow \neg r)$
    a) $(p \vee q) \vee r$
    b) $\neg (p \vee q) \wedge r$
    c) $(p \vee q) \wedge r$
    d) $p \wedge q \wedge r$

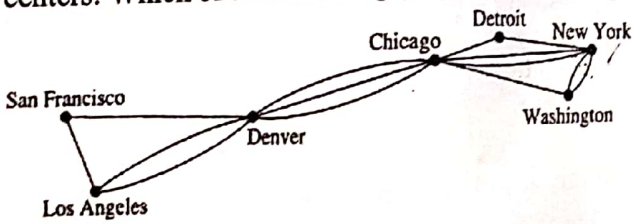
16. Consider the following proposition $(p \vee \neg q) \wedge (\neg p \vee q) \wedge (\neg p \vee \neg q)$. it is
    a) Satisfiable
    b) Not satisfiable
    c) Cannot be predicted

17. Which of the following equivalences hold good
    a) $p \vee (p \wedge q) \equiv p$
    b) $p \wedge (p \wedge q) \equiv q$
    c) $p \vee (p \vee q) \equiv p$
    d) all of the above

18. Applications of propositional logic include
    a) System specifications
    b) Logic puzzles & Circuits
    c) Artificial Intelligence
    d) All of the above

19. Which of the following represent absorption law in Boolean algebra
    a) $(x+y)+z = x+(y+z)$
    b) $x + xy = x$
    c) $x+y = y+x$
    d) $x + x = x$

20. Consider the following computer network where multiple links exist between data centers. Which of the following graph can be to represent it



    a) Simple graph
    b) Multi graph
    c) Pseudo graph
    d) Cannot be represented using graph

21. Consider a graph with 10 vertices each of degree 6, how many edges are there
    a) 30 b) 20 c) 10 d) 6

22. Which of the following statements is TRUE about graphs
    a) In a directed graph sum of indegrees of all vertices = sum of outdegrees of all vertices = number of edges in the graph
    b) In an undirected graph sum of degrees of all vertices = number of edges in the graph
    c) In a graph degree of any vertex cannot be odd number

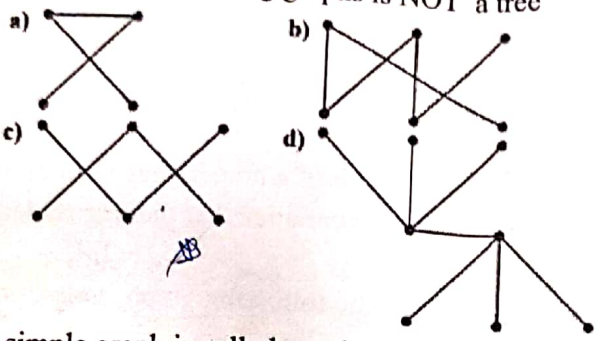
d) A cycle graph of 'n' vertices consists of 'n-1' edges

23. Which of the following graphs contain vertices with equal degree
    a) A complete graph (K_n)
    b) A wheel graph
    c) A complete bi-partite graph
    d) None of the above

24. Consider the following graph. Which of the below are TRUE about the graph

a) It has Euler circuit but not Hamilton circuit
b) It has both Euler and Hamilton circuit
c) It has only Hamilton Circuit
d) It doesn't have both Euler and Hamilton

25. which of the following graphs is NOT a tree



26. A simple graph is called regular if every vertex of this graph has the same degree. A regular graph is called n-regular if every vertex in this graph has degree *n*. Then which of the following graphs is regular
    a. A complete graph of n vertices (K_n)
    b. A wheel graph of n vertices (W_n)
    c. A cycle graph of n vertices (C_n)
    d. All of the above

27. Consider the following set $R = \{ x \mid 0 < x \leq 1 \}$. R over Multiplication operator is
    a. A group
    b. A monoid but not group
    c. Abelian group
    d. Not an algebraic structure

28. Consider the following proposition $(p \vee \neg q) \rightarrow p$ is
    a. Tautology
    b. Contradiction
    c. Contingency

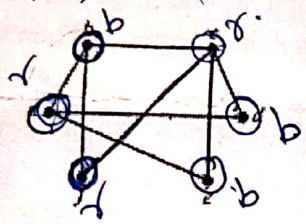
29. The number of Hamilton circuits in a complete graph of *6* vertices is
    a) 20 b) 60 c) 2 d) cannot be determined

30. In computer Networks, each computer on the network is given an IP address. The address consist of two parts network_id, host_id. Class A address is defined as : network_id is 0 followed by 7-bits and host-id is 24 bits(32 bit address). With this condition, how many addresses are there in a class A network.?(all zeroes and all ones are excluded for host id, 01111111 is excluded for a network id)
    a. $2^8 * 2^{24}$
    b. $(2^7-1) * (2^{24}-2)$
    c. $2^7 * 2^{24}$
    d. $2^7 * 2^{22}$

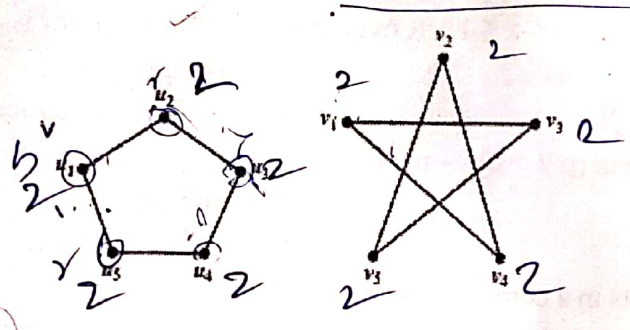
Section- B

Answer any THREE of the following 3 * 10M =30M

1. (a) Define different set operators and give appropriate examples (5M)
   (b) Define Distributive laws over sets and prove them using membership table (5M)
2. Construct a truth table for the following compound propositions (10M)
   a. $(p \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg p)$
   b. $(p \rightarrow q) \wedge (\neg p \vee q)$
3. (a) Define Bijective function with an example (4M)
   (b) Define sub graph, Anti symmetric relation, principal of inclusion & Exclusion (6M)
4. (a) Discuss various rules of inference used in propositional logic (6M)
   (b) Define pigeon hole principle (2M)
   (c) What is the minimum number of students, each of whom comes from one of the 30 districts, who must be enrolled in a university to guarantee that there are at least 50 who come from the same district? (2M)
5. (a) Define Bipartite graph, Determine whether the following graph is bipartite or not (5M)



(b) Find whether the below two graphs are isomorphic or not (5M)



6. Define Algebraic Structure, Semi group, Monoid, Group, abelian group and give examples (10M)

END of PAPER

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DEC-2

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y.2020-21,Sem1)

Computer Science & Engineering

Subject Name: Discrete Mathematics
Date: 29/09/2021
Exam: E2S1_MT

Subject code: CS2102
Duration : 30 Mins
Max. Marks: 20

Answer ALL

10 * 2M= 20M

1. Let A and B are two sets, which of the below is implied from the following definition

$$\neg \forall x(x \in A \rightarrow x \in B)$$

a) A = B b) A ⊆ B c) B ⊆ A d) None

2. Which of the following is NOT cardinality of a power set

a) 4 b) 24 c) 128 d) 256

3. Find the number of integers from a set of 1-100 that are not divisible by 2, 3 and 5 using principle of inclusion and exclusion

a) 22 b) 25 c) 26 d) 33

4. How many bit strings of length 8 contain exactly three 1's

a) 112 b) 48 c) 56 d) 24

5. which of the following proposition is a tautology

a) $((p \vee q) \wedge \neg q) \rightarrow p$ c) $(p \vee q) \rightarrow q$
b) $(p \wedge \neg p) \wedge q$ d) $(p \vee q) \wedge \neg q$

6. Which of the following represent the Demorgan's law in propositional logic

a) $(p \vee q) \equiv (q \vee p)$ c) $(p \rightarrow q) \equiv (\neg p \vee q)$
b) $\neg (p \wedge q) \equiv \neg p \vee \neg q$ d) $\neg (p \wedge q) \equiv \neg p \wedge \neg q$

7. Let Z be set of all integers, '+' represent arithmetic addition then the structure (Z, +) is

a) Monoid but not group c) Semi group but not monoid
b) An abelian group d) Only an algebraic structure but not semi group

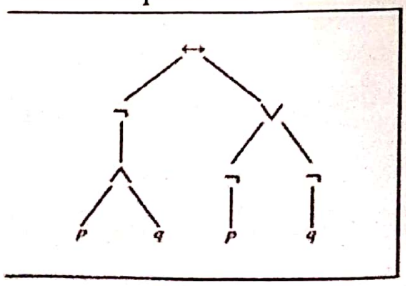
8. How many Boolean functions of degree *4* (number of Boolean variables) are there

a) 16 b) 4 c) 2^{16} d) 8

9. Chromatic number(Minimum No. of colors needed to color vertices where no two adjacent vertices get same color) of a complete graph of *n* vertices is

a) n-1 b) n c) n+1 d) 2

10. Postfix expression of the following expression tree is



a) pq∧¬ p¬q¬∨↔ b) ↔¬∧pq∨¬p¬q c) p∨q¬p↔¬q d) None

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2021-22,Sem1)

Computer Science & Engineering

B182276

Subject Name: Discrete Mathematics | Subject code: CS2102

Date: 23/02/2022 | Duration : 60 Mints

Exam: E2S1_MT1 | Max. Marks: 30

SECTION-A 20M

Questions from 1-10 carry 1 mark each.

1. Consider the following set definition
   A={x | x is square of an integer and x<100}. What is cardinality (no. of elements) of A.
   a. 10 b. 9 c. 50 d. infinite
2. In which of the following sets, 2 is an element of the set
   a. {{{2}}} b. {{2}, {2}} c. {{2}, {2,{2}}} d. {2, {2}}
3. Let A={a,b,c,d}, B={y,z} which of the following is a member of A × B
   a. (a,z) b. {z,a} c. (y,b) d. (y,z)
4. Which of the following definition represents set difference A-B
   a. $\{x \mid x \in A \wedge x \notin B\}$
   b. $\{x \mid x \in A \vee x \notin B\}$
   c. $\{x \mid x \notin B \vee x \in A\}$
   d. $\{x \mid x \notin A \wedge x \notin B\}$
5. Which of the following are False where A and B are not empty sets
   a. $A - \emptyset = A$
   b. $A \cup \emptyset = A$
   c. $A \cap A = A$
   d. $A \cup (A \cup B) = A$
6. Consider a set A={1,2,3,4}, a relation R on A defined as {(1,4),(2,3),(1,3),(3,1),(3,2)} is
   a. Transitive c. Reflexive
   b. Symmetric d. None of the above
7. Which of the following is true about $f(x)= \sqrt{x}$
   a. Is a function from Z to R
   b. Is a function from R to R
   c. Is a function from Z^+ to R
   d. Is not a function from Z^+ to R
8. Consider a mapping defined from set of all bit strings to set of integers, then f(S) defined as the position of 0 in S. Then f is
   a. A function b. Not a function
9. Consider a function $f(x) = x^3$ then f from Z to Z is
   a. Only One-one b. Only On-to c. Bijection d. None
10. Consider the function f: Z×Z → Z defined as f(m,n) = m+n. function f is
    a. One-one and onto
    b. One-one but not Onto
    c. Onto but not one-one
    d. Neither one-one nor onto

The Questions from 11-15 carry 2 Marks each.

11. Consider the following relation R1= {(a,b)| (a+b) mod 3 =0} {note: x mod y= reminder when x is divided by y} The relation R1 is
    a. Reflexive but not symmetric
    b. Symmetric but not reflexive
    c. Both reflexive and symmetric
    d. Neither reflexive nor symmetric
12. Given the function f(x) = 2x+1, Then f(x) is
    S1: Bijective function over R to R and $f^{-1}(y) = (y-1)/2$
    S2: Inverse is not possible if f is from Z to Z
    a. S1 is true, S2 is false
    b. Both S1 and S2 are true
    c. S2 is true, S1 is False
    d. both S1 and S2 are false
13. Which of the following statements is TRUE
    a. Every relation is either symmetric or Anti symmetric
    b. A Reflexive relation can be Anti Symmetric but not Symmetric
    c. An empty relation over set A={1,2,3,4} is symmetric, Anti Symmetric and Transitive
    d. None of the above
14. Let R be a relation from A to B. Complementary relation R^c is defined as {(a,b)| (a,b)$\notin$ R} then
    a. If R is Symmetric R^c is also symmetric
    b. If R is reflexive R^c is also reflexive
    c. If R is symmetric R^c is not symmetric
    d. If R is anti symmetric R^c is also anti Symmetric
15. Number of reflexive relations on a set with number of elements n is
    a. 2^n b. 2^{2n} c. 2^m where m is $(n^2 - n)$ d. infinite

Section-B

2*5M=10M

Write any TWO of the following

1. (a) Prove the following distributive laws using membership table (5M)
   $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
   $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$
2. (a) Prove DeMorgan's law using set builder notation (3M)
   (b) Define Symmetric relation and give an example (2M)
3. Consider a set A={0,1,2,3}, a relation R over A×A defined as {(a,b)| a+b $\neq$ 3} Represent the relation using digraph and determine the type of the relation (5M)
4. Define the following and give suitable examples. Onto function, bijective function, Inverse function (5M)

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y.2021-22,Sem1)

Computer Science & Engineering

B182276

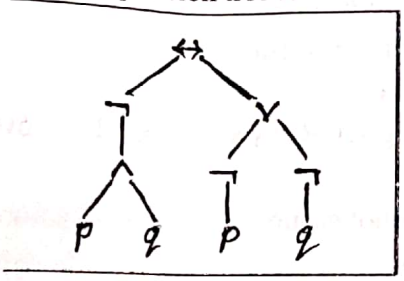
Subject Name: Discrete Mathematics
Date: 12/04/2022
Exam: E2S1_MT2

Subject code: CS2102
Duration : 60 Mins
Max. Marks: 30

Answer ALL

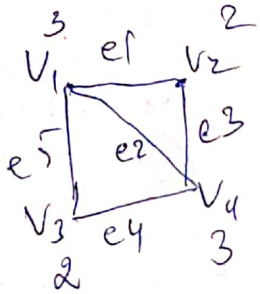
20*1M= 20M

1. Which of the following is TRUE in directed graphs
   a. In degree = out degree = number of edges
   b. In degree + out degree = number of edges
   c. A loop contributes 2 to the 'in degree' of a vertex
   d. All of the above
2. Let Z be set of all integers, '+' represent arithmetic addition then the structure (Z, +) is
   a. Monoid but not group
   b. An abelian group
   c) Semi group but not monoid
   d) Only an algebraic structure but not semi group
3. Postfix expression of the following expression tree is

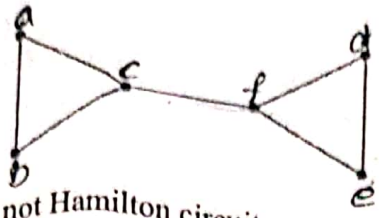


   a) pq∧¬ p¬q¬∨↔ b) ↔¬∧pq∨¬p¬q c) p∨q¬p↔¬q d) None
4. Chromatic number(Minimum No. of colors needed to color vertices where no two adjacent vertices get same color) of a complete bi-partite graph of *n* vertices is
   a) n-1 b) n c) n+1 d) 2
5. Which of the following laws holds good in Boolean algebra?
   a. x+yz = (x+y)(x+z)
   b. x+xy = x+y
   c. x+1=x
   d. All of the above
6. Consider the following incidence matrix. Which of the following represent the degree sequence of the represented graph?

	e_1	e_2	e_3	e_4	e_5
v_1	1	1	0	0	0
v_2	1	0	1	0	1
v_3	0	0	0	1	1
v_4	0	1	1	1	0



   a. 1,2,3,4 b) 2,2,3,3 c) 2,2,3,4 d) 1,1,2,2
7. Consider the following graph. Which of the following is TRUE



a, b c, f, e, d f, c

a. It has Euler circuit but not Hamilton circuit
b. It has both Euler and Hamilton circuit
c. It has only Hamilton Circuit
d. It doesn't have both Euler and Hamilton circuits

8. A simple graph with 'n' vertices ($n \geq 3$) has Hamilton circuit if the graph
   a. is complete graph
   b. has vertices such that every vertex has degree at least 'n/2'
   c. both (a) and (b)
   d. has vertices of all even degree
9. Which of the following graphs contain Euler circuit
   a. A complete graph of 6 vertices
   b. A cycle graph of 6 vertices
   c. A Wheel graph of 6 vertices
   d. All of the above
10. Consider the following set $R = \{ x \mid 0 < x \leq 1 \}$. R over Multiplication operator is
   a. A group
   b. A monoid but not group
   c. Abelian group
   d. Not an algebraic structure
11. A graph with 'n' vertices is said to be a tree if and only if
   a. It is connected
   b. 'n-1' edges
   c. Connected and has no circuits
   d. Connected and has circuits
12. If Q^* represents set of all non-zero rational numbers, then $(Q^*, /)$ is {/ denote division }
   a. Monoid but not group
   b. Group
   c. Not an algebraic structure
   d. Semi group but not monoid

Algebraic but not semigroup

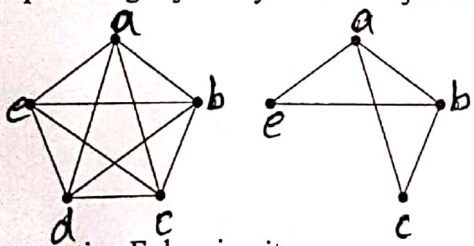
13. Which of the following is a finite group?
   a. {0,1} over addition
   b. {1,-1} over multiplication
   c. {0,1,-1} over addition
   d. {0,1,2} over congruence modulo 4
14. Which of the following is NOT a cyclic group over multiplication operator?
   a. {1,-1} b) $\{1, w, w^2\}$ c) {1,-1,i,-i} d) {0,1}

15. Which of the following is FALSE
    a. Set of natural numbers including zero is a free monoid
    b. The group ({1,-1,i, -i}, *) is a subgroup of group (Z, *)
    c. (Z, /) is not a group
    d. None of the above
16. Which of the following conditions are necessary for two graphs to be isomorphic
    a. Number of vertices and edges must be same
    b. Degree sequences of both the graphs must be same
    c. both (a) and (b)
    d. No such condition exist
17. Finding of a Hamilton circuit in a graph has applications of
    a. Molecular biology for sequencing DNA
    b. The traversal which covers each link in a communication network
    c. Connections in a utility grid
    d. Travelling salesman problem
18. If Q^* represents set of all non-zero rational numbers, and It is a group with respect to * where * is defined as $a*b = ab/3$ for all $a,b \in Q^*$ then which of the following is FALSE
    a. Identity element is 3
    b. Inverse of a is 9/a
    c. Inverse of 2/3 is 3/2
    d. Inverse of 1=9
19. The maximum no. of spanning trees possible for a tree with 3 vertices is
    a. 3 b. 4 c. 5 d. 6
20. Which of the following degree sequences do NOT represent a graph
    a. (1,1,1,1,1,1) b. (2,2,2,2,2,2) c. (3,3,3,1,0,0) d. (3,2,1,1,1,0)

Section-B

Answer any TWO of the following 2*5M=10M

1. Represent the following graphs using adjacency list and adjacency matrix. (5M)



2. (a) Write algorithm for constructing Euler circuit (3M)
   (b) Construct the Euler circuit for the complete graph of 5 Vertices (K_5) (2M)
3. Define Prefix, Infix, and Post fix notations. Construct expression tree of the following expression and write prefix and postfix notation of it. (5M)
   $((x + 2) \uparrow 3) * (y - (3 + x)) - 5$
4. Define group, ring and field, Give suitable examples. (5M)

Student ID:

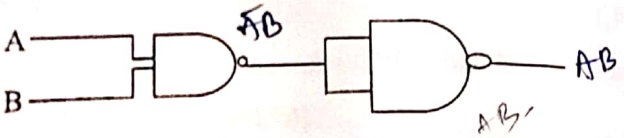
RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2020-2021)
BRANCH: CSE

Subject Name: Digital Electronic circuits | **Subject Code: EC2101**
Exam: AY20_21_CSE_SEM_1_EST | **Date: 1/10/2021**
Max Marks: 60 | **Time: 2 Hours**

SECTION –A (30M)
Objective Part

NOTE: All 15 bits are compulsory,there is NO Choice in Section-A.

15X2=30

1. The simplified form of a logic function $Y=A(B+C(\overline{AB+AC}))$ is ..0..
2. The dual of Boolean expression is A+[B+(AC)]+D is ..A[B(A+C)]D..
3. Convert the decimal number to its equivalent Binary number $(1248.56)_{10} = (\ldots?\ldots)_2$ (10011100000.10001)2.
4. Perform the Binary subtraction of $(1010.010)_2 - (111.111)_2$ ..(10.011)2.
5. Convert the decimal number $(88)_{10}$ into Excess-3 code. — 1011 1011.
6. 

The output of the logic gate is .....
7. Nibble is combination of ..4..binary bits.
8. The number of characters represented by ASCII code is ..128..
9. A full –adder circuit has both the inputs 1 and carry-in is also 1.Its sum and carry outputs will be ...1.... and 1.....
10. A ripple counter is ..Asynchronous..sequential circuit.
11. The 1's and 2's complement of 11011010 ..1's – 00100101 — 2's 0010 0110
12. PROM has fixed AND-array ..programmable..OR-array. PLA - both programmable; PAL OR-fixed AND-Programm
13. In a T flip-flop, the Q output ..0.... when T=0 and clock pulse is applied.
14. A logic circuit that gates one out of several inputs to single output is known as a Multiplexer .....
15. In a J-K Flip-Flop if J= K=1,its Q output will be ...1.....when a clock pulse is applied. (Toggle)

SECTION –B

NOTE: Answer any 3 out of 6 questions. Each question carries 10 marks.

Answers for sub parts of a question should be written at one place

1.

i. List the differences of Analog signal and Digital signal ?**[2M]**

ii. Convert 1100 Gray code to Binary code?**[2M]**

iii. Perform in BCD $(57)_{10}+(26)_{10}$.**[2M]**

iv. Perform Binary Division $(110110)_2/(101)_2$.**[2M]**

v. Convert 364 octal number in it's equivalent Binary number.**[2M]**

2.

i. Reduce the following function using K-map technique and implement using NOR – gates $f(a,b,c,d)=\Pi M(0,3,4,7,8,10,12,14)+dc(2,6)$

ii. Express the following to canonical form:

$f(A,B,C,D)=\Sigma m(0,1,2,3,11,12,14,15)$

iii. Convert the following expression into POS and SOP form.

$(u+xw)(x+u'v)$

[6+2+2marks]

3. i. Explain in detail about Full Adder with neat circuit representation ?

ii. Write and explain SR Flip-Flop by truth table and logic digram.

[5 + 5 marks]

4. i. Explain about 4:1 Multiplexer and Realize 4:1 mux using gates.

ii.Design Binary to Gray code converter.

iii.Explain about 4-Bit Binary Parallel Adder.

iv.Expalin about Half –subtractor.**[3+3+2+2marks]**

5. i. List the differences between Asynchronus and Synchronus counters..

ii. Define Decoder.Explain about the types of Decoders.

[5 + 5 marks]

6. i. Write and Explain about JK Flip-Flop by Truth table and logic diagram.

ii. Explain in detail about all the Shift Registers. **[5+ 5 marks]**

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2020-2021)

BRANCH: CSE

Subject Name: Digital Electronic circuits
Exam: MT PAPER
Max Marks: 20

Subject Code: EC2101
Date: 1/10/2021
Time: 30 minutes

1.

NOTE: Answer any ALL questions and each question carries two marks

2X10=20marks

1. If a three-input AND gate has eight input possibilities ,how many of those possibilities will result in a HIGH output?
   a.1
   b.2
   c.7
   d.8

   NOR - 1

2. Which of the following gate corresponds to the action of parallel switches for the input?
   a.AND
   b.NAND
   c.OR
   d.NOR

   AND - series.

3. A+AB+ABC+ABCD+ABCDE+......= A(1+B+BC+BCD+BCDE)
   a.1
   b.A
   c.A+AB
   d.AB

   A(1)
   [1+X] =1.
   A

4. Which of the following operations is Commutative but not Associative ? NAND, NOR.
   a.NAND
   b.NOR
   c.OR
   d.X-OR .

   NAND, NOR, X-NOR

5. How much data the shift register can store?.
   a.only one
   b.only two
   c.only three
   d.None of the above

6. In positive logic ,logic gate 1 corresponds to
   a.Positive voltage
   b.Higher voltage level
   c.Zero voltage level
   d.Lower voltage level

7. Simplfied form of the function f=(x+y+xy)(x+z)
   a.x+y
   b.x+yz
   c.x+xyz
   d.y+xz

$(x+y(1+x))(x+z)$
$(x+y)(x+z)$
$= x\cdot x + x\cdot z + y\cdot x + y\cdot z$
$= x + xz + yx + yz$
$= x(1+z) + yx + yz$
$= x + yx + yz$
$= x(1+y) + yz$
$= x + yz$

8. How many entries will be in the truth table of a 4-input NAND gate?
   a.6
   b.8
   c.32
   d.16

9. In the toggle mode, a JK flip flop has
   a.J=0, K=1
   b.J=1, K=1
   c.J=0, K=0
   d.J=1, k=0

10. Temperature variation is a /an
   a.Analog quantity
   b.Digital quantity
   c.Either Analog or Digital quantity
   d.None of these

Student ID: B181500

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR

(A.Y. 2020-2021)

BRANCH: CSE

Subject Name: Digital Electronic circuits **Subject Code: EC2101**

Exam: MT 2 PAPER **Date: 13 /04/2022**

Max Marks: 30 **Time: 60 minutes**

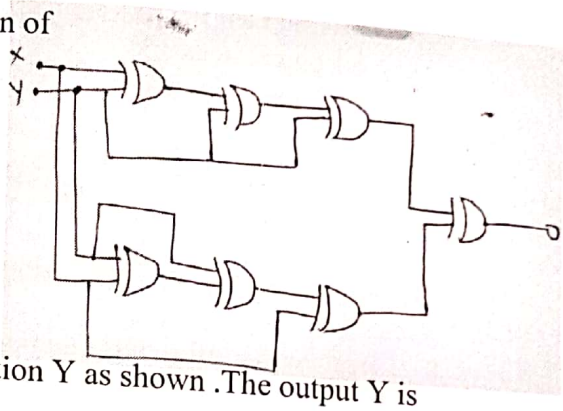
SECTION-A 2X10=20marks

NOTE: Answer any ALL questions and each question carries two marks

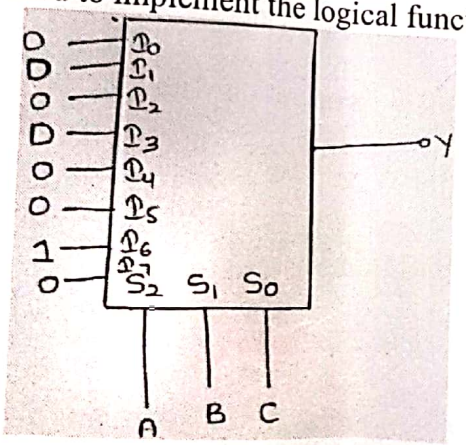
1. On a J-K FLIP-FLOP ,When is the flip-flop in a Hold Condition
   a.J=0,K=1
   b.J=1,K=0
   c.J=0,K=0
   d.J=1,K=1

2. How many AND gates are required for a 1 –to-8 De-multiplexer?
   a.2 b.6 c.8 d.5

3. The circuit shown in figure below generates the function of
   a.X Ex-or Y
   b.0
   c.XY'+YX+Y'X
   d.XY'



4. In 8:1 multiplexer is used to implement the logical function Y as shown .The output Y is given as.....
   $[I_1=D, I_3= D]$



5. The minimum number of flip-flops that can be used to construct a modulus-5 counter is.....
   a.3 b.8 c.5 d.10

6. Draw the functional table for T-flip flop-------

7. Consider the following combinational function block involving four Boolean variables x,y,a,b where x,a,b are inputs and y is the output.f(x,y,a,b)

```
{
if (x is 1) y=a;
else y =b;
}
```

Which one of the following digital logic blocks is the most suitable for implementing the function?

a.Full adder
b.Priority encoder
c.Multiplexer
d.Flip-flop

8. A negative edge-triggered FLIP-FLOP changes state at the .....of the clock pulse.

9. In Serial Shifting method,Data shifting occurs.....
a.One bit at a time
b.Two bit at a time
c.Simunatesouly
d.Three bit at a time

10. The number of logic gates and the way of their interconnections can be classified as.....
a.Logical network
b.system network
c.Circuit network
d.Gate network

SECTION-B

NOTE: Answer any TWO questions and each question carries five marks

1. i.Realize the following function 8×1 MUX $F(A,B,C) = \Sigma(0,1,3,4,5)$
ii.Design a Full adder with neat Circuit representation. **[2+3M]**

2.i.Design a left shift register and explain its operation with an Example.
ii.Design a 3 bit Even parity generator. **[3+2M]**

3.i.Explain the operation of RS Flip-flop with its functional table.
ii.Design a 4×2 Priority Encoder. **[3+2M]**

4.i.Design a 2-bit Digital Comparator. **[5M]**

B181500.

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-2022)
COMPUTER SCIENCE ENGINEERING

Subject Name: DIGITAL ELECTRONICS CIRCUITS
Time: 2 Hours
Exam: E2_SEM1_EST

Subject Code: EC2101
Max Marks: 60
Date: 21 /4/22

Note: Attempt any 3 out of 6 questions in part A, each Question carries 10Marks
Attempt all the MCQ's in part B, each question carries 1.5 Marks

PART A [30 Marks]:

1) a) Subtract 1100 from 1001 by using 2's complement method. [2M]
b) Prove the Boolean expressions using the Boolean theorems.
(i)A+ A'B=A+B
(ii)ABC+A B'C+AB C'=AB+AC [4M]
C) Reduce the Boolean expressions using Boolean laws
(i) A+B[AC+(B+ C')D]
(ii) AB+A B'C+B C' [4M]

2) a) Minimize the following expressions using K-map and realize using NOR Gates.
$f = \sum m(1, 5, 6, 12, 13, 14) + d(2, 4)$ [6 M]
b) Realize EX-OR and EX-NOR gates using NAND gates. [4M]

3) a) Explain the operation JK master -slave flip flop. [5M]
b) Draw and explain the working of RS flip-flop with its functional table. [5M]

4) a) Design and explain a 4-bit ring counter using D-flip flops . [5M]
b) Design and construct MOD-8 Asynchronous counter using JK flip flops. [5M]

5) a) Explain about 8*1 with the help of circuit diagram . [3M]
b) Obtain 8*1 MUX from 2*1 MUX and realize all the gates using 2*1 MUX [7M]

6) a) Convert JK to SR flip-flop. [5M]
b) Explain about universal shift register and with the help of neat diagram explain about parallel in parallel out register. [5M]

PART B [30 Marks]:

1. Convert $(BAD)_{16}$ to decimal.
2. $(25.625)_{10}$ to binary
3. The representation of octal number $(532.2)_8$ in decimal is ____
a)$(346.25)_{10}$ b)$(532.864)_{10}$ c)$(340.67)_{10}$ d) $(531.668)_{10}$

4. Gray code is also called as.....
a) Complement code b) binary code c) reflected code d) reflected binary code

5. Gray code of the given binary number 1011 is.....

6. The group of 1's is called.....
a) Implicants b) prime implicants c) essential prime implicants d)none

7. The boolean function A + BC is a reduced form of _____
a) AB + BC b) (A + B)(A + C) c) A'B + AB'C d) $\overline{(A + C)B}$

8. Complement of the expression A'B + CD' is _____
a) (A' + B)(C' + D) b) (A + B')(C' + D) c) $\overline{(A' + B)(C' + D)}$ d) (A + B')(C + D')

9. EXOR and EXNOR are always complement to each other.....(True or False)

10. A D flip-flop can be constructed from an _____ flip-flop.
a) S-R b) J-K c) T d) S-K

11. A counter circuit is usually constructed of _____
a) A number of latches connected in cascade form
b) A number of NAND gates connected in cascade form
c) A number of flip-flops connected in cascade
d) A number of NOR gates connected in cascade form

12. In a parallel in/parallel out shift register, D0 = 1, D1 = 1, D2 = 1, and D3 = 0.consider D0 as MSB. After three clock pulses, the data outputs are _____
a) 1110 b) 0001 c) 1100 d) 1000

13. The output of multiplexer depends on
a) Data inputs b) data outputs c) Selected inputs d) none

14. PLA refers to _____
a) Programmable Loaded Array
b) Programmable Array Logic
c) Programmable Logic Array
d) Programmed Array Logic

15. The decimal number 10 is represented in its BCD form as _____

16. Race around condition can be eliminated by the condition
a)half time period of clock (Tc)< propagation delay of flip-flop.
b) half time period of clock (Tc)> propagation delay of flip-flop.
c) half time period of clock (Tc)= propagation delay of flip-flop

17. To obtain 64*1 MUX from 2*1 MUX how many 2*1 muxes are needed .
a) 31 b)61 c)62 d)32

18. The logical sum of two or more logical product terms is called _____

19. JK flip-flop is called universal flip flop .....(True or False).

20. Convert 7_3 into $_2$
a)111 b) 0111 c)110 d)none.

Student ID: B181500

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2020-2021)
BRANCH: CSE

Subject Name: Digital Electronic circuits **Subject Code: EC2101**
Exam: MT 1 PAPER **Date: 24/02/2022**
Max Marks: 30 **Time: 60 minutes**

SECTION-A

NOTE: Answer any ALL questions and each question carries two marks

2X10=20marks

1. What is the one's complement binary representation of decimal number (-75) ?
   a.00110100
   b.01010100
   c.10110011
   d.10110100
2. Which of the following gate corresponds to the action of parallel switches for the input?
   a.AND
   b.NAND
   c.OR
   d.NOR
3. The Boolean expression (X+Y)(X+Y')(X'+Y)=
   a.X'Y
   b.XY'
   c.XY
   d.X'Y'
4. Which of the following operations is Commutative but not Associative?
   a.AND
   b.NOR
   c.OR
   d.X-OR
5. If the X and Y logic inputs are available and their complements X' and Y' are not available, the minimum number of two –input NAND required to implement X**xor** Y
   a.5 b.4 c.6 d.7
6. Convert $(E6C4)_{16}$ to decimal-------
7. Simplfied form of the function f=(x+y+xy)(x+z)
   a.x+y
   b.x+yz

c.x+xyz
d.y+xz

8. Perform the subtraction using 2's complement method for 0011.1001-0001.1110.....
9. The parameter through which 16 distinct values can be represented is known as
   a.Bit
   b.Word
   c.Byte
   d.Nibble
10. Temperature variation is a /an
   a.Analog quantity
   b.Digital quantity
   c.Either Analog or Digital quantity
   d.None of these

SECTION-B

NOTE: Answer any TWO questions and each question carries five marks

1. Minimise the four variable logic function using k-map.
   f(A,B,C,D)=Σm(0,1,2,3,5,7,8,9,11,14) **[5M]**

2.i.List the differences between the analog and digital signals.
ii.Realize EX-OR and EX-NOR using NAND gates. **[2+3M]**

3.Reduce the Boolean expression using Boolean laws
i.A[B+C'(AB+AC')']
ii.(B+BC)(B+B'C)(B+D) **[5M]**

4.i.Design a 4-bit binary to gray code convertor using neat logic Diagram.
ii.State De-Morgan's Theorem. **[4+1M]**

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2021-2022)

Time: 2 hours
Max Marks: 60
Subject Code: 19MA2102/MA2102

Date: 17/09/2022
Exam: E2S1_CSE_EST(REMEDIAL)
Subject: Probability and Statistics (PS)

SECTION-A

Please read each MCQ carefully, making certain to provide only ONE answer for each one. Here each MCQ carries 2 marks. $15 \times 2 = 30\ M$

1. If you throw 8 biscuits(identical) at 3 monkeys, what is the probability each monkey gets at least one biscuit.

A. $\frac{3}{5}$ B. $\frac{7}{15}$ C. $\frac{1}{3}$ D. $\frac{5}{12}$

2. Consider two boxes, one box containing 1 black and 1 white marble, second box contains 2 black and 1 white marble. A box is selected at random, and a marble is drawn at random from the selected box. What is the probability that white marble is drawn?

A. $\frac{1}{9}$ B. $\frac{1}{6}$ C. $\frac{5}{12}$ D. $\frac{4}{9}$

3. A problem in Probability Theory is Assigned to three students A, B, C and they try to solve it on their own. And probabilities of A, B, C solving it are 0.2,0.3, 0.5 respectively. Find the probability for that problem being solved.

A. 0.72 B. 0.28 C. 0.03 D. 0.97

4. Suppose 5 cards are selected at random without replacement from well shuffled deck of cards. Let X is the random variable which denote the number of King cards in the selection, then $E(X) =$

A. $\frac{2}{3}$ B. $\frac{4}{5}$ C. $\frac{5}{4}$ D. $\frac{3}{2}$

5. If $M_X(t) = e^{2(e^t-1)}$, then $P(X \geq 1) =$

A. e^{-2} B. $\frac{1-e^{-2}}{2}$ C. $1-\frac{e^{-2}}{2}$ D. $1-e^{-2}$

6. If $X \sim U[a, b]$, with $E(X) = 3$, and $Var(X) = \frac{4}{3}$ then $P(2 < X < 4) =$

A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. $\frac{1}{4}$

7. A group of 350 equally smart high school students (competitive programmers) from all over the world will be giving 34^{th} IOI (International Olympiad in Informatics) test for year 2022, and if we assume the probability that a student achieve perfect score in the test is 0.005. What is the (approximate) probability that at least one student achieve the perfect score in the 34^{th} IOI?

A. 0.423 B. 0.451 C. 0.312 D. 0.826

8. If $(X, Y) \sim BVN(2,1,4,9,-\frac{1}{2})$, then $Cov(2X, X-3Y) =$

A. 18 B. 25 C. 26 D. 23

9. If $X \sim N(1,\sigma^2)$, and $P(1 < X < 2) = 0.1915$, then $\sigma =$

A. 4 B. 3 C. 2 D. 1

10. Let X denote the number failures before the first success in the sequence of independent and identically distributed Bernoulli trials with probability of success p and $2P(X = 1) = 3P(X = 2)$, then $p =$

A. $\frac{2}{3}$ B. $\frac{1}{3}$ C. $\frac{1}{6}$ D. $\frac{1}{4}$

11. If X_1, X_2, X_3 are (pairwise) uncorrelated random variables each having mean 0 and variance 1, then $Cov(X_1 + X_2, X_2 + X_3) =$

A. 0 B. 1 C. 2 D. 3

12. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$ then which of the following is true?

I. $\frac{\sqrt{n}(\bar{X} - \mu)}{\sigma} \sim N(0,1)$ II. $\frac{\sqrt{n}(\bar{X} - \mu)}{S} \sim t_n$

A. Only I true B. Only II true C. Both I and II are true D. Both I and II are false

13. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$, then sample variance $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is

I. Unbiased estimator for σ^2 II. Consistent estimator for σ^2

A. Only I true B. Only II true C. Both I and II are true D. Both I and II are false

14. The frequency distribution table for test marks of 142 students is given on right, then (median, mode) =

Marks	Frequency	Cumulative Frequency
1	7	7
2	20	27
3	25	52
4	30	82
5	45	127
6	11	138
7	4	142

A. (4, 4) B. (5, 4) C. (5, 5) D. (4, 5)

15. Let $x_1, x_2, \ldots, x_n$ be a realisation of random sample from Normal population with known mean μ, and unknown variance σ^2, then $100(1-\alpha)\%$ Confidence Interval for σ, $CI_{1-\alpha}(\sigma) =$

A. $\left(\sqrt{\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2},n-1}}}, \sqrt{\frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2},n-1}}}\right)$ B. $\left(\sqrt{\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2},n}}}, \sqrt{\frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2},n}}}\right)$

C. $\left(\sqrt{\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{\frac{\alpha}{2},n-1}}}, \sqrt{\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{1-\frac{\alpha}{2},n-1}}}\right)$ D. $\left(\sqrt{\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{\frac{\alpha}{2},n}}}, \sqrt{\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{1-\frac{\alpha}{2},n}}}\right)$

SECTION-B

Answer any three of the following questions, each question carries 10 marks. $3 \times 10 = 30\ M$

16.

a. If 3 balls are randomly drawn from a bowl containing 6 white and 5 black balls, what is the probability that one of the drawn balls is white and other two black? (2.5M)

b. Two fair dice are rolled, what is the conditional probability that at least one lands on 6 given that the dice lands on different numbers? (2.5M)

c. A boy from town wants to become a film maker, so he completed a film making course, now he wants to move to one of the three following cities to try for chances: Hyderabad(Tollywood), Chennai (Kollywood), Mumbai (Bollywood), and he estimated that probabilities of him getting direction chance if he moves to Hyderabad, Chennai, Mumbai as 2/5,3/10,1/5 respectively. He decides the city that he should be moving to based on card pick from well shuffled deck of 52 cards. If red card picked, he will move to Hyderabad, if spades card picked he will move to Chennai, and if clubs card picked, he will move to Mumbai. After some years you found out that he became a director. What is the probability that he is a Bollywood director. (5 M)

17.

a. The PDF of random variable X, the life time of a certain type of electronic device(measured in hours), is given by

$$f_X(x) = \begin{cases} \frac{100}{x^2} & x > 100 \\ 0 & \text{otherwise} \end{cases}$$

What is the probability that of 5 such types of devices at least 2 will function for at least 150 hours? (5M)

b. Let X be the random variable with $PDF, f_X(x) = \frac{1}{\pi(1+x^2)}, \ -\infty < x < \infty$, then find the CDF of $Y = \frac{1}{X}$, hence compute PDF of Y. (5 M)

18.

a. Suppose you are surveying people exiting from a polling booth and asking them if they voted independent, It is estimated that the probability that person voted independent is 0.2.

i. What is the probability 15 people say 'No' before you find 5 people who voted independent. (2.5 M)

ii. What is the probability 12 people must be asked before you find 6 people who voted independent. (2.5 M)

b. From past experience a professor knows that test score of student taking her final examination is a random variable with mean 75, and variance equal to 25, then give a lower bound for the probability that a student will score between 65 and 85? (3 M)

c. The time (in hours) required to repair a machine is exponentially distributed random variable with mean 2. What is The probability that a repair time between 2 and 3 hours. (2 M)

19.

a. The JPDF of (X, Y) is $f_{X,Y}(x, y) = \begin{cases} 2 & 0 < x < y < \\ 0 & \text{otherwise} \end{cases}$, then find $Var(X + Y)$. (5 M)

b. The JPDF of (X, Y) is $f_{X,Y}(x, y) = \begin{cases} cx^2y & 0 < x < y < 1 \\ 0 & \text{otherwise} \end{cases}$, then

i. Find c (2 M)

ii. $P(X + Y > 1)$ (3 M)

20.

a. Each computer chip made in a certain plant will independently be defective with probability 0.2 . If a sample of 1000 chips is tested, use Central Limit Theorem (CLT) to compute the approximate probability that fewer than 220 chips will be defective? (5 M)

b. The frequency distribution table for test marks of 152 students is given on right, find a 5-Number Summary and draw the Box-and-Whisker Plot. (5 M)

Marks	Frequency	Cumulative Frequency
3	3	3
4	11	14
5	16	30
6	33	63
7	22	85
8	39	124
9	21	145
10	7	152

21.

a. Let $X_1, X_2, \ldots, X_n$ be a random sample from population with Exponential distribution with unknown parameter $\lambda > 0$, then derive Maximum likelihood estimator for population mean μ and population variance σ^2. (5 M)

b. A statistician chooses 27 randomly selected dates, and when examining the occupancy records of a particular motel for those dates, finds a (sample) standard deviation of 5.86 rooms rented. If the number of rooms rented is normally distributed, find the 99% confidence interval for the population standard deviation of the number of rooms rented. (*Note:* $\chi^2_{0.005,26} = 48.28$; $\chi^2_{1-0.005,26} = 11.16$) (2.5 M)

c. Suppose 300 people are surveyed to determine if they own a tablet device. Of the 300 surveyed, 110 reported owning a tablet. Find the 95% confidence interval of the true proportion of people who own tablet devices. (2.5 M)

THE END

TABLE 5.1: AREA $\Phi(x)$ UNDER THE STANDARD NORMAL CURVE TO THE LEFT OF X

X	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.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

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2021-2022)

B182276

Date: 26/04/2022
Exam: E2S1_CSE_EST
Subject: Probability and Statistics (PS)

Time: 2 hours
Max Marks: 60
Subject Code: 19MA2102

SECTION-A

Please read each MCQ carefully, making certain to provide only ONE answer for each one. Here each MCQ carries 2 marks. $15 \times 2 = 30\ M$

1. If you throw 10 biscuits (identical) at 3 dogs (Labrador, German Shepard, and Doberman), what is the probability Labrador gets at least two biscuits , each of German Shepard and Doberman gets at least one biscuit.

A. $\frac{3}{10}$ B. $\frac{5}{22}$ C. $\frac{7}{11}$ D. $\frac{14}{33}$ ✓

2. In the exam you are attempting a match the following question (four matchings to be made) which carry four marks (one mark for each correct matching). Suppose you know nothing about that question, so you are randomly doing matching. What is the probability you get 1 mark for that question.

A. $\frac{2}{3}$ B. $\frac{1}{3}$ C. $\frac{1}{5}$ D. $\frac{2}{5}$ ✗

3. A problem in Probability is given to two students A, B(they try solving it on their own), whose chances of solving it are $\frac{1}{3}, \frac{1}{4}$ respectively. What is the probability for problem being solved?

A. 0.2 B. 0.3 C. 0.4 D. 0.5 ✗

4. Let E and F are two events with $P(E) = \frac{2}{3}$, $P(E/F) = \frac{5}{9}$ and $P(F/E) = \frac{5}{8}$, then the $P(F) =$

A. $\frac{3}{5}$ B. $\frac{2}{5}$ C. $\frac{3}{4}$ D. $\frac{1}{4}$ ✗

5. Suppose 6 cards are selected at random without replacement from well shuffled deck of cards. Let X is the random variable which denote the number of Heart cards in the selection, then $P(X \leq 2) =$

A. 0.315 B. 0.230 C. 0.656 D. 0.843 ✓

6. Let X is a random variable with mean $\mu = \frac{1}{2}$, and $\mu_1 = 0, \mu_2 = \frac{1}{4}, and\ \mu_3 = \frac{1}{4}$ then $\mu_3' =$

A. $\frac{3}{4}$ B. $\frac{3}{8}$ C. $\frac{5}{8}$ D. $\frac{1}{2}$ ✓

7. If $A \sim U[0, 5]$, then the probability that the quadratic expression $3x^2 + 4Ax + A > 0 \forall x \in \mathbb{R}$

A. $\frac{3}{10}$ B. $\frac{3}{20}$ C. $\frac{3}{5}$ D. $\frac{4}{15}$ ✓

8. Let X be a random variable with $E(X) = 2$, and $Var(X) = 5$, then $P(X^2 + 7X + 13 \geq 48)$

A. At most $\frac{1}{4}$ B. At least $\frac{1}{4}$ C. At most $\frac{3}{4}$ D. At least $\frac{3}{4}$ ✓

9. If $X \sim N(\mu,4)$, and $P(1 < X < 2) = 0.1915$, then $\mu =$

A. 0 B. 1 C. 2 D. 3

10. A couple wants to have two boys, so they keep making babies until they have second boy. If we let X denote the number of children in that family, then standard deviation of X, $S.D(X) =$

A. 4 B. 3 C. 2 D. 1

11. Let $X_1, X_2, \ldots, X_8 \overset{i.i.d}{\sim} U[0,1]$ then $E(X_{(4)}) =$

A. $\frac{4}{9}$ B. $\frac{5}{8}$ C. $\frac{1}{2}$ D. $\frac{1}{3}$

12. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$ then which of the following is true?

I. $\frac{\sqrt{n}(\overline{X}-\mu)}{S} \sim t_n$ II. $\frac{n(\overline{X}-\mu)^2}{S^2} \sim F_{1,n-1}$

A. Only I true B. Only II true C. Both I and II are true D. Both I and II are False

13. For a random sample $X_1, X_2, \ldots, X_n$ if we consider $T = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2$ as an estimator for population variance σ^2 then the bias of T is

A. 0 B. $\frac{\sigma^2}{n}$ C. $-\frac{\sigma^2}{n}$ D. $\frac{\sigma^2}{n-1}$

14. The frequency distribution table for test marks of 142 students is given on right, then which of the following is true?

Marks	Frequency	Cumulative Frequency
1	7	7
2	20	27
3	25	52
4	30	82
5	45	127
6	11	138
7	4	142

A. Mean < Median < Mode B. Mode < Median < Mean

C. Mean = Median = Mode D. Mean < Mode < Median

15. Let $x_1, x_2, \ldots, x_n$ be a realisation of random sample from Normal population with known mean μ, and unknown variance σ^2, then $100(1-\alpha)\%$ Confidence Interval for σ^2, $CI_{1-\alpha}(\sigma^2) =$

A. $\left(\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2},n-1}}, \frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2},n-1}}\right)$ B. $\left(\frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2},n}}, \frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2},n}}\right)$

C. $\left(\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{\frac{\alpha}{2},n-1}}, \frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{1-\frac{\alpha}{2},n-1}}\right)$ D. $\left(\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{\frac{\alpha}{2},n}}, \frac{\sum_{i=1}^{n}(x_i-\mu)^2}{\chi^2_{1-\frac{\alpha}{2},n}}\right)$

SECTION-B

Answer any three of the following questions, each question carries 10 marks. $3 \times 10 = 30\ M$

16.

a. A bowl contains 16 chips, of which 6 are red, 7 are white and 3 are blue. If four chips are taken at random without replacement, find the probability that

i. Each of the four chips is red (1.5 M)

ii. None of the chips is red (1.5 M)

iii. There is at least one chip of each colour (2 M)

b. A student who graduated PUC wants to be a data scientist. So he decide to chose one of the three following majors in the university: Computer Science(CS), Mathematics(Math), Statistics(Stat), and he estimated that probabilities of him getting a data science job if he has CS degree, Math degree, Stat degree as 0.4,0.5,0.8 respectively. He decides that he will be picking his major by throwing a fair die. If die lands on prime number he pick CS as his major, else if it lands on composite number then he will pick Math as his major, else he will pick Stat as his major. After his university you found out that he became a data scientist. What is the probability that he is a CS Major. (5 M)

17.

a. The *PDF* of random variable X, the life time of a certain type of electronic device(measured in hours), is given by

$$f_X(x) = \begin{cases} \frac{100}{x^2} & x > 100 \\ 0 & \text{otherwise} \end{cases}$$

What is the probability that of 5 such types of devices at least 2 will function for at least 150 hours? (4 M)

b. Let X be the random variable with $PDF, f_X(x) = \begin{cases} \frac{1}{\pi} & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0 & \text{otherwise} \end{cases}$, then find the PDF of $Y = \tan X$. (4 M)

c. Let X is a random variable with $MGF\ M_X(t) = \frac{1}{(1-2t)^2}, -\frac{1}{2} < t < \frac{1}{2}$ then find $E(X)$. (2 M)

18.

a. An airline knows that 5 percent of people who makes reservation on a certain flight do not turn up for the flight, so it sells 52 tickets for 50 seat flight. What is the probability that every passenger who turn up for the flight will get a seat. (3 M)

b. The expected number of typographical errors on page of certain magazine is 0.2. What is the probability that the next page you read contains more than 1 typographical errors. (2 M)

c. The number of years that machine functions is a random variable whose hazard rate function is given by

$$\lambda(t) = \begin{cases} 0.2 & 0 < t < 2 \\ 0.2 + 0.3(t-2) & 2 \le t < 5 \\ 1.1 & t > 5 \end{cases}$$

What is the probability that the machine will still be working six years after being purchased? (3 M)

d. The time (in hours) required to repair a machine is exponentially distributed random variable with mean 2. What is The probability that a repair time between 2 and 3 hours (2 M)

19.

a. The JPDF of (X, Y) is $f_{X,Y}(x,y) = \begin{cases} 2 & 0 < x < y < 1 \\ 0 & \text{otherwise} \end{cases}$, then find $\rho_{X,Y}$ (5 M)

b. If $(X, Y) \sim BVN(0,0,4,3,\frac{\sqrt{3}}{2})$, then find $P(X - 2Y > -4 / X + Y = 10)$ (5 M)

20.

a. Ram is standing on the number line at position 0. He rolls a die repeatedly. If the roll is 1 or 2, he takes one step right(in positive direction). If the roll is 3,4,5 or 6, he takes two steps to the right. Let S_n be the Ram's position after n rolls of the die. Using Central Limit Theorem estimate the probability that S_{90} is at least 160. (5 M)

b. The frequency distribution table for test marks of 152 students is given on right, find a 5-Number Summary and draw the Box-and-Whisker Plot. (5 M)

Marks	Frequency	Cumulative Frequency
3	3	3
4	11	14
5	16	30
6	33	63
7	22	85
8	39	124
9	21	145
10	7	152

21.

a. Let $X_1, X_2, \ldots, X_n$ be a random sample from population with Normal distribution with known mean μ, and unknown variance σ^2, then show that Maximum likelihood estimator for σ^2, $\hat{\sigma}^2_{M.L.E} = \frac{1}{n}\sum_{i=1}^{n}(X_i - \mu)^2$ (5 M)

b. Two different types of electrical cable insulation have recently been tested to determine the voltage level at which failures tend to occur. When specimens were subjected to an increasing voltage stress in a laboratory experiment, failures for the two types of cable insulation occurred at the following voltages:
Type-1: 36, 54, 44, 52, 41, 37, 53, 51 ; **Type-2:** 52, 60, 64, 44, 38, 48, 68.
Suppose that it is known that the amount of voltage that cables having Type-1 insulation can withstand is normally distributed with unknown mean μ_1, and known variance σ_1^2=40, whereas the corresponding distribution for Type-2 insulation is normal with unknown mean μ_2 and known variance σ_2^2=100. Find the 98% percent confident interval for $\mu_1 - \mu_2$. **[Note:** $z_{0.01} = 2.326$ **]** (2.5 M)

c. Viscosity of two brands of oil used in cars is measured and the following data is recorded.
Brand-1:10.62, 10.58, 10.33,10.72, 10.44; **Brand-2:**10.50, 10.52, 10.62, 10.53.
Assuming the viscosity of both brands normally distributed. Find the 95% confidence interval for the ratio of the variances for viscosity of two brands. **[Note:** $F_{1-0.025,3,4} = 0.066$, $F_{0.025,3,4} = 9.98$ **]** (2.5 M)

****THE END****

TABLE 5.1: AREA $\Phi(z)$ UNDER THE STANDARD NORMAL CURVE TO THE LEFT OF X

X	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.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

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2021-2022)

B182276.

Date: 11/04/2022
Exam: E2S1_CSE_MT2
Subject: Probability and Statistics (PS)

Time: 1 hour
Max Marks: 30
Subject Code: 19MA2102

SECTION-A

Please read each MCQ carefully, making certain to provide only ONE answer for each one. $10 \times 2 = 20$

1. Suppose the life distribution of an item has hazard rate function, $\lambda(t) = t^2$. What is the probability that a 1-year old item will survive to age 2.

A. $e^{-\frac{5}{3}}$ B. $e^{-\frac{5}{2}}$ C. $e^{-\frac{7}{2}}$ D. $e^{-\frac{7}{3}}$

2. If $X \sim Bin(n,p)$ with $E(X) = 2$ and $Var(X) = \frac{2}{3}$ then $P(X \geq 1) =$

A. $\frac{26}{27}$ B. $\frac{1}{27}$ C. $\frac{8}{27}$ D. $\frac{19}{27}$

3. Let (X,Y) is bivariate random variable with $\sigma_X^2 = 16$, $\sigma_Y^2 = 9$ and $Cov(X,Y) = 7$, then $\rho_{5X-9,3Y+2} =$

A. 0.048 B. 0.583 C. 0.417 D. 0.834

4. Which of the following is a Cauchy-Schwartz inequality

A. $[E(XY)]^2 \leq [E(X)]^2[E(Y)]^2$ B. $[E(XY)]^2 \leq E(X^2)E(Y^2)$

C. $E(XY)^2 \leq E(X^2)E(Y^2)$ D. $E(X^2Y^2) \leq [E(X)]^2[E(Y)]^2$

5. Let $(X,Y) \sim BVN(3,1,16,25,0.6)$, then $E(Y \mid X = 8)$

A. 4.0 B. 4.25 C. 4.75 D. 4.50

6. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$ then which of the following is true?

I. $\sum_{i=1}^{n} \left(\frac{X_i - \bar{X}}{\sigma}\right)^2 \sim \chi_n^2$ II. $\frac{\sqrt{n}(\bar{X} - \mu)}{S} \sim t_{n-1}$

A. Only I true B. Only II true C. Both I and II are true D. Both I and II are False

7. The approximate(using CLT) probability of $P(\chi_{50}^2 \leq 45) =$

A. 0.309 B. 0.456 C. 0.721 D. 0.856

8. If $X_1, X_2, X_3, \ldots X_n$ are independent and identically distributed (i.i.d) random variables with population $PDF\ f(x)$ and $CDF\ F(x)$ then PDF of $X_{(1)}$?

A. $(1 - F(x))^{n-1} f(x)$ B. $(F(x))^{n-1} f(x)$ C. $n(1 - F(x))^{n-1} f(x)$ D. $n(F(x))^{n-1} f(x)$

9. The frequency distribution table for test marks of 142 students is given on right, then 58th Population Percentile $P_{58} =$

A. 4 B. 5 C. 4.5 D. 5.5

Marks	Frequency	Cumulative Frequency
1	7	7
2	20	27
3	25	52
4	30	82
5	45	127
6	11	138
7	4	142

10. Let $X_1, X_2, \ldots, X_5$ be a random sample from population having mean μ and variance σ^2. Consider following estimators.

$\hat{\theta}_1 = \frac{X_1 + X_3 + X_5}{4}$, $\hat{\theta}_2 = \frac{2X_1 + X_3 + X_5}{2}$, and $\hat{\theta}_3 = \frac{\bar{X}}{5}$,

Which of the following is an unbiased estimator of μ

A. $\hat{\theta}_1$ B. $\hat{\theta}_2$ C. $\hat{\theta}_3$ D. None of the above

SECTION-B

Answer any two of the following questions. $2 \times 5 = 10$

11. Suppose you are surveying people exiting from a polling booth and asking them if they voted independent, It is estimated that the probability that person voted independent is 0.2.

i. What is the probability 15 people say 'No' before you find 5 people who voted independent. (2.5 M)

ii. What is the probability 12 people must be asked before you find 6 people who voted independent. (2.5 M)

12. The $JPDF$ of (X, Y) $f_{X,Y}(x, y) = \begin{cases} 2 & 0 < y < x < 1 \\ 0 & \text{otherwise} \end{cases}$, then Find $Var(X - Y)$ (5M)

13. Let $(X, Y) \sim BVN(1,0,1,4,0.5)$ then find,

i. $P(2X + Y \leq 3)$ ii. $Cov(X + Y, 2X - Y)$ (3M +2M)

14.

i. Let $X_1, X_2, \ldots, X_n$ be a random sample from population with Exponential distribution with unknown parameter $\lambda > 0$, then find $M.L.E$ for population variance σ^2. (3M)

ii. A statisticians chooses 27 randomly selected dates, and when examining the occupancy records of a particular motel for those dates, finds a (sample) standard deviation of 5.86 rooms rented. If the number of rooms rented is normally distributed, find the 99% confidence interval for the population standard deviation of the number of rooms rented. (Note: $\chi^2_{0.005,26} = 48.28$, and $\chi^2_{1-0.005,26} = 11.16$) (2M)

**** THE END ****

TABLE 5.1: AREA $\Phi(x)$ UNDER THE STANDARD NORMAL CURVE TO THE LEFT OF X

X	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.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

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2020-2021)

Date: 07/10/2021
Exam: E2S1_CSE_MT
Subject: Probability and Statistics (PS)

Time: 30 minutes
Max Marks: 20
Subject Code: 19MA2102

Please read each question below carefully, making certain to provide only ONE answer for each multiple choice question. Here each MCQ carries 2 marks. $10 \times 2 = 20$

1. In the exam you are attempting a match the following question (four matchings to be made) which carry four marks (one mark for each correct matching). Suppose you know nothing about that question, so you are randomly doing matching. What is the probability you get zero marks for that question.

   A. $\frac{1}{12}$ B. $\frac{3}{8}$ C. $\frac{5}{8}$ D. $\frac{1}{8}$

2. A problem in Probability is assigned to two students A, B (and they try on their own to solve it), whose chances of solving it are $\frac{1}{3}, \frac{1}{4}$ respectively. What is the probability for the problem being solved?

   A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $\frac{1}{4}$ D. $\frac{3}{4}$

3. If $X \sim Bin(n,p)$ with $E(X) = 2$ and $Var(X) = \frac{2}{3}$ then $P(X \geq 1) =$

   A. $\frac{26}{27}$ B. $\frac{1}{27}$ C. $\frac{8}{27}$ D. $\frac{19}{27}$

4. Let X be a random variable with $E(X) = 4$ then the possible value for $E(X^2)$

   A. 13 B. 14 C. 15 D. 17

5. Let X is continuous random variable with $MGF\ M_X(t) = e^{t+\frac{t^2}{2}}$, then $E(X-1)^5 =$

   A. 1 B. 0 C. 2 D. -1

6. Which of the following is a Cauchy-Schwartz inequality

A. $[E(XY)]^2 \leq [E(X)]^2[E(Y)]^2$

B. $|E(XY)|^2 \leq E(X^2)E(Y^2)$

C. $E(XY)^2 \leq E(X^2)E(Y^2)$

D. $E(X^2Y^2) \leq [E(X)]^2[E(Y)]^2$

7. Let X and Y are jointly distributed random variables with $E(X) = 15, E(Y) = 20$, $E(X^2) = 250, E(Y^2) = 500$ and $Cov(X, Y) = -30$, then $Var(X + Y) =$

A. 185 B. 125 C. 65 D. 150

8. Let $(X, Y) \sim BVN(3,1,16,25,0.6)$, then $E(Y \mid X = 7)$

A. 5 B. 4 C. 3 D. 2

9. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$ then

A. $\frac{\sqrt{n}(\overline{X} - \mu)}{S} \sim t_{n-1}$

B. $\frac{\sqrt{n}(\overline{X} - \mu)}{S} \sim t_n$

C. $\frac{\sqrt{n}(\overline{X} - \mu)}{S} \sim \chi^2_{n-1}$

D. $\frac{\sqrt{n}(\overline{X} - \mu)}{S} \sim \chi^2_n$

10. Let $X_1, X_2, \ldots, X_{10} \overset{i.i.d}{\sim} U[0,1]$ then $E(X_{(4)}) =$

A. $\frac{1}{2}$ B. $\frac{5}{11}$ C. $\frac{4}{11}$ D. $\frac{4}{7}$

*** THE END***

Standard Normal Table

TABLE 5.1: AREA $\Phi(x)$ UNDER THE STANDARD NORMAL CURVE TO THE LEFT OF X

X	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
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.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
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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

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2021-2022)

B181500

Date: 11/04/2022
Exam: E2S1_CSE_MT2
Subject: Probability and Statistics (PS)

Time: 1 hour
Max Marks: 30
Subject Code: 19MA2102

SECTION-A

Please read each MCQ carefully, making certain to provide only ONE answer for each one. $10 \times 2 = 20$

1. Suppose the life distribution of an item has hazard rate function, $\lambda(t) = t^2$. What is the probability that a 1-year old item will survive to age 2.

A. $e^{-\frac{5}{3}}$ B. $e^{-\frac{5}{2}}$ C. $e^{-\frac{7}{2}}$ D. $e^{-\frac{7}{3}}$

2. If $X \sim Bin(n,p)$ with $E(X) = 2$ and $Var(X) = \frac{2}{3}$ then $P(X \geq 1) =$

A. $\frac{26}{27}$ B. $\frac{1}{27}$ C. $\frac{8}{27}$ D. $\frac{19}{27}$

3. Let (X,Y) is bivariate random variable with $\sigma_X^2 = 16$, $\sigma_Y^2 = 9$ and $Cov(X,Y) = 7$, then $\rho_{5X-9,3Y+2} =$

A. 0.048 B. 0.583 C. 0.417 D. 0.834

4. Which of the following is a Cauchy-Schwartz inequality

A. $[E(XY)]^2 \leq [E(X)]^2[E(Y)]^2$ B. $[E(XY)]^2 \leq E(X^2)E(Y^2)$

C. $E(XY)^2 \leq E(X^2)E(Y^2)$ D. $E(X^2Y^2) \leq [E(X)]^2[E(Y)]^2$

5. Let $(X,Y) \sim BVN(3,1,16,25,0.6)$, then $E(Y \mid X = 8)$

A. 4.0 B. 4.25 C. 4.75 D. 4.50

6. Let $X_1, X_2, \ldots, X_n \overset{i.i.d}{\sim} N(\mu, \sigma^2)$ then which of the following is true?

I. $\sum_{i=1}^{n} \left(\frac{X_i - \bar{X}}{\sigma}\right)^2 \sim \chi_n^2$ II. $\frac{\sqrt{n}(\bar{X} - \mu)}{S} \sim t_{n-1}$

A. Only I true B. Only II true C. Both I and II are true D. Both I and II are False

7. The approximate(using CLT) probability of $P(\chi_{50}^2 \leq 45) =$

A. 0.309 B. 0.456 C. 0.721 D. 0.856

8. If $X_1, X_2, X_3, \ldots X_n$ are independent and identically distributed (i.i.d) random variables with population $PDF\ f(x)$ and $CDF\ F(x)$ then PDF of $X_{(1)}$?

A. $(1 - F(x))^{n-1} f(x)$ B. $(F(x))^{n-1} f(x)$ C. $n(1 - F(x))^{n-1} f(x)$ D. $n(F(x))^{n-1} f(x)$

9. The frequency distribution table for test marks of 142 students is given on right, then 58th Population Percentile $P_{58} =$

Marks	Frequency	Cumulative Frequency
1	7	7
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4	30	82
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7	4	142

A. 4 B. 5 C. 4 .5 D. 5.5

10. Let $X_1, X_2, \ldots, X_5$ be a random sample from population having mean μ and variance σ^2. Consider following estimators.

$\hat{\theta}_1 = \frac{X_1 + X_3 + X_5}{4}$, $\hat{\theta}_2 = \frac{2X_1 + X_3 + X_5}{2}$, and $\hat{\theta}_3 = \frac{\bar{X}}{5}$,

Which of the following is an unbiased estimator of μ

A. $\hat{\theta}_1$ B. $\hat{\theta}_2$ C. $\hat{\theta}_3$ D. None of the above

SECTION-B

Answer any two of the following questions. $2 \times 5 = 10$

11. Suppose you are surveying people exiting from a polling booth and asking them if they voted independent, It is estimated that the probability that person voted independent is 0.2.

i. What is the probability 15 people say 'No' before you find 5 people who voted independent. (2.5 M)

ii. What is the probability 12 people must be asked before you find 6 people who voted independent. (2.5 M)

12. The $JPDF$ of (X, Y) $f_{X,Y}(x, y) = \begin{cases} 2 & 0 < y < x < 1 \\ 0 & \text{otherwise} \end{cases}$, then Find $Var(X - Y)$ (5M)

13. Let $(X, Y) \sim BVN(1,0,1,4,0.5)$ then find,

i. $P(2X + Y \leq 3)$ ii. $Cov(X + Y, 2X - Y)$ (3M +2M)

14.

i. Let $X_1, X_2, \ldots, X_n$ be a random sample from population with Exponential distribution with unknown parameter $\lambda > 0$, then find $M.L.E$ for population variance σ^2. (3M)

ii. A statisticians chooses 27 randomly selected dates, and when examining the occupancy records of a particular motel for those dates, finds a (sample) standard deviation of 5.86 rooms rented. If the number of rooms rented is normally distributed, find the 99% confidence interval for the population standard deviation of the number of rooms rented. (Note: $\chi^2_{0.005,26} = 48.28$, and $\chi^2_{1-0.005,26} = 11.16$) (2M)

**** THE END ****

TABLE 5.1: AREA $\Phi(x)$ UNDER THE STANDARD NORMAL CURVE TO THE LEFT OF X

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.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.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

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2020-2021)

Date: 07/10/2021
Exam: E2S1_CSE_EST
Subject: Probability and Statistics (PS)

Time: 2 hours
Max Marks: 60
Subject Code: 19MA2102

SECTION-A

Please read each question below carefully, making certain to provide only ONE answer for each multiple choice question. Here each MCQ carries 2 marks. $15 \times 2 = 30\ M$

1. If you throw 7 bananas(identical) at 3 monkeys, what is the probability each monkey gets at least one banana.

   A. $\frac{5}{11}$ B. $\frac{5}{12}$ C. $\frac{3}{12}$ D. $\frac{2}{11}$

2. Let E and F are two events with $P(E) = \frac{2}{3}$, $P(F) = \frac{3}{4}$, and $P(F/E) = \frac{5}{8}$, then the $P(E/F) =$

   A. $\frac{5}{9}$ B. $\frac{4}{9}$ C. $\frac{4}{5}$ D. $\frac{2}{3}$

3. Consider two boxes, one box containing 1 black and 1 white marble, second box contains 2 black and 1 white marble. A box is selected at random, and a marble is drawn at random from the selected box. What is the probability that white marble is drawn?

   A. $\frac{1}{6}$ B. $\frac{5}{12}$ C. $\frac{1}{9}$ D. $\frac{4}{9}$

4. Let X be a random variable with PDF $f_X(x) = \frac{1}{x^2}$, $1 < x < \infty$, zero elsewhere. Median $Q_{1/2} =$

   A. 1 B. 1.5 C. 2 D. 3

5. Let X is a random variable with PDF $f_X(x) = \frac{e^x}{(1+e^x)^2}$, $-\infty < x < \infty$, then $P(X > 1) =$

   A. $\frac{1}{1+e}$ B. $\frac{2}{(1+e)^2}$ C. $\frac{1}{2(1+e)}$ D. $\frac{2}{1+e}$

6. Let $f(x) = \begin{cases} cx^3(1-x)^4 & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$

   A. 240 B. 120 C. 280 D. 60

7. A group of 600 equally smart students from all over the world will be giving 63^{rd} IMO (International Mathematical Olympiad) test for year 2022, and if we assume the probability that a student achieve perfect score in the test is 0.001. What is the (approximate) probability that at least one student achieve the perfect score in the 63^{rd} IMO?

A. 0.2230 B. 0.4511 C. 0.1125 D. 0.6620

8. Let X be a random variable with $E(X) = 2$, and $Var(X) = 5$, then $P(X^2 + 7X + 13 \geq 48)$

A. At most $\frac{1}{4}$ B. At most $\frac{3}{4}$ C. At least $\frac{1}{4}$ D. At least $\frac{3}{4}$

9. If $X \sim N(1,\sigma^2)$, and $P(1 < X < 2) = 0.1915$, then $\sigma =$

A. 4 B. 3 C. 2 D. 1

10. Suppose that the life distribution of an item has hazard rate function. $\lambda(t) = 1 + 2t, t > 0$. What is the probability that item survive to age 3.

A. e^{-2} B. e^{-3} C. e^{-9} D. e^{-12}

11. If $M_X(t) = e^{2(e^t-1)}$, then $P(X \geq 1) =$

A. e^{-2} B. $\frac{1-e^{-2}}{2}$ C. $-\frac{e^{-2}}{2}$ D. $1 - e^{-2}$

12. If X_1, X_2, X_3 are (pairwise) uncorrelated random variables each having mean 0 and variance 1, then $Cov(X_1 + X_2, X_2 + X_3) = ?$

A. 0 B. 1 C. 2 D. 3

13. If $(X, Y) \sim BVN(2,1,4,9,-\frac{1}{2})$, then $P(1 < X < 3/Y = 1) =$

A. 0.3411 B. 0.4362 C. 0.6223 D. 0.5672

14. If X follows the Chi-squared distribution with 8 degrees of freedom then $E(X^2) =$

A. 20 B. 40 C. 60 D. 80

15. The $JPDF$ of (X, Y) $f_{X,Y}(x,y) = \begin{cases} 4xy & 0 < x < 1, 0 < y < 1 \\ 0 & \text{otherwise} \end{cases}$, then

$P\left(0 < X < \frac{1}{2}, \frac{1}{2} < Y < 1\right) =$

A. $\frac{1}{16}$ B. $\frac{5}{16}$ C. $\frac{3}{16}$ D. $\frac{7}{16}$

SECTION-B

Answer any three of the following questions, each question carries 10 marks. $3 \times 10 = 30\ M$

16.

a. A bowl contains 16 chips, of which 6 are red, 7 are white and 3 are blue. If four chips are taken at random without replacement, find the probability that

i. Each of the four chips is red (1.5 M)

ii. None of the chips is red (1.5 M)

iii. There is at least one chip of each colour (2 M)

b. A laboratory blood test is 95% effective in detecting a certain disease when it is in fact present. However, the test also yields a "false positive result" for 1 precent of healthy persons tested. If 0.5 percent population actually has the disease, what is the probability a person has the disease given that the test result is positive? (5 M)

17.

a. The probability density function of X, the life time of a certain type of electronic device(measured in hours), is given by $f_X(x) = \begin{cases} \frac{10}{x^2} & x > 10 \\ 0 & x \leq 10 \end{cases}$

What is the probability that of 6 such types of devices at least 3 will function for at least 20 hours? (5 M)

b. Let X be the random variable with $PDF, f_X(x) = \frac{1}{\pi(1+x^2)}, \ -\infty < x < \infty$, then find the CDF of $Y = \frac{1}{X}$, hence compute PDF of Y. (5 M)

18.

a. When three friends go for coffee, they decide who will pay the bill by each flipping a coin and letting the "odd person" pay. If all three flips are same (so there is no odd person), then they make second round flips and continue to do so until there is an odd person. What is the probability that ,

i. Exactly three rounds of flips are made (2 M)

ii. More than 4 rounds are needed (3 M)

b. The time (in hours) required to repair a machine is exponentially distributed random variable with mean 2. What is,

i. The probability that a repair time between 2 and 3 hours (2 M)

ii. The conditional probability that a repair takes at least 10 hours, given that its duration exceeds 9 hours (3 M)

19.

a. The JPDF of (X, Y) is $f_{X,Y}(x,y) = \begin{cases} cx^2y & 0 < x < y < 1 \\ 0 & \text{otherwise} \end{cases}$, then

i. Find c (2 M)

ii. $P(X+Y \le 1)$ (3 M)

b. The JPDF of (X, Y) is given by $f_{X,Y}(x,y) = \begin{cases} \frac{3}{2}(x^2+y^2) & 0 < x < 1, 0 < y < 1 \\ 0 & \text{otherwise} \end{cases}$

then find the $Cov(X, Y)$ (5 M)

20.

a. From past experience a professor knows that test score of student taking her final examination is a random variable with mean 75.

i. Give an upper bound for the probability that a students test score will exceed 85. (2 M)

ii. Suppose, in addition, the professor knows that the variance of a student's test score is equal to 25, then what can be said the probability that a student will score between 65 and 85? (3 M)

b. Find all the moments of the distribution with $MGF\ M_X(t) = \frac{1}{(1-2t)^2}, \quad -\frac{1}{2} < t < \frac{1}{2}$ (5 M)

21.

a. Kalyan is standing on the number line at position 0. He toss a biased coin (with probability of head $\frac{1}{3}$) repeatedly. If the coin lands on heads, he takes one step right(in positive direction),if the coin lands on tails, he takes two steps to the right. Let S_n denote the Kalyan's position after n coin tosses. Use CLT to estimate the $P(S_{90} \ge 160)$ (5 M)

b. The time it takes a CPU unit to process a certain types of job is normally distributed with mean 20 seconds and standard deviation 3 seconds. If a sample of 15 jobs is observed, what is the probability that the sample variance will exceed 12 ? (*Note:* $F_{\chi^2_{14}}(18.67) = 0.82205$) (5 M)

THE END

B171598.

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2020-2021)

Civil Engineering

Subject : **Probability and Statistics**
Date : **07-10-2021**
Exam : **E2S1EST**

Subject Code : **19MA2103**
Time : **2 hrs**
Max Marks : **60**

SECTION - A

Answer all the questions. Each question carries 2 mark. *(2×15 = 30)*

1. A box contains 20 tickets numbered from 1 to 20. A ticket is drawn at random, what is the probability that it is divisible by 3 or 4

   A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) None of the above

2. Which of the following $c.d.f$ property is NOT correct

   A) $F(\infty) = 1$ B) $F(-\infty) = 0$

   C) $P(a < x \leq b) = F(b) - F(a)$ D) None of the above

3. The $p.d.f$ of random variable X is $f(x) = \begin{cases} 0 & ; x < 0 \\ \frac{x}{3} & ; 0 \leq x < 1 \\ \frac{x+1}{3} & ; 1 \leq x < 2 \\ 0 & ; x \geq 2 \end{cases}$ then $P(0 < x \leq 1.5)$ value

   A) $\frac{7}{24}$ B) $\frac{13}{24}$ C) $\frac{5}{12}$ D) None of the above

4. The $m.p.d.f$ of X; when $j.p.d.f$ of (X, Y) is

   $$f(x,y) = \begin{cases} \frac{1}{8}(6 - x - y) & ; 0 < x < 2, 2 < y < 4 \\ 0 & ; \text{otherwise} \end{cases}$$

   A) $\frac{1}{8}(3 - x)$ B) $\frac{1}{3}(6 - 2x)$ C) $\frac{1}{4}(3 - x)$ D) None of the above

5. The expected number $E[X]$ of heads in tossing three coins

   A) 1.5 B) 2 C) 1 D) None of the above

6. The variance of discrete uniform distribution is

   A) $\frac{n+1}{2}$ B) $\frac{(n+1)(2n+1)}{6}$ C) $\frac{n^2-1}{12}$ D) None of the above

7. The cumulative distribution function of exponential distribution is

A) $F(x) = (1 - e^{-\lambda x})$ B) $F(x) = (1 + e^{-\lambda x})$

C) $F(x) = (1 + e^{\lambda x})$ D) None of the above

8. The moment generating function $M_X(t)$ of continuous random variable X, where it exists is

A) $\sum_x e^{tx} f(x)$ B) $\int_{-\infty}^{\infty} e^{tx} f(x)dx$

C) $\int_{-\infty}^{\infty} x^n f(x)dx$ D) None of the above

9. Which of the following is the correct relation between r^{th} moment μ_r' and moment generating function $M_X(t)$

A) $\left[\frac{d}{dt} M_X(t)\right]_{t=0} = \mu_r'$ B) $\left[\frac{d^{r-1}}{dt^{r-1}} M_X(t)\right]_{t=0} = \mu_r'$

C) $\left[\frac{d^r}{dt^r} M_X(t)\right]_{t=0} = \mu_r'$ D) None of the above

10. The sample variance (s^2) of the points 4,3,5,7,2,9,11,7 is

A) 9.43 B) 4.72 C) 14.15 D) None of the above

11. The value of a test statistic which separates the rejection region and the acceptancce region is called

A) Alternative value B) Level of significance

C) Critical value D) None of the above

12. For large values of n, the binomial distribution tends to

A) Exponential distribution B) Gamma distribution

C) Uniform distribution D) None of the above

13. The variance value of $t - distribution$ is allways

A) > 0 B) > 1 C) > 2 D) None of the above

14. Which of the following is the property of $F - distribution$

A) Positively skewed B) Negatively skewed

C) Not skewed D) None of the above

15. The size of small sample is

A) < 50 B) < 100 C) < 200 D) None of the above

SECTION - B

Answer any three of the following questions. *(3×10 = 30)*

1. a)) Define random variable. A random variable X has the following probability function.

x	-2	-1	0	1	2	3
$p(x)$	0.1	k	0.2	$2k$	0.3	k

Find k, mean, variance values. (5)

b) Define cumulative distribution function. Let the probability density function of a random variable X is $f(x) = \begin{cases} 0 & ; x < 0 \\ kx & ; 0 \le x < 1 \\ k(x+1) & ; 1 \le x < 2 \\ 0 & ; x \ge 2 \end{cases}$. Find $c.d.f.$ (5)

2. a) The $j.p.d.f$ X and Y is given by $P(x,y) = \frac{1}{36}(x+y)$, $x = 1,2,3$; $y = 1,2,3$. Find marginal distributions of X and Y, conditional distribution of X given Y. (5)

b) Average life time of certain electric tubes 400 hrs, which is exponentially distributed.
i) Find the probability that the tube functioning more than 600 hrs and less than 700 hrs.
ii) Out of 6 tubes, what is the probability that exactly 2 tubes functioning more than 300 hrs. (5)

3. a) Define Normal distribution and find its mean and variance. (5)

b) Find moment generating function of the random variable where $p.d.f$ is given by $f(x) = \begin{cases} e^{-x} & ; x > o \\ 0 & ; otherwise \end{cases}$ and use it to find μ_r' (5)

4. a) Write the procedure for testing of hypothesis. (5)

b) A survey was conducted on TB patients in India. The data received that 1% of population are suffering from TB in the country. A sample data was collected in two colleges. In college A there are 5 TB patients out of 400 students and in college B there are 10 TB patients out of 1200 students. Test the significance difference between the proportion of TB patients in 2 colleges. (5)

5. a) A random sample of 1600 students has a mean score 99. Test whether the sample has been drawn from a population with mean score 100 and standard deviation 15. (5)

b) A factory is producing the bolts with the average diameter $21mm$. A random sample of 25 bolts has a mean diameter $2.26mm$ and standard deviation $3mm$. Can we assume that the sample has been drawn from the population at 5% level of significance? (5)

6. a) A continuous random variable X has a $p.d.f$ $f(x) = 3x^2$, $0 \leq x \leq 1$. Find 'a' and 'b' such that (i) $P(X \leq a) = P(X > a)$ and $(ii) P(X > b) = 0.05$. **(5)**

b) X is a normal variate with mean 30 and standard deviation 5. Find the probability $P(|X - 30| > 5)$. (Note: $\int_0^1 g(z)dz = 0.3413$) **(5)**

*****END OF THE PAPER*****

Rajiv Gandhi University of Knowledge Technologies

Basar, Telangana State

E2_SEM1_MT_Probability and Statistics (A.Y. 2020 - 2021)

Subject Code: 19MA2103

Date: 07-10-2021
Branch: CIVIL

Time: 30 Minutes
Max Marks: 20 Marks

Answer all the questions. Each question carries 2 mark.

1. A bag contains 3 red, 6 white and 7 blue balls. What is the probability that two balls drawn are white and red.

   A) $\frac{1}{4}$ B) $\frac{1}{20}$ C) $\frac{3}{20}$ D) None of the above

2. The random variable X: *"The length of time to play 18 holes of golf"* is

   A) Discrete random variable B) Continuous random variable.

   C) Bivariate random variable D) None of the above

3. The $j.p.m.f$ of bivariate random variable (X, Y) is

   $p(x,y) = \begin{cases} k(x+2y); & x = 0,1,2; y = 0,1 \\ 0; & otherwise \end{cases}$. Then k value is

   A) $\frac{1}{12}$ B) $\frac{1}{6}$ C) $\frac{1}{3}$ D) None of the above

4. The probability distribution of random variable X is defined as $P(x = 0) = 0.16$, $P(x = 1) = 0.48$ *and* $P(x = 2) = 0.36$ then σ^2 value is

   A) 0.4 B) 0.5 C) 0.45 D) None of the above

5. The $E[X^2]$ value of continuous uniform distribution is

   A) $\frac{a^2+ab+b^2}{3}$ B) $\frac{a+ab+b}{3}$ C) $\frac{a+b}{2}$ D) None of the above

6. Which of the following is *NOT* the characteristic of Normal distribution graph

   A) Graph is bell shaped B) Graph is symmetric about $x = \mu$

   C) Graph is flatten for large values of σ D) None of the above

7. Let $X_1, X_2, \ldots X_n$ be a sample of values from the population. The sample mean is defined as $\bar{X} = \frac{X_1 + X_2 + \cdots + X_n}{n}$ then $var(\bar{X}) =$

   A) $n\sigma^2$ B) σ^2 C) $\frac{\sigma^2}{n}$ D) None of the above

8. The standard deviation of the sampling distribution of a statistic is known as
   A) Standard level of significance
   B) Standard error
   C) Standard mean
   D) None of the above

9. In Z-test for single mean, the test statistic is
   A) $Z = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$
   B) $Z = \frac{\bar{x}-\mu}{\sigma^2}$
   C) $Z = \frac{\bar{x}-\mu}{n}$
   D) None of the above

10. The number of independent ways by which a dynamic system can move without violating any conditions imposed on it is called
   A) Degree of test
   B) Degree of independency
   C) Degree of freedom
   D) None of the above

*****END OF THE PAPER*****

B182205

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR
(A.Y. 2021-2022)

Civil Engineering

Subject : **Probability and Statistics**
Date : **26-04-2022**
Exam : **E2S1EST**

Subject Code : **MA2103**
Time : **2 hrs**
Max Marks : **60**

SECTION - A

Answer all the questions. Each question carries 2 mark. *(15× 2 = 30)*

1. A bag contains 3 red, 6 white and 7 blue balls. What is the probability that two balls drawn are white and red.

   A) $\frac{1}{4}$ B) $\frac{1}{20}$ C) $\frac{3}{20}$ D) None of the above

2. The $m.p.d.f$ of random variable X; when $j.p.d.f$ of (X, Y) is

   $$f(x) = \begin{cases} \frac{4}{3}(x - xy + y); 0 < x < 1, 0 < y < 1 \\ 0; \quad otherwise \end{cases}$$

   A) $\frac{1}{3}(x+1)$ B) $\frac{2}{3}(x+1)$ C) $\frac{4}{3}(x+1)$ D) None of the above

3. The $p.d.f$ of random variable X is $f(x) = \begin{cases} 0 & ; x < 0 \\ \frac{x}{3} & ; 0 \le x < 1 \\ \frac{x+1}{3} & ; 1 \le x < 2 \\ 0 & ; x \ge 2 \end{cases}$ then $P(0 < x \le 1.5)$ value

   A) $\frac{7}{24}$ B) $\frac{13}{24}$ C) $\frac{5}{12}$ D) None of the above

4. The $E[X^2]$ value of continuous uniform distribution is

   A) $\frac{a^2+ab+b^2}{3}$ B) $\frac{a+ab+}{3}$ C) $\frac{a+b}{2}$ D) None of the above

5. The mean of Negative binomial distribution is

   A) $\frac{rq}{p^2}$ B) $\frac{rq}{p}$ C) rq D) None of the above

6. The cumulative distribution function of exponential distribution is

   A) $F(x) = (1 - e^{-\lambda x})$ B) $F(x) = (1 + e^{-\lambda x})$
   C) $F(x) = (1 + e^{\lambda x})$ D) None of the above

7. The moment generating function $M_X(t)$ of continuous random variable X, where it exists is

A) $\sum_x e^{tx} f(x)$ B) $\int_{-\infty}^{\infty} e^{tx} f(x)dx$

C) $\int_{-\infty}^{\infty} x^n f(x)dx$ D) None of the above

8. If the number of bernouli trials are very huge then we use the following distribution

A) *Negative binomial* B) *Poisson* C) *Geometric* D) None of the above

9. Which of the following is *NOT* the characteristic of Normal distribution graph

A) Graph is bell shaped B) Graph is symmetric about $x = \mu$

C) Graph is flatten for large values of σ D) None of the above

10. Which moment measures the central location μ_1'

A) First moment B) Second moment C)Third moment D) None of the above

11. For large values of n, the binomial distribution tends to

A) Exponential distribution B) Gamma distribution

C) Uniform distribution D) None of the above

12. The number of independent ways by which a dynamic system can move without violating any condition imposed on it is called

A) Degree of freedom B) Degree of test

C) Degree of independency D) None of the above

13. In the procedure of testing of hypothesis if $|Z| < Z_\alpha$ then we may

A) Reject H_0 B) Accept H_0 C) Indecisive D) None of the above

14. For large degree of freedom, the $t-$ distribution becomes more similar to

A) Exponential distribution B) Uniform distribution

C) Normal distribution D) None of the above

15. The variance value of $t-$ *distribution* is always

A) > 2 B) > 0.5 C) > 0 D) None of the above

SECTION - B

$(3 \times 10 = 30)$

Answer any three of the following questions.

1. a)) Define random variable. A random variable X has the following probability function.

x	0	1	2	3	4	5	6	7	8
$p(x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Find $'a'$, $P(X < 3), P(X \geq 3), P(0 < X < 5)$ (5)

b) Define cumulative distribution function. Let the probability density function of a random variable X is $f(x) = \begin{cases} 0 & ; x < 0 \\ kx & ; 0 \leq x < 1 \\ k(x+1) & ; 1 \leq x < 2 \\ 0 & ; x \geq 2 \end{cases}$. Find $c.d.f.$ (5)

2. a) Define binomial distribution and find its mean and variance. (5)

b) The $j.p.d.f$ X and Y is given by $f(x,y) = \begin{cases} \frac{1}{8}(6-x-y) & ; 0 < x < 2, 2 < y < 4 \\ 0 & ; otherwise \end{cases}$, Find $P(x < 1)$ and $P(x + y < 3)$ (5)

3. a) Buses arrives at a specified stop at 15 minutes intervals starting ar $7am$ $i.e$, they arrive at $7{:}00, 7{:}15, 7{:}30, 7{:}45am$ and so on. If a passenger arrives the stop at time $i.e$, uniformly distributed by $7{:}00am$ and $7{:}30am$. Find the probability that passenger waits
(i) Less than 5 minutes for bus (ii) More than 10 minutes for bus (5)

b) Given that X has the probability distribution $f(x) = \frac{1}{8}3_{C_x} : x = 0,1,2,3$. Find moment generating function of this random variable and use it to determine μ_1' and μ_2' (5)

4. a) A coin was thrown 400 times and head resulted 240 times. Test whether coin is unbiased at 1% level of significance. $(Z_\alpha = 2.58)$ (5)

b) A survey was conducted on TB patients in India. The data received that 1% of population are suffering from TB in the country. A sample data was collected in two colleges. In college A there are 5 TB patients out of 400 students and in college B there are 10 TB patients out of 1200 students. Test the significance difference between the proportions of TB patients in 2 colleges. (5)

5. a) The standard deviations of two samples of sizes 1000 and 500 are 2.6 and 2.7 respectively, assuming that the samples are independent. Find whether the two samples have come from the populations with same standard deviation at 5% level of significance. $(z_\alpha = 1.96)$ (5)

b) The manufacturer of a certain make of LED bulb claims that his bulbs have a mean life of 20 months of random sample of size 7. Such bulbs gave the life of bulbs in months 19,21,25,16,17,14,21. Can you regard the procedures claim to be valid at 1% level of significance? ($t_{1\%} = 3.707$ *tabulated value*) (5)

6. a) A random sample of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same at 5% level of significance. ($z_\alpha = 1.96$ *at 5% level of significance*) (5)

b) The means of two large samples of 1000 and 2000 members are 67.5 and 68 respectively. Can the samples be regarded as drawn from the same population with standard deviation 2.5 with 5% level of significance? ($z_\alpha = 1.96$ *at 5% level of significance*) (5)

*****END OF THE QUESTION PAPER*****

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, BASAR.

(A.Y. 2021-2022)

Date: 22/02/2022
Exam: E2S1_CSE_MT1
Subject: Probability and Statistics

Time: 1 hour
Max Marks: ~~60~~ 30
Subject Code: MA2102

SECTION-A

Please read each question below carefully, making certain to provide only ONE answer for each multiple choice question. Here each MCQ carries 2 marks. $10 \times 2 = 20\ M$

1. If you throw 7 bananas(identical) at 3 monkeys, what is the probability each monkey gets at least one banana.

A. $\frac{5}{11}$ B. $\frac{5}{12}$ C. $\frac{3}{12}$ D. $\frac{2}{11}$

2. There are 10 doors( ) in the Monty Hall problem(generalised) with 4 cars( ) and 6 goats( ), if you decide to take switch in the game, then what is the probability you win a car?

A. $\frac{4}{9}$ B. $\frac{5}{9}$ C. $\frac{9}{20}$ D. $\frac{9}{24}$

3. Consider two boxes, one box containing 1 black and 1 white marble, second box contains 2 black and 1 white marble. A box is selected at random, and a marble is drawn at random from the selected box. What is the probability that white marble is drawn?

A. $\frac{1}{6}$ B. $\frac{5}{12}$ C. $\frac{1}{9}$ D. $\frac{4}{9}$

4. If A, B,C are independents events with $P(A) = 0.4$, $P(B) = 0.5$ and $P(C) = 0.7$, then $P(A^c \cap B \cap C) =$

A. 0.21 B. 0.25 C. 0.35 D. 0.14

5. Let E and F are two events with $P(E) = \frac{2}{3}$, $P(F) = \frac{3}{4}$, and $P(F/E) = \frac{5}{8}$, then the $P(E/F) =$

A. $\frac{5}{9}$ B. $\frac{4}{9}$ C. $\frac{4}{5}$ D. $\frac{2}{3}$

6. Let X be a random variable with PDF $f_X(x) = \frac{3}{x^4}$, $1 < x < \infty$, and *zero* elsewhere , then median $Q_{1/2} =$

A. 2.46 B. 1.55 C. 2.15 D. 1.26

7. Consider the cumulative distribution function of a continuous random variable X is

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{x^4}{16} & 0 \le x < 2 \\ 1 & x \ge 2 \end{cases}$$, then the probability density function of X is

A. $f(x) = \begin{cases} \frac{x^4}{16} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$

B. $f(x) = \begin{cases} \frac{x^3}{4} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$

C. $f(x) = \begin{cases} \frac{x^4}{4} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$

D. $f(x) = \begin{cases} \frac{x^3}{16} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$

8. Let X is a random variable with CDF $F_X(x) = \begin{cases} 0 & x < 0 \\ \frac{x}{2} & 0 \le x < 1 \\ \frac{2}{3} & 1 \le x < 2 \\ \frac{11}{12} & 2 \le x < 3 \\ 1 & x \ge 3 \end{cases}$ then $P(X = 2) =$

A. $\frac{11}{12}$ B. $\frac{1}{4}$ C. $\frac{1}{12}$ D. $\frac{1}{4}$

9. Let X is a random variable with the which of the following is TRUE

I. $\sqrt{E(X)} \le E(\sqrt{X})$

II. $|E(X)| \le E(|X|)$

A. Only I is TRUE.

B. Only II is TRUE.

C. Both I and II are TRUE.

D. Both I and II are FALSE

10. If the Moment generating function $M(t) = \left(\frac{2}{3} + \frac{1}{3}e^t\right)^5$ then $E(X^2) =$

A. $\frac{14}{9}$ B. $\frac{25}{9}$ C. $\frac{35}{9}$ D. $\frac{10}{9}$

SECTION-B

Answer any two of the following questions, each question carries 5 marks. $2 \times 5 = 10\ M$

11.

A bowl contains 16 chips, of which 6 are red, 7 are white and 3 are blue. If four chips are taken at random without replacement, find the probability that

i. Each of the four chips is red (1.5 M)

ii. None of the chips is red (1.5 M)

iii. There is at least one chip of each colour (2 M)

12.

i. If A and B are mutually exclusive, then prove that $P(A/A \cup B) = \dfrac{P(A)}{P(A) + P(B)}$ (2M)

ii. A laboratory blood test is 95% effective in detecting a certain disease when it is in fact present. However, the test also yields a "false positive result" for 1 precent of healthy persons tested. If 0.5 percent population actually has the disease, what is the probability a person has the disease given that the test result is positive? (3 M)

13.

Let X be the random variable with $PDF, f_X(x) = \dfrac{1}{\pi(1+x^2)}, \ -\infty < x < \infty$, then find the CDF of $Y = \dfrac{1}{X}$, hence compute PDF of Y. (5 M)

14.

From past experience a professor knows that test score of student taking her final examination is a random variable with mean 75.

i. Give an upper bound for the probability that a students test score will exceed 85. (2 M)

ii. Suppose, in addition, the professor knows that the variance of a student's test score is equal to 25, then what can be said the probability that a student will score between 65 and 85? (3 M)

*** Good Luck ***