

University of Mumbai
Examination 2020 under cluster __ (Lead College: _____)

Examinations Commencing from 15^h June to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester III(for Direct Second Year-DSE)

Course Code: CSC304

Course Name: Digital Logic & Computer Organization and Architecture

Time: 2 hour

Max. Marks: 80

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	C
Q3.	C
Q4	B
Q5	D
Q6	C
Q7	C
Q8.	B
Q9.	D
Q10.	B
Q11.	A
Q12.	C
Q13.	C
Q14.	B
Q15.	A
Q16.	C
Q17.	C
Q18.	C
Q19.	D
Q20.	B

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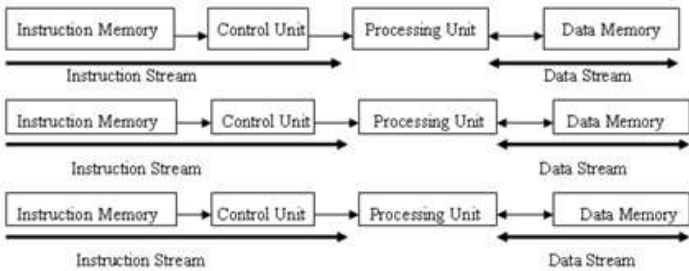
Course Name: Digital Logic & Computer Organization and Architecture

Time: 2 hour

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	What is the Function of MAR
Option A:	Read/write a word form memory
Option B:	Specify an address of memory
Option C:	Contains the 8 bit opcode
Option D:	Store address of next instruction
2.	What is does the Instruction Register holds
Option A:	It Holds the Address of the Current Instruction
Option B:	It Holds the Address of the Next Instruction
Option C:	It Holds the Current Instruction
Option D:	It Holds the Next Instruction
3.	What will be the Value stored in Register A & Q of Booths Algorithm if we multiply 5 & -6
Option A:	00011110
Option B:	11100001
Option C:	11100010
Option D:	11100011
4.	The normalized form of 100001111.001 is
Option A:	1.00001111001 x 2 raise to -8
Option B:	1.00001111001 x 2 raise to 8
Option C:	0. 100001111001 x 2 raise to 9
Option D:	1.00001111001 x 2 raise to 9
5.	In Restoring division Algorithm if $A < 0$ then which of the following is immediate step (Assume M as Dividend Q as Divisor And A as result)
Option A:	$Q_0 = 0$
Option B:	$A = A + M$
Option C:	$Q_0 = 0$ & $A = A - M$
Option D:	$Q_0 = 0$ & $A = A + M$
6.	Which of the following statement is true about D-Flip Flop
Option A:	The output is Complement of Input
Option B:	The output continues to remain in previous state

Option C:	The output Follows the D-Input
Option D:	The output is always high irrespective of D-input
7.	Identify which of the following is not a valid Addressing Mode
Option A:	Register Addressing mode
Option B:	Direct Addressing mode
Option C:	Register Opcode Addressing mode
Option D:	Stack Addressing Mode
8.	State table method is the method for designing
Option A:	Microprogram Control unit
Option B:	Hardwired Control Unit
Option C:	Memory Unit
Option D:	I/O devices
9.	Basic task for control unit is
Option A:	to perform logical operations
Option B:	to perform execution
Option C:	to initiate the resources
Option D:	to decode instructions and generate control signal
10.	The micro instruction MAR \leftarrow PC is executed to
Option A:	fetch the data
Option B:	fetch the instruction
Option C:	Fetch both data and instruction
Option D:	Send control signals
11.	In micro programmed control unit, micro instructions are stored in special memory called
Option A:	Control Memory
Option B:	RAM
Option C:	ROM
Option D:	Micro memory
12.	Which of the following is not a key characteristics of memory devices or memory system
Option A:	Location
Option B:	Physical Characteristics
Option C:	Availability
Option D:	Access Method
13.	Which is not true about Register memory
Option A:	fastest possible access
Option B:	only hundreds of bytes in size
Option C:	Very Large in Capacity
Option D:	Part of the processor
14.	Cache memory is implemented using
Option A:	Dynamic RAM
Option B:	Static RAM

Option C:	EPROM
Option D:	PROM
15.	The correspondence between the main memory blocks and those in the cache is given by _____.
Option A:	Mapping function
Option B:	Hash function
Option C:	Locale function
Option D:	Assign function
16.	In a Pipelined Processing System The Instruction $A \leftarrow 3 + A$ $B \leftarrow 4 \times A$ Leads _____ Hazard
Option A:	Resource Hazard
Option B:	Structural Hazard
Option C:	Data Hazard
Option D:	Branch Hazard
17.	In Instruction Pipelining Structural Hazard means
Option A:	any condition in which either the source or the destination operands of an instruction are not available at the time expected in the pipeline
Option B:	a delay in the availability of an instruction causes the pipeline to stall
Option C:	the situation when two instructions require the use of a given hardware resource at the same time.
Option D:	When a data gets overwritten by branching
18.	Flynn's taxonomy classifies computer architectures based on
Option A:	the number of instructions that can be executed
Option B:	how they operate on data.
Option C:	the number of instructions that can be executed and how they operate on data.
Option D:	The number of Control Signals Generated
19.	Identify the Type of Flynn's Classification of Parallel Processing shown below 
Option A:	SISD
Option B:	SIMD
Option C:	MISD
Option D:	MIMD
20.	We can expand the processor bus connection by using
Option A:	SCSI bus
Option B:	PCI bus
Option C:	Controllers
Option D:	Multiple bus

Q2 (20 Marks)	Solve any Four out of Six (5 marks each)
A	Differentiate between Computer Organization and Architecture with a example
B	Explain any five addressing Modes with examples
C	Define Instruction cycle. Explain it with a detailed state diagram.
D	Explain Hardwired control unit design method (state table method)
E	Differentiate between Hardwired control unit and Micro programmed control unit
F	Explain the different types of Bus Arbitration methods.

Q3. (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Consider a Cache memory of 16 words. Each block consists of 4 words. Size of the main memory is 128 bytes. Draw the Associative Mapping and Calculate the TAG and WORD size.
B	Draw the flowchart of Restoring Division Algorithm & perform 7 / 3 using this Algorithm
C	Write short note on Flynn's classification

University of Mumbai
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Examinations Commencing from 15th June to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: **CSC304** and Course Name: **Digital Logic and Computer Architecture**

Time: 2 hour

Max. Marks: 80

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	C
Q2.	A
Q3.	D
Q4	D
Q5	C
Q6	D
Q7	A
Q8.	D
Q9.	B
Q10.	B
Q11.	C
Q12.	B
Q13.	D
Q14.	C
Q15.	B
Q16.	D
Q17.	C
Q18.	D
Q19.	C
Q20.	B

Note: The distribution of marks for the descriptive questions is given below for your illustration. Examiners may vary with this and add additional criteria's for evaluation

Q2:

- A. For difference 3 marks and example 2 marks
- B. Von-Neumann Model block diagram 2 marks and explanation 3 marks
- C. For every addressing with block representation or explanation and example allot 1 marks
- D. SR Flip Flop diagram 1 mark truth table 1 mark operation 2 mark and draw back 1 mark
- E. Explanation of hardwired control unit and state table method 4 marks block diagram 1 mark
- F. For every difference allot 1 marks

Q3.

- B. Flow chart and explanation 4 marks for numerical 6 marks.
- C. Introduction to parallel processing and Flynn's classification 2 marks & explanation to each classification with block diagram and example 8 marks(2 marks for each type)

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Curriculum Scheme: Rev2019

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Time: 2 hour

Max. Marks: 80

Q1. 40 marks	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (2marks each)
1.	Convert hexadecimal number (8A9.B4) to binary equivalent.
Option A:	$(100010101001.110101)_2$
Option B:	$(100010101011.101101)_2$
Option C:	$(100010101001.101101)_2$
Option D:	$(100010101001.101011)_2$
2.	Write equivalent binary number for 10101010 gray code
Option A:	11001100
Option B:	10001100
Option C:	11000100
Option D:	11001110
3.	Which of the following the correct expression for two input NOR Gate
Option A:	$A + B$
Option B:	$A \cdot B$
Option C:	$\overline{A + B}$
Option D:	$\overline{A + B}$
4.	Program Counter Holds
Option A:	The Instruction
Option B:	The Data
Option C:	Address of the Current Instruction which is executed
Option D:	Address of the Next Instruction to be fetched
5.	Perform binary subtraction using 2's complement representation. 23 - 48 (use 8 bit representation)
Option A:	10001110
Option B:	11110111
Option C:	11100111
Option D:	11001001
6.	Write number (15.5) ₁₀ in IEEE754 format
Option A:	41766666H
Option B:	C170000H
Option C:	41780006H
Option D:	41780000H

7.	In Booths Algorithm in one of the step the A=0110 Q=1100 $Q_{-1}=0$ and count is not zero what it will be the result of Arithmetic Right shift A,Q, Q_{-1}
Option A:	001101100
Option B:	001101101
Option C:	001101110
Option D:	111101100
8.	Perform hexadecimal addition 2F8 + 5A3
Option A:	79B
Option B:	9AB
Option C:	96B
Option D:	89B
9.	Choose correct equation of carry of full adder
Option A:	$A \text{ OR } B \text{ AND } C_{in}(A \text{ XOR } B)$
Option B:	$A \text{ AND } B \text{ OR } C_{in}(A \text{ XOR } B)$
Option C:	$A \text{ AND } B \text{ AND } C_{in}$
Option D:	$A \text{ OR } B \text{ OR } C_{in}$
10.	Which method of combination circuit implementation is widely adopted with maximum output functions and minimum requirement of ICs?
Option A:	Multiplexer Method
Option B:	Decoder Method
Option C:	Encoder Method
Option D:	Full Adder
11.	The addressing mode used in an instruction of the form ADD AX , 07h is _____ addressing mode
Option A:	Direct
Option B:	Indirect
Option C:	Immediate
Option D:	Register
12.	State table method is the method for designing
Option A:	Microprogram Control unit
Option B:	Hardwired Control Unit
Option C:	Memory Unit
Option D:	I/O devices
13.	Basic task for control unit is
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14.	Which is not true about Register memory
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Option C:	Large in Capacity

Option D:	Part of the processor										
15.	Cache memory is implemented using										
Option A:	Dynamic RAM										
Option B:	Static RAM										
Option C:	EPROM										
Option D:	PROM										
16.	Match the memory type with respective erasing mechanism used										
	<table border="1"> <thead> <tr> <th><i>Memory Type</i></th> <th><i>Erasing Mechanism</i></th> </tr> </thead> <tbody> <tr> <td>1- ROM & PROM</td> <td>a- Electrically, Byte-level</td> </tr> <tr> <td>2-EPROM</td> <td>b- Electrically, Block-level</td> </tr> <tr> <td>3- EEPROM</td> <td>c- UV light, Chip Level</td> </tr> <tr> <td>4- Flash Memory</td> <td>d- Not Possible</td> </tr> </tbody> </table>	<i>Memory Type</i>	<i>Erasing Mechanism</i>	1- ROM & PROM	a- Electrically, Byte-level	2-EPROM	b- Electrically, Block-level	3- EEPROM	c- UV light, Chip Level	4- Flash Memory	d- Not Possible
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Option A:	1 - c, 2 - d, 3 - b, 4 - a										
Option B:	1 - d, 2 - a, 3 - c, 4 - b										
Option C:	1 - d, 2 - b, 3 - a, 4 - c										
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17.	In a Pipelined Processing System The Instruction $A \leftarrow 3 + A$ $B \leftarrow 4 \times A$ Leads _____ Hazard										
Option A:	Resource Hazard										
Option B:	Structural Hazard										
Option C:	Data Hazard										
Option D:	Branch Hazard										
18.	Which is not true about Instruction Pipelining										
Option A:	It will improve system performance in terms of throughput.										
Option B:	Pipeline rate limited by slowest pipeline stage										
Option C:	Unbalanced lengths of pipe stages reduces speedup										
Option D:	Pipelining will not be affected by branching instruction.										
19.	Flynn's taxonomy classifies computer architectures based on										
Option A:	the number of instructions that can be executed										
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Option C:	Controllers										
Option D:	Multiple bus										

Q2. (20 Marks)	Solve any Four out of Six (5 marks each)
A	Differentiate between Computer Organization and Architecture with a example
B	Describe the detailed Von-Neumann Model with a neat block diagram
C	Explain any five addressing Modes with examples
D	Write Short Note on SR Flip Flop
E	Explain Hardwired control unit design method (state table method)
F	Differentiate between Hardwired control unit and Micro programmed control unit

Q3. (20 Marks)	Solve any two 10 marks each
A	Consider a Cache memory of 16 words. Each block consists of 4 words. Size of the main memory is 128 bytes. Draw the Associative Mapping and Calculate the TAG and WORD size.
B	Draw the flow chart of Booths algorithm for signed multiplication and Perform -7×-3 using booths algorithm
C	Write short note on Flynn's classification

University of Mumbai
Examination 2020 under cluster 4 (Lead College: PCE, New Panvel)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev 2019

Examination: SE Semester III (DSE)

Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour

Max. Marks: 80

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	B
Q3.	C
Q4	D
Q5	B
Q6	D
Q7	A
Q8.	C
Q9.	D
Q10.	C
Q11.	A
Q12.	D
Q13.	A
Q14.	B
Q15.	B
Q16.	A
Q17.	B
Q18.	C
Q19.	C
Q20.	B

Q. 2 A) Define CNF form

1mark

Derivation Steps

4 marks

Ans: $(a \vee b) \wedge (\sim a \vee b) \wedge (\sim b \vee a)$

B)

For each correct definition 1 mark

5marks

C)

Define a Euler Path

1 mark

Define Euler Circuit.

1 mark

G1 has two vertices of odd degree and and the rest of them have even degree. So this graph has an Euler path but not an Euler circuit. The path starts and ends at the vertices of odd degree. The path is- a,c,d,a,b,d.

G2 has four vertices all of even degree, so it has a Euler circuit. The circuit is –

a,d,b,a,c,d,a

3 marks

D) Multiplication table of G

2 marks

\times	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	1	3	5
3	3	6	2	5	1	4
4	4	1	5	2	6	3
5	5	3	1	6	4	2
6	6	5	4	3	2	1

inverse of 2^{-1} is 4, 3^{-1} is 5, 6^{-1} is 6

2 mark

G is cyclic

1 mark

E) Define MI

1 mark

Correct proof

4 marks

F) Definition with example

3 marks

example is injective not surjective

2 marks

Q. 3 A)

- a) Elements of D_{60} 2 marks
- b) correct Haase diagram 3 mark each
- c) Lattice Definition 2 mark
Reason for lattice 3 marks

B) Define Isomorphic graph 2 marks

- Draw K_6 3 marks
- Draw $K_{3,3}$ 3 marks
- (graphs are not isomorphic) 2 mark

C)

- Definition of Equivalence relation 2 marks
- Show that R is Equivalence 3 marks
- Find equivalence classes 3 marks
- $[a]=\{a,b,c\}$ $[b]=\{a,b,c\}$ $[c]=\{c,a,b\}$ $[d]=\{d\}$
- Find rank of R - Rank definition 1 mark
- Rank of R is 2 1 mark

University of Mumbai
Examination 2020 under cluster _4_ (Lead College: PCE, New Panvel)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour Max. Marks: 80

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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	C
Q2.	A
Q3.	B
Q4	D
Q5	A
Q6	B
Q7	A
Q8.	B
Q9.	D
Q10.	C
Q11.	D
Q12.	C
Q13.	B
Q14.	C
Q15.	C
Q16.	C
Q17.	D
Q18.	D
Q19.	A
Q20.	B

Q2)
a

20) Let A be a set of integers and R be a relation on $A \times A$ defined by $(a, b) R (c, d)$ if $a+d = b+c$
 prove that R is an equivalence relation.

Qⁿ :- a) We have $(a, b) R (a, b)$
 because $a+b = b+a$
 $\therefore R$ is reflexive

b) If $(a, b) R (c, d)$
 then $a+d = b+c$
 $\therefore a+a = c+b$
 $c+b = d+a$
 $\therefore (c, d) R (a, b)$
 $\therefore R$ is symmetric

c) Let $(a, b) R (c, d)$ and $(c, d) R (e, f)$
 $\therefore a+d = b+c$ and $c+f = d+e$
 Adding L.H.S and R.H.S
 $a+d+c+f = b+c+d+e$
 $a+f = b+e$
 $(a, b) R (e, f)$
 $\therefore R$ is Transitive.
 $\therefore R$ is an Equivalence Relation.

Q2)b

Q2b) Show that the sum of three consecutive integers is divisible by 3.

Qⁿ :- Let $P(n) = n^2 + (n+1)^2 + (n+2)^2$

Step 1 :- For $n=1$
 $P(1) = 1^2 + (1+1)^2 + (1+2)^2 = 1+4+9=14$
 which is divisible by 3.
 $P(2) = 2^2 + (2+1)^2 + (2+2)^2 = 4+9+16=29$
 which is divisible by 3.
 Hence $P(1)$ & $P(2)$ is true.

Step 2 :- Assume that the result is true for $n=k$ i.e. $P(k)$ is true.
 $\therefore k^2 + (k+1)^2 + (k+2)^2$ is divisible by 3
 $\therefore k^2 + (k+1)^2 + (k+2)^2 = 3m$ for any
 the next term is $P(k+1)$
 Now $P(k+1) = (k+1)^2 + (k+2)^2 + (k+3)^2$
 $= (k+1)^2 + (k+2)^2 + (k^2 + 6k + 9)$
 $= [k^2 + (k+1)^2 + (k+2)^2] + 6k + 9$
 $= 3m + 9 = 3(m+3)$
 $P(k+1) = 3(m+3)$
 Hence $P(k+1)$ is divisible by 3
 $\therefore P(k+1)$ is true
 $\therefore P(n)$ is true for $n=k+1$

Step 3 :- Hence by Mathematical induction the result is true for all $n \in \mathbb{N}$.

Q2)
c

Q2c) Prove that the set $A = \{0, 1, 2, 3, 4, 5\}$ is a finite Abelian group under addition modulo 6.

Solⁿ prepare the table

\oplus	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	0
2	2	3	4	5	0	1
3	3	4	5	0	1	2
4	4	5	0	1	2	3
5	5	0	1	2	3	4

From the table we see that $0 \neq 0$
 For eg: $2 \oplus (3 \oplus 5) = (2 \oplus 3) \oplus 5$
 $2 \oplus 2 = 5 \oplus 5$
 $4 = 4$

The first row or the first column shows '0' is the identity element

The positions of '0' (the additive inverse every row (and every column) shows every element of A has the additive inverse)
 eg: $1 \oplus 5 = 0$ hence inverse of 1 is 5
 Also $3 \oplus 3 = 0 \therefore 3^{-1} = 3$
 $2 \oplus 4 = 0 \therefore 2^{-1} = 4$

$\therefore G$ is a group under addition mod 6

Further $a \oplus b = b \oplus a$
 eg $4 \oplus 5 = 3$ and $5 \oplus 4 = 3$
 $\therefore A \oplus 5 = 5 \oplus 4 \therefore G$ is Abelian

Q2)
d

Q2d) Find the Transitive Closure of R on $A = \{1, 2, 3, 4\}$ where the $R = \{(1,2), (2,3), (3,4), (4,1), (2,1), (3,1)\}$.

Solⁿ: $M_R = A_R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

$C_1 = 4$ put it in position
 $R_1 = 2, 3$ $(4,2) (4,3)$

$M_1 = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ $C_2 = 1, 2, 3$
 $R_2 = 2, 4$

put it in positions $(1,2), (1,4), (2,3), (2,4), (3,4)$

$M_2 = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$ $C_3 = 4$
 $R_3 = 2, 4$
 put it in pos $(4,2) (4,4)$

$M_3 = M_2$ $C_4 = 1, 2, 3, 4$
 $R_4 = 1, 2, 3, 4$
 put it in all pos

$M_4 = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} \therefore R^+ = \{(1,1), (1,2), (1,3), (1,4), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2), (3,3), (3,4), (4,1), (4,2), (4,3), (4,4)\}$

Q2)
e

Q2e) Check whether Euler cycle and Euler path exist for the graph given below

Vertex	a	b	c	d	e	f	g
Degree	3	6	3	4	4	3	3

Sum of vertices with odd degree = 4

If a graph G has a vertex of odd degree there can be no Euler Cycle (exists) in G .

If a graph G has more than two vertices of odd degree then there can be no Euler path in G .

Hence the given graph has no Euler path and no Euler cycle or path.

Q2)f

Q2f) Let $f: A \rightarrow B$ be a function from A to B . Prove that f^{-1} exists if and only if f is a bijective function.

Solⁿ: f is bijective means every element of A is associated with some element of B and any element of B is associated with a unique element of A .

In other words f is bijective means there is one to one correspondence between the elements of A and the elements of B .

Let a_1, a_2 be two elements of A
 let b_1, b_2 be two elements of B
 such that
 $f(a_1) = b_1$ and $f(a_2) = b_2$
 hence $a_1 = f^{-1}(b_1)$ and $a_2 = f^{-1}(b_2)$
 if possible let $f^{-1}(b_1) = f^{-1}(b_2)$
 $\therefore a_1 = a_2$
 $\therefore f(a_1) = f(a_2)$
 $\therefore b_1 = b_2$
 This means f^{-1} is one to one.

University of Mumbai
Examination 2020 under cluster 4 (Lead College: PCE, New Panel)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: **Computer Engineering**

Curriculum Scheme: Rev 2019

Examination: SE Semester III


Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks.
1.	In a class of 50 students , 20 students play cricket and 16 students play football. It is found that 10 students play both the games. Find out the number of students who play neither of the games.
Option A:	42
Option B:	24
Option C:	12
Option D:	14
2.	Let $A = \{1,2,3,4,5,6,7,8\}$. Let xRy whenever y is divisible by x , so R is a _____
Option A:	Equivalence Relation
Option B:	Partial Order Relation
Option C:	Symmetric
Option D:	Neither Equivalence Nor Partial Order Relation
3.	$(p \wedge p) \wedge (p \rightarrow (q \wedge q))$ is equivalent to _____.
Option A:	$p \rightarrow q$
Option B:	$q \rightarrow p$
Option C:	$p \wedge q$
Option D:	None of the above
4.	If f and g are onto then function $(g \circ f)$ is ?
Option A:	one to one
Option B:	one to many
Option C:	into
Option D:	onto
5.	Consider P : Food is good , Q : Service is good , R : Restaurant is 5-star. Write the symbolic notation of the statement “ It is not true that 5 star rating always means good food and good service”
Option A:	$(P \wedge Q) \rightarrow R$
Option B:	$\sim(R \rightarrow (P \wedge Q))$
Option C:	$R \rightarrow \sim(P \wedge Q)$
Option D:	$P \wedge \sim Q$

6.	A _____ is a semigroup $(A, *)$ that has an identity element.
Option A:	Cyclic group
Option B:	Lattice
Option C:	Poset
Option D:	Monoid
7.	A graph having all vertices with equal degree is known as _____.
Option A:	Regular Graph
Option B:	Euler Graph
Option C:	Simple Graph
Option D:	Hamiltonian Graph
8.	Which of the following is a Tautology?
Option A:	$(\sim p \vee p) \wedge q$
Option B:	$(p \vee q) \rightarrow (p \rightarrow q)$
Option C:	$((p \vee q) \wedge \sim p) \rightarrow q$
Option D:	$(\sim p \vee \sim q) \rightarrow (p \rightarrow q)$
9.	A graph has an Euler circuit if _____
Option A:	it is connected and has an even number of vertices.
Option B:	it is connected and has an even number of edges.
Option C:	it is connected and every vertex has an odd degree.
Option D:	every vertex has even degree
10.	Let f and g be the function from the set of integers to itself, defined by $f(x) = 3x + 1$ and $g(x) = 4x + 4$. Then the composition of f and g is _____
Option A:	$12x+4$
Option B:	$12x+5$
Option C:	$12x + 13$
Option D:	$12x+8$
11.	K_{10} is a complete graph on 10 vertices and will have _____ edges.
Option A:	45
Option B:	54
Option C:	40
Option D:	42
12.	Solution of linear homogenous recurrence relation: $a_n = 3a_{n-1} - 2a_{n-2}$ with $a_0 = 1, a_1 = 3, n \geq 2$
Option A:	$a_n = (-1) + 2^n$
Option B:	$a_n = (-1) + 3 \cdot 2^n$
Option C:	$a_n = (-1)(-1)^n + 2^n$
Option D:	$a_n = (-1) + 2 \cdot 2^n$
13.	Let A be a finite set of size n, the number of elements in the power set of A is
Option A:	2^n
Option B:	n^2
Option C:	$(2n)^2$
Option D:	2^{2n}

14.	The transitive closure of the relation $R=\{(a,b),(b,c),(c,d),(e,d)\}$ on set $A=\{a,b,c,d,e\}$ is
Option A:	$\{(a,b),(b,c),(c,d),(e,d),(a,c)\}$
Option B:	$\{(a,b),(b,c),(c,d),(e,d),(a,c),(a,d),(b,d)\}$
Option C:	$\{(a,b),(b,c),(c,d),(e,d),(a,c),(a,d)\}$
Option D:	$\{(a,b),(b,c),(c,d),(d,e),(a,c),(a,d)\}$
15.	What is the correct translation of the following statement into mathematical logic? "Some real numbers are rational"
Option A:	$\exists x(\text{real}(x) \vee \text{rational}(x))$
Option B:	$\exists x(\text{real}(x) \wedge \text{rational}(x))$
Option C:	$\forall x(\text{real}(x) \rightarrow \text{rational}(x))$
Option D:	$\exists x(\text{rational}(x) \rightarrow \text{real}(x))$
16.	The minimum number of edges in a connected graph with n vertices is _____.
Option A:	n-1
Option B:	n
Option C:	n+1
Option D:	n+2
17.	The following graph is _____.
	
Option A:	Bipartite Graph
Option B:	Complete Bipartite Graph
Option C:	Mixed Graph
Option D:	Simple Graph
18.	What is the minimum number of students required in a class to be sure that at least 6 will receive the same grade, if there are five possible grades A,B,C,D and E.
Option A:	62
Option B:	66
Option C:	26
Option D:	22
19.	Which of the following four subset of integers N is not closed under the operation of multiplication.
Option A:	$A=\{0,1\}$
Option B:	$F=\{2,4,6,\dots\}$
Option C:	$B=\{1,2\}$
Option D:	$E=\{1,3,5,\dots\}$
20.	The _____ between two words is the number of differences between corresponding bits.
Option A:	Hamming code

Option B:	Hamming distance
Option C:	Hamming rule
Option D:	Hamming parity checks

Q2. (20 Marks)	Solve any Four questions out of Six.	5 marks each
A	Find the CNF form of $(\sim a \rightarrow b) \wedge (a \leftrightarrow b)$	
B	Define the following with example 1. Ring 2. Bipartite Graph 3. Chain 4. Semigroup 5. Sublattice	
C	Define Euler Path and Euler Circuit. Check whether Euler Path, Euler Circuit exist in the following graphs. <div style="text-align: center;"> </div>	
D	Consider $G = \{1, 2, 3, 4, 5, 6\}$ under the multiplication modulo 7. i) Find multiplication table of G ii) Find $2^{-1}, 3^{-1}, 6^{-1}$ iii) Is G cyclic?	
E	Prove using Mathematical Induction that $n^3 + 2n$ is divisible by 3 for all $n \geq 1$	
F	Define and give examples of injective surjective and bijective functions. Check the injectivity and surjectivity of the following function $f: \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = x^3$	

Q3. (20 Marks)	Solve any Two Questions out of Three .	10 marks each
A	Let D_{60} be the poset consisting of all the positive divisors of 60 under the partial order of divisibility. (a) Write down the elements of D_{60} (b) Draw the Hasse Diagram of D_{60} . (c) Define Lattice. Is D_{60} a lattice? Give a reason for your answer	
B	Define Isomorphic Graph. Draw K_6 and $K_{3,3}$ graphs. Find whether they are Isomorphic or not?	
C	Let $A = \{a, b, c, d\}$ and let $R = \{(a, a), (a, b), (a, c), (b, a), (b, b), (c, a), (b, c), (c, b), (c, c), (d, d)\}$. Show that R is a	

	equivalence relation and determine the equivalence classes and find the rank of R.
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University of Mumbai
Examination 2020 under cluster 4 (Lead College: PCE, New Panvel)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: **Computer Engineering**

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The binary relation $\{(1,1), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2)\}$ on the set $\{1, 2, 3,4\}$ is _____
Option A:	Reflexiive, Symmetric and Transitive
Option B:	Irreflexive, Symmetric and Transitive
Option C:	Neither Reflexiive, nor Irreflexive but Transitive
Option D:	Irreflexive and Antisymmetric
2.	Given the following statements pick the one that is not a tautology?
Option A:	$(p \rightarrow q) \rightarrow q$
Option B:	$p \rightarrow (p \vee q)$
Option C:	$(p \wedge q) \rightarrow (p \rightarrow q)$
Option D:	$(p \wedge q) \rightarrow (p \vee q)$
3.	Given the set $\{1, 2, 3, 4\}$ How many numbers must be selected from it to guarantee that at least one pair of these numbers add up to 7?
Option A:	14
Option B:	5
Option C:	9
Option D:	24
4.	All Isomorphic graph must have _____ representation
Option A:	cyclic
Option B:	tree
Option C:	adjacency list
Option D:	adjacency matrix
5.	The cardinality of the set of odd positive integers less than 10 is ?
Option A:	5
Option B:	10
Option C:	3
Option D:	20
6.	If $g(x) = 3x+2$ then $g \circ g(x)$:
Option A:	$6x+4$
Option B:	$9x+8$
Option C:	$3x-2$

Option D:	2-3x
7.	Length of path is
Option A:	Number of Edges in the path
Option B:	Number of circuits in the path
Option C:	Number of loops in the path
Option D:	Number of Vertices in the path
8.	If every two elements of a poset are comparable then the poset is called
Option A:	Sub ordered poset
Option B:	Totally ordered poset
Option C:	Sub Lattice
Option D:	Semigroup
9.	A _____ has a greatest element and a least element which satisfy $0 \leq a \leq 1$ for every a in the lattice(say, L).
Option A:	semilattice
Option B:	Join semilattice
Option C:	Meet semilattice
Option D:	Bounded semilattice
10.	Let $S = \{a, b, c, d, e, f, g\}$. Determine which of the following are partitions of S:
Option A:	$P_1 = [\{a, c, e\}, \{b\}, \{d, g\}]$,
Option B:	$P_2 = [\{a, e, g\}, \{c, d\}, \{b, e, f\}]$,
Option C:	$P_3 = [\{a, b, e, g\}, \{c\}, \{d, f\}]$,
Option D:	$P_4 = [\{a, b, c, d, e, f, g\}, \{c, g\}]$
11.	Solution of linear homogenous recurrence relation: $a_n = 3a_{n-1} - 2a_{n-2}$ with $a_0 = 1, a_1 = 3, n \geq 2$ is
Option A:	$a_n = (-1) + 2^n$
Option B:	$a_n = (-1) + 3 \cdot 2^n$
Option C:	$a_n = (-1)(-1)^n + 2^n$
Option D:	$a_n = (-1) + 2 \cdot 2^n$
12.	The number of integers between 1 and 1000 that are divisible by 3 but not by 2 or 5 is
Option A:	132
Option B:	127
Option C:	134
Option D:	143
13.	If six numbers are selected from 1 to 15, find the least number of selections which will have the same sum
Option A:	61
Option B:	91
Option C:	41
Option D:	51
14.	The number of relations from $A = \{a, b, c\}$ to $B = \{1, 2\}$
Option A:	54

Option B:	74
Option C:	64
Option D:	84
15.	Let $G = (Z_6, +_6)$ is an Abelian group then the inverse element of 4 is _____.
Option A:	0
Option B:	1
Option C:	2
Option D:	3
16.	If $G = (Z_7^*, \times_7)$ is a group, the inverse of elements 2, 3 and 6 are _____
Option A:	2,3 and 6
Option B:	1,2 and 3
Option C:	4,5 and 6
Option D:	3,4 and 6
17.	The complete graph with four vertices has _____ edges.
Option A:	3
Option B:	4
Option C:	5
Option D:	6
18.	Which of the following function is bijective?
Option A:	$f: R \rightarrow R$ defined as $f(x) = x^2$
Option B:	$f: R \rightarrow R$ defined as $f(x) = 3^x$
Option C:	$f: R \rightarrow R$ defined as $f(x) = x^3 - x$
Option D:	$f: R \rightarrow R$ defined as $f(x) = x^3 + 1$
19.	Let a POSET L, \leq be a Lattice. Then for every pair of elements $a, b \in L$ has _____.
Option A:	a GLB.
Option B:	a LUB.
Option C:	both GLB and LUB.
Option D:	Both Maximal and Minimal
20.	In a graph a node which is not adjacent to any other node is called _____ node.
Option A:	Simple
Option B:	Isolated
Option C:	Initiating
Option D:	Different

Q2	Solve any Four out of Six	5 marks each
A	Let A be a set of integers, Let R be a Relation on $A \times A$ defined by $(a,b)R(c,d)$ if	

	and only if $a+d = b+c$. Prove that R is an Equivalence Relation.
B	Show that the sum of the cubes of three consecutive integers is divisible by 9
C	Prove that the set $A=(0,1,2,3,4,5)$ is a finite Abelian group under Addition modulo 6
D	Find the Transitive closure of the relation R on $A=\{1,2,3,4\}$ where the Relation $R=\{(1,2),(2,2),(2,4),(3,4),(4,3),(3,2),(4,1)\}$
E	<p>Check whether Euler cycle and Euler Path exists in the Graph given below.</p>
F	Let $f : A \rightarrow B$ be a Function from A to B . Prove that f^{-1} exists if and only if f is a Bijective Function.

Q3.	Solve any Two Questions out of Three 10 marks each
A	Draw the Hasse Diagram of D_{72} and D_{105} and check whether they are Lattice.
B	<p>Consider the Set $A=\{1,2,3,4,5,6\}$ under multiplication Modulo 7.</p> <p>1) Prove that A is a Cyclicgroup</p> <p>2) Find the orders and the Subgroups generated by $\{2,3\}$ and $\{3,4\}$</p>
C	<p>A Function $f : \mathbb{R} - \left\{\frac{7}{3}\right\} \rightarrow \mathbb{R} - \left\{\frac{4}{3}\right\}$ is defined as $f(x) = \frac{(4x-5)}{(3x-7)}$ Prove that f is Bijective and find the rule for f^{-1}</p>

University of Mumbai
Examination 2020 under cluster 4 (Lead College: PCE)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: COMPUTER ENGINEERING

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CSC303 and Course Name: DATA STRUCTURE

Time: 2 hour

Max. Marks: 80

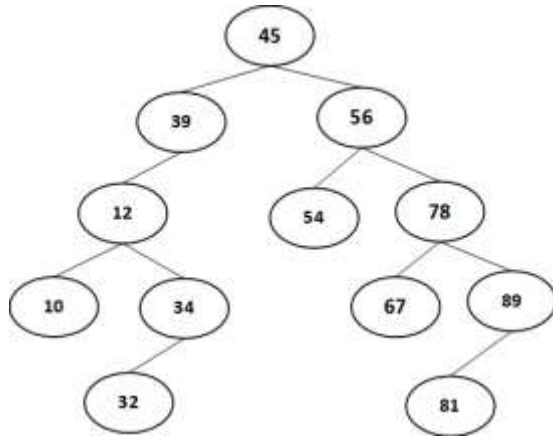
Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	C
Q2.	C
Q3.	B
Q4	D
Q5	A
Q6	B
Q7	B
Q8.	B
Q9.	C
Q10.	A
Q11.	D
Q12.	C
Q13.	B
Q14.	D
Q15.	D
Q16.	A
Q17.	C
Q18.	B
Q19.	A
Q20.	B

Q2 (20 Marks Each)	Solve any Four out of Six 5 marks each																																																																																																																																																				
A	<p>Consider marks of 5 subjects of a student represented as singly linked list. Write a C program to compute the total and percentage of the student.</p> <p>Node / Variables declaration: 1 Mark Program logic and functions: 4 Marks</p>																																																																																																																																																				
B	<p>An array contains the elements – 8,13,17,26,44,56,88,97. Using binary search algorithm, trace the steps followed to find numbers 56 & 9 . At each step, show the contents of low, high & mid and array after each iteration</p> <p>i) Item to be searched=56</p> <p>Initial Array</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th></th> <th style="text-align: center;">low</th> <th colspan="3"></th> <th style="text-align: center;">mid</th> <th colspan="3"></th> <th style="text-align: center;">high</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">8</td> <td style="text-align: center;">13</td> <td style="text-align: center;">17</td> <td style="text-align: center;">26</td> <td style="text-align: center;">44</td> <td style="text-align: center;">56</td> <td style="text-align: center;">88</td> <td style="text-align: center;">97</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td></td> </tr> </tbody> </table> <p>Low=0; 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high=7; mid=5; a[mid]=a[5]=56 Item is found, so return location 5.</p> <p>ii) Item to be searched=9</p> <p>Initial Array</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th></th> <th style="text-align: center;">low</th> <th colspan="3"></th> <th style="text-align: center;">mid</th> <th colspan="3"></th> <th style="text-align: center;">high</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">8</td> <td style="text-align: center;">13</td> <td style="text-align: center;">17</td> <td style="text-align: center;">26</td> <td style="text-align: center;">44</td> <td style="text-align: center;">56</td> <td style="text-align: center;">88</td> <td style="text-align: center;">97</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td></td> </tr> </tbody> </table> <p>Low=0; 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high=mid-1=2; mid=1; a[mid]=a[1]=13 13 > 9,</p> <p>Step2</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th></th> <th style="text-align: center;">low,</th> <th style="text-align: center;">mid,</th> <th style="text-align: center;">high</th> <th colspan="5"></th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">8</td> <td style="text-align: center;">13</td> <td style="text-align: center;">17</td> <td style="text-align: center;">26</td> <td style="text-align: center;">44</td> <td style="text-align: center;">56</td> <td style="text-align: center;">88</td> <td style="text-align: center;">97</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td></td> </tr> </tbody> </table> <p>low=0; 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$8 < 9$,
 $Low = mid + 1 = 1$; $high = 0$;
Since ($high < low$) , this means the item is not found in the array.

Create a Binary Search Tree for the following sequence and write all the 3 traversal sequences from resultant BST: 45,39,56,12,34,78,32,10,89,54,67,81.

Creation of BST: 2 Marks
Writing all 3 traversals correctly: 3 Marks



Inorder Traversal: 10,12,32,34,39,45,54,56,67,78,81,89
 Preorder Traversal: 45,39,12,10,34,32,56,54,78,67,89,81
 Postorder Traversal: 10,32,34,12,39,54,67,81,89,78,56,45

Use linear probing, insert the following keys in a hash table of size 11:
 15,85,90,54,67,43,76.
 Find the number of collisions.

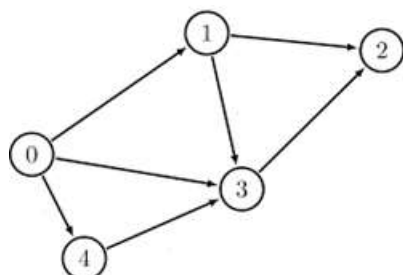
Formula of linear probing: 1 Mark
Writing all steps for calculating array index for given data: 3 Marks
Final answer with number of collisions: 1 Mark

Final Hash Table is:

43	67	90	76	15				85		54
0	1	2	3	4	5	6	7	8	9	10

Number of collisions=5


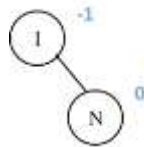
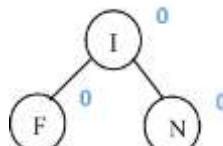
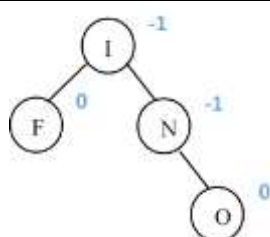
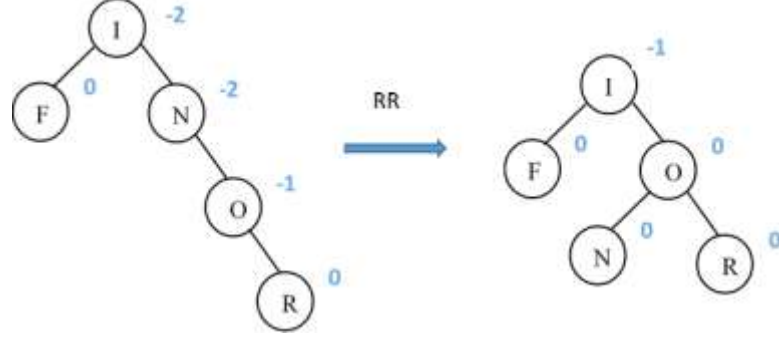
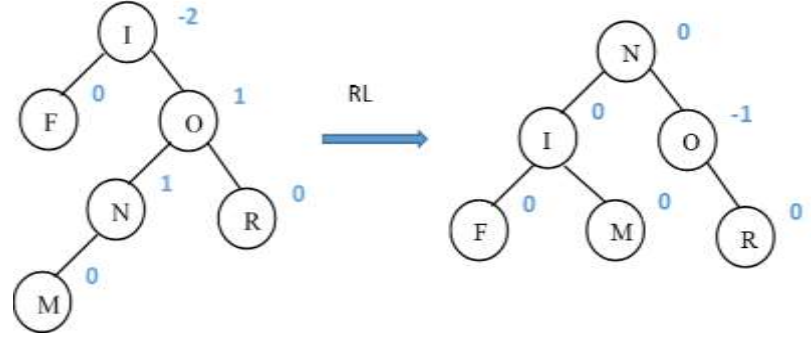
Illustrate topological sorting for the following graph:

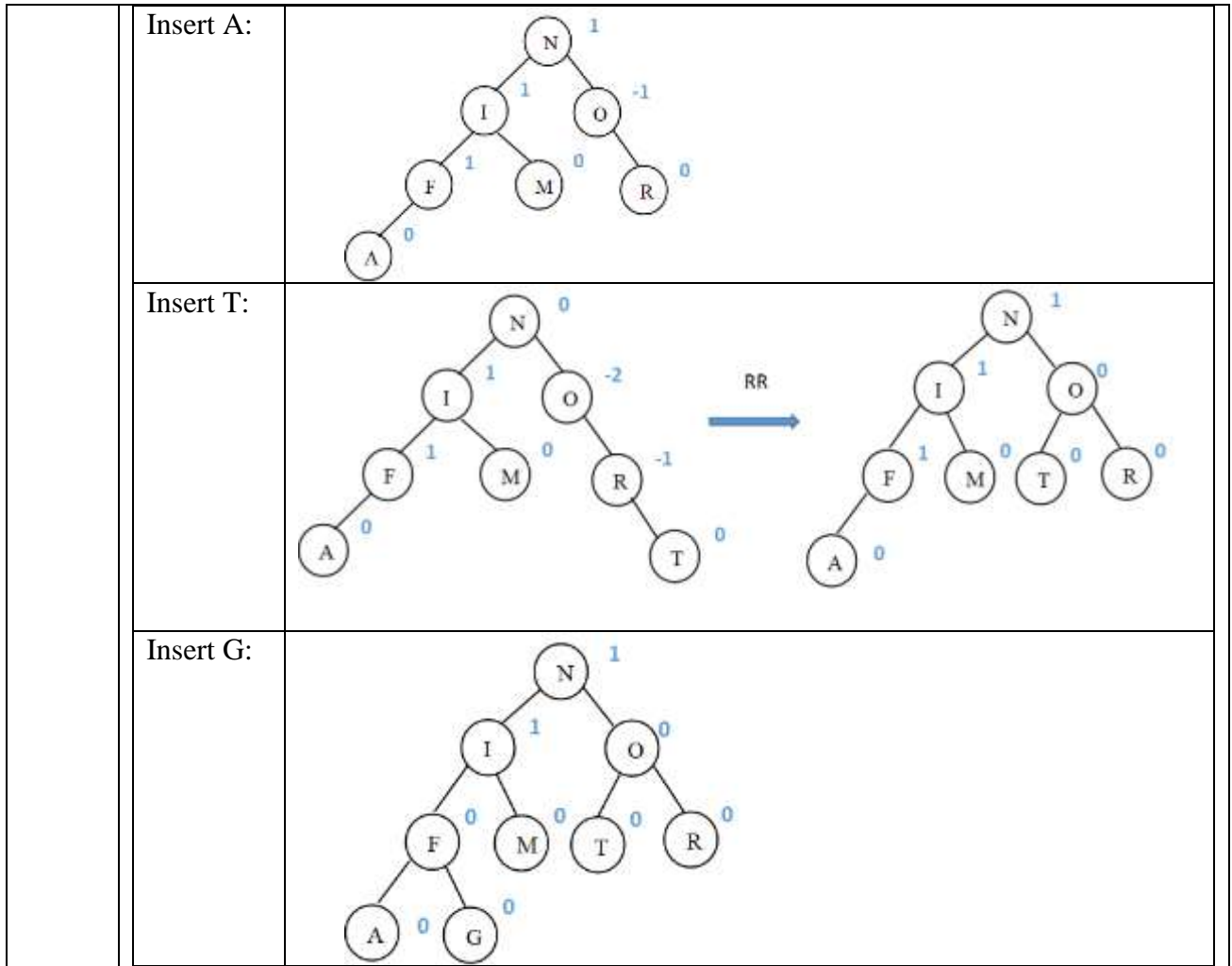


Writing in-degrees in all steps correctly and removing nodes and adding in the topological sorting order is expected.							
	Vertex 0	Vertex 1	Vertex 2	Vertex 3	Vertex 4	Output Sequence	Action
In-degree	0	1	2	3	1	0	Delete Vertex 0 & update in-degrees
	-	0	2	2	0	0,1	Delete Vertex 1 & update in-degrees
	-	-	1	1	0	0,1,4	Delete Vertex 4 & update in-degrees
	-	-	1	0	-	0,1,4,3	Delete Vertex 3 & update in-degrees
	-	-	0	-	-	0,1,4,3,2	Delete 2
<p>Topological order is: 0,1,4,3,2</p> <p>OR</p> <p>In case if 4 is considered before 1 in sequence, then the order changes and Topological order is: 0,4,1,3,2</p>							
F	<p>Define circular queue. Assume a circular queue with a capacity 6, currently having the elements 50 and 70 at locations 2 and 3 respectively. Show with example, the queue full and queue empty conditions by performing necessary operations on circular queue.</p>						
	<p>Definition of circular queue: 2 Marks</p> <p>Initial queue status with front and rear pointers pictorial representation: 1 Mark</p> <p>Queue full illustration with insertion operations: 1 Mark</p> <p>Queue empty illustration with deletion operations: 1 Mark</p>						

Q3. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Create a AVL tree for the sequence:	

I, N, F, O, R, M, A, T, G.
 Consider the characters to arrange in alphabetic sequence.
 Show the tree after each insertion with balance factors.

Insert I:	
Insert N:	
Insert F:	
Insert O:	
Insert R:	
Insert M:	

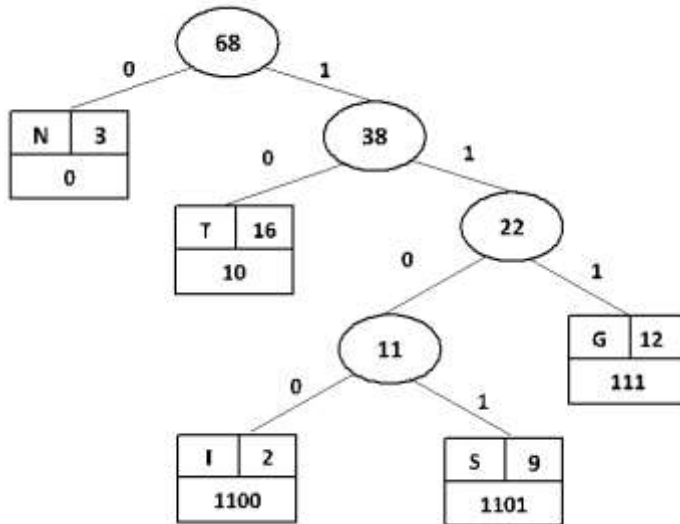


B

Given the following frequencies for characters, find the Huffman code for all the characters:

Character	S	T	I	N	G
Frequency	9	16	2	30	12

Selection of proper nodes and combining: 6 Marks
Writing binary codes: 2 Marks
Correct computation of Huffman codes: 2 Marks



Define recursion. Differentiate between iteration and recursion. Write a C program to check whether a string is palindrome or not, with the help of stack data structure.

C

Definition of recursion: 2 Marks
Difference between iteration and recursion: 2 Marks
Program logic and main function: 2 Marks
pop operation: 2 Marks
push operation: 2 Marks

University of Mumbai
Examination 2020 under cluster 4 (Lead College: PCE)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester: III(for Direct Second Year-DSE)

Course Code: CSC303 and Course Name: Data Structure

Time: 2 hour

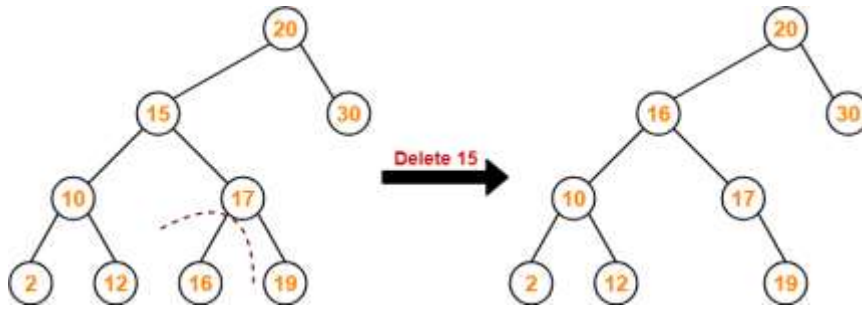
Max. Marks: 80

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	A
Q2.	D
Q3.	C
Q4	D
Q5	D
Q6	B
Q7	D
Q8.	B
Q9.	B
Q10.	A
Q11.	D
Q12.	B
Q13.	D
Q14.	A
Q15.	C
Q16.	D
Q17.	D
Q18.	D
Q19.	C
Q20.	C

Q2	Solve any Four out of Six	5 marks each
A	<p>Write a C functions to implement insertion and deletion in queue using linked list.</p> <p>Solution:</p> <p>Let the node declaration for queue using linked list implementation is:</p> <pre> struct node{ int data; struct node *next; }; struct node *front=NULL, *rear=NULL,*temp,*newNode; // Insertion function 'enqueue' for queue. void equeue(int item) { newNode=(struct node*) malloc(sizeof(struct node)); newNode->data =item; newNode->next=NULL; if(front==NULL) { front=rear=newNode; } else { rear->next=newNode; rear=newNode; } } // Deletion function 'dequeue' from queue. void dequeue() { if(front==NULL) { printf("queue is empty!!! Deletion not possible!!!\n"); return; } else { temp=front; printf("\ndeleted item=%d",temp->data); front=front->next; free(temp); } } </pre>	

Example-

Consider the following example where node with value = 15 is deleted from the BST-

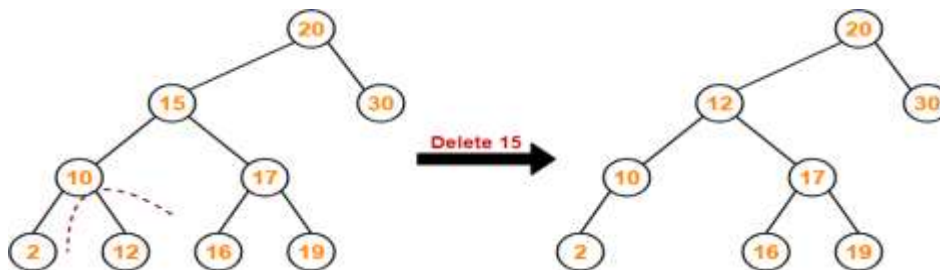


Method-02:

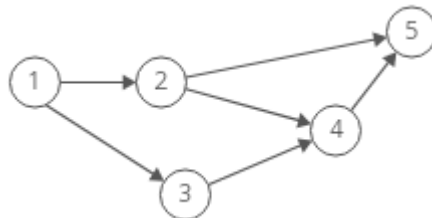
- Visit to the left subtree of the deleting node.
- Pluck the greatest value element called as inorder predecessor.
- Replace the deleting element with its inorder predecessor.

Example-

Consider the following example where node with value = 15 is deleted from the BST-



Find topological sorting sequence in the following graph:

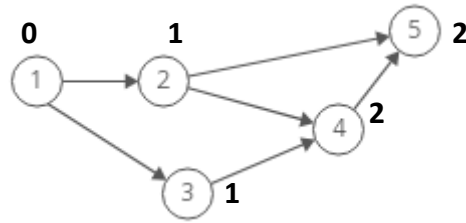


C

Solution:

Step-01:

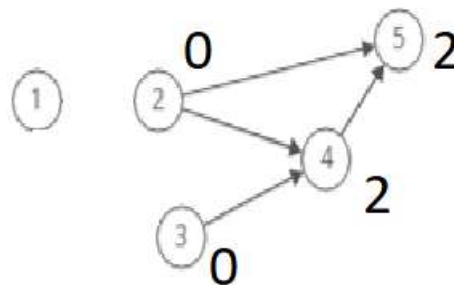
Write in-degree of each vertex-



Step-02:

- Vertex-1 has the least in-degree and add it in topological order list.
- So, remove vertex-1 and its associated edges.
- Now, update the in-degree of other vertices.

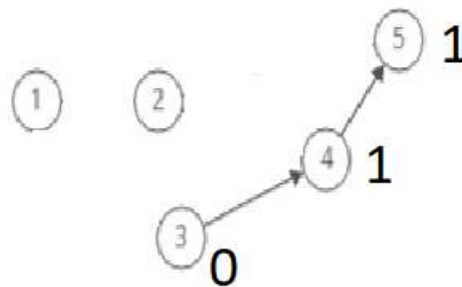
Topological order list : 1



Step-03:

- Vertex-2 & Vertex-3 has the least in-degree. So any one can be selected for removal and add that vertex in topological order list.
- So, remove vertex-2 as selected for ordering and its associated edges.
- Now, update the in-degree of other vertices.

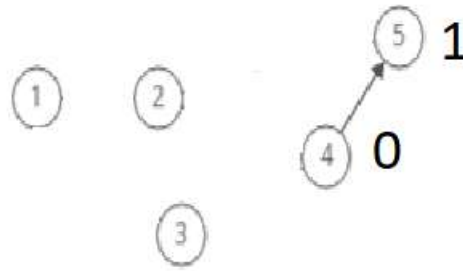
Topological order list : 1,2



Step-04:

- Vertex-3 has the least in-degree add that vertex in topological order list.
- So, remove vertex-3 and its associated edges.
- Now, update the in-degree of other vertices.

Topological order list : 1,2,3



Step-05:

- Vertex-4 has the least in-degree add that vertex in topological order list.
- So, remove vertex-4 and its associated edges.
- Now, update the in-degree of other vertices.

Topological order list : 1,2,3,4



Step-06:

- Vertex-5 has the least in-degree add that vertex in topological order list.
- So, remove vertex-5 and its associated edges.
- Now, update the in-degree of other vertices.

Topological order list : 1,2,3,4,5

Another possible topological ordering sequence is: 1,3,2,4,5.

Consider a hash table with size = 7. Using Linear probing, insert the keys 99,33,23, 44, 43 into the table.

D Solution:
Formula with correct insertion for each key : 1Mark

Hash table of size=7

Index	0	1	2	3	4	5	6
Key		99	23	44	43	33	

Define ADT. Write ADT for stack.

E Solution:
 Definition: 2 Marks
 ADT for Stack: 3 marks

F Write an algorithm to check the well-formedness of parenthesis in an algebraic expression using Stack data structure.

	<p>Solution:</p> <p>Step 1: Scan the expression from left to right.</p> <p>Step 2: Set flag = 1</p> <p>Step 3: Repeat until each symbol in the expression is scanned</p> <p style="padding-left: 20px;">If symbol is '(' or '{' or '[', push it on the stack.</p> <p style="padding-left: 20px;">If symbol is ')' or '}' or ']', then</p> <p style="padding-left: 40px;">If stack is empty, then set flag = 0</p> <p style="padding-left: 40px;">Else</p> <p style="padding-left: 60px;">pop top of the stack and place it in temp.</p> <p style="padding-left: 60px;">If symbol is ')' and temp is either '{' or '[', then set flag=0 and GOTO step 5</p> <p style="padding-left: 60px;">If symbol is '}' and temp is either '(' or '[', then set flag=0 and GOTO step 5</p> <p style="padding-left: 60px;">If symbol is ']' and temp is either '(' or '{', then set flag=0 and GOTO step 5</p> <p>Step 4: If stack is not empty, then set flag=0 and GOTO step 5</p> <p>Step 5: If flag =1, then Print “ Valid expression”</p> <p style="padding-left: 20px;">Else Print “Invalid expression”</p> <p>Step 6: END</p>
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Q3	Solve any Two Questions out of Three	10 marks each														
A	<p>Write a C program for Singly Linked list for performing following operations</p> <ol style="list-style-type: none"> i. Create SLL ii. Display SLL iii. Delete last node from SLL <p style="padding-left: 40px;">Insert a node at start of SLL</p> <p>Node definition – 1M</p> <p>Main function – 1M</p> <p>Create function – 2M</p> <p>Display function – 2M</p> <p>Insert at Beginning function – 2M</p> <p>Delete last node function– 2M</p>															
B	<p>Create a Huffman tree and find Huffman codes for each character in the string “CONNECTION”.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="padding: 5px;">Char.</th> <th style="padding: 5px;">C</th> <th style="padding: 5px;">O</th> <th style="padding: 5px;">N</th> <th style="padding: 5px;">E</th> <th style="padding: 5px;">T</th> <th style="padding: 5px;">I</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Frequency</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">1</td> </tr> </tbody> </table> <p>Computing frequency: 1 mark</p> <p>Arranging and creating a nodes: 5 marks</p> <p>Final tree: 1 mark</p> <p>Assigning codes: 1mark</p> <p>Computing code for each character: 2 marks</p>	Char.	C	O	N	E	T	I	Frequency	2	2	3	1	1	1	
Char.	C	O	N	E	T	I										
Frequency	2	2	3	1	1	1										
C	<p>Draw the B-tree of order 4 created by inserting the following data arriving in sequence: 25,16,20,5,39,7,11.</p> <p>Insertion of each key :7 Marks</p> <p>Correct Splitting: 2 marks</p> <p>Final tree : 1mark</p>															

University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE, Panvel)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: COMPUTER ENGINEERING

Curriculum Scheme: Rev2019

Examination: SE Semester III (for Direct Second Year-DSE)

Course Code: CSC303 and Course Name: DATA STRUCTURE

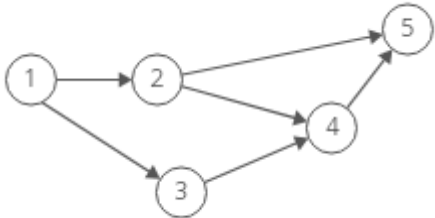
Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following option is true about nonlinear data structures?
Option A:	data elements are present at multiple levels.
Option B:	Garbage each element is traversable through a single run.
Option C:	data elements are sequentially connected
Option D:	Efficient utilization of memory.
2.	The operation of processing each element in the list is known as
Option A:	Creation
Option B:	Insertion
Option C:	Deletion
Option D:	Traversal
3.	A full binary tree with n leaves contains
Option A:	n - 1 nodes
Option B:	$\log_2 n$ nodes
Option C:	$2n - 1$ nodes
Option D:	2^n nodes
4.	Queue data structure is used for -
Option A:	Preorder traversal in tree
Option B:	Postorder traversal in tree
Option C:	Depth first traversal in graph
Option D:	Breadth first traversal in graph
5.	Top value in stack changes -
Option A:	While checking overflow
Option B:	While checking underflow
Option C:	Before deletion of an element from stack
Option D:	After deletion of an element from stack
6.	For which of the following operation, Linked lists are not suitable data structures?
Option A:	Linear search
Option B:	Binary search
Option C:	Sorting
Option D:	traversal

7.	Stacks cannot be used to
Option A:	evaluate an arithmetic expression in postfix form
Option B:	implement recursion
Option C:	convert a given arithmetic expression in infix form to its equivalent postfix form
Option D:	allocates resources (like CPU) by the operating system
8.	The Depth First Search algorithm has been implemented on following graph. One possible order of visiting the nodes of the graph is
	<pre> graph TD M --- R M --- N M --- Q N --- O O --- P Q --- P P --- O </pre>
Option A:	MRQNOP
Option B:	NMRQPO
Option C:	OPMQNR
Option D:	NORMQP
9.	Which of the following is essential for evaluating a postfix expression?
Option A:	An operator stack
Option B:	An operand stack
Option C:	An operator stack and an operand stack
Option D:	A parse tree
10.	A tree in which, at every node the height of its left sub tree and right sub tree differ at most by one is known as
Option A:	AVL Tree
Option B:	Complete Binary Tree
Option C:	Binary Search Tree
Option D:	Threaded Binary Tree
11.	Hash function f defined as $f(\text{key}) = \text{key} \bmod 11$, with linear probing, is used to insert the keys 37,38,72,48,98,56 into a table index starting from 0. What will be the location of key 16?
Option A:	5
Option B:	6
Option C:	7
Option D:	8
12.	Assume a binary search tree created by inserting the values 27, 9, 23, 22, 29, 25, 15, 50, 95, 60, 40. Number of nodes in the right subtree will be
Option A:	4
Option B:	5
Option C:	6
Option D:	7

13.	Which is not the valid balance factor for an AVL tree
Option A:	0
Option B:	1
Option C:	-1
Option D:	2
14.	B+ tree can contain a maximum of 7 pointers in a node. What is the minimum number of keys in leaves?
Option A:	3
Option B:	4
Option C:	5
Option D:	6
15.	Which of the following statement is not true about the doubly linked list?
Option A:	We can traverse in both the directions.
Option B:	It requires extra space
Option C:	Implementation of doubly linked list is easier than the singly linked list
Option D:	It stores the addresses of the next and the previous node
16.	Given, arr = {1,3,5,6,7,9,14,15,17,19} and the search_key = 19, how many comparisons are required using binary search?
Option A:	1
Option B:	2
Option C:	3
Option D:	4
17.	B-tree of order n is a order-n multiway tree in which each non-root node contains
Option A:	at most $(n - 1)/2$ keys
Option B:	exact $(n - 1)/2$ keys
Option C:	at least $2n$ keys
Option D:	at least $(n - 1)/2$ keys
18.	Postfix expression corresponding to the infix expression $“(1 + 4) / (8 - 6) * 3”$ is
Option A:	$1\ 4\ /\ 8\ 6\ *\ 3\ -$
Option B:	$14\ /\ 8\ 6\ *\ -\ 3\ +$
Option C:	$1\ 4\ +\ 8\ 6\ /\ -\ *\ 3$
Option D:	$1\ 4\ +\ 8\ 6\ -\ /\ 3\ *$
19.	Which of the following trait of a hash function is most desirable?
Option A:	It should be easy to implement
Option B:	It should occupy less space
Option C:	It should cause less collisions
Option D:	It should cause more collisions
20.	Topological sort can be implemented on a?
Option A:	Linked list
Option B:	Binary tree
Option C:	Directed acyclic graph
Option D:	Directed cyclic graph

Q2 (20 Marks Each)	Solve any Four out of Six	5 marks each
A	Write a C functions to implement insertion and deletion in queue using linked list.	
B	Explain deletion of a node in a binary search tree.	
C	Find topological sorting sequence in the following graph: 	
D	Consider a hash table with size = 7. Using Linear probing, insert the keys 99,33,23, 44, 56,43,19 into the table.	
E	Define ADT. Write ADT for stack.	
F	Write an algorithm to check the well-formedness of parenthesis in an algebraic expression using Stack data structure.	

Q3. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Create a Huffman tree and find Huffman codes for each character in the string "CONNECTION".	
B	Write a C program for Singly Linked list for performing following operations i. Create SLL ii. Display SLL iii. Delete last node from SLL iv. Insert a node at start of SLL	
C	Draw the B-tree of order 4 created by inserting the following data arriving in sequence: 25,10,16,32,20,5,27,39,7,11.	

University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE)

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev2019

Examination: SE Semester: III

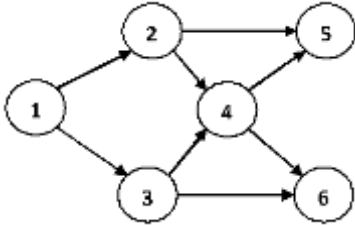
Course Code: CSC303 and Course Name: Data Structures

Time: 2 hour

Max. Marks: 80

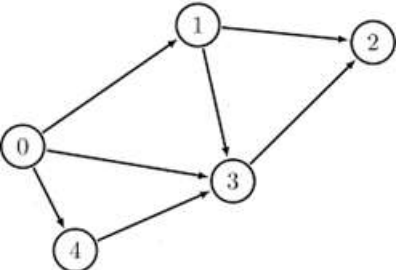
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	To convert the infix expression (D+(C-E)*F) into postfix, how many pop operations will be required?
Option A:	3
Option B:	4
Option C:	5
Option D:	6
2.	<p>What is the operation performed by the following code with respect to Binary search tree, if 'rt' is pointing to the root node:</p> <pre> struct node *ptr=rt; struct node *fun(struct node *ptr) { if(ptr==NULL) return NULL; else if(ptr->right==NULL) return ptr; else return fun(ptr->right); } </pre>
Option A:	returns the smallest value in the binary search tree
Option B:	returns the right child of root node
Option C:	Returns the largest value in the binary search tree
Option D:	Returns all right nodes in the binary search tree
3.	Which of the following statements is not correct for queues?
Option A:	Queue is used in process and job scheduling
Option B:	Queue is used in depth first search traversal
Option C:	The last inserted elements is removed at the last from queue
Option D:	Elements in the queue can be removed based on their priority.
4.	<p>The following postfix expression with single digit operands is evaluated using a stack:</p> $2\ 3\ ^\ 4\ / \ 7\ 5\ +\ * \ 3\ *$ <p>Note that ^ is the exponentiation operator. The top two elements of the stack after '+' is evaluated are:</p>
Option A:	5,7
Option B:	7,4

Option C:	12,8
Option D:	12,2
5.	<p>After performing these set of operations, what will be the contents of a double ended queue?</p> <pre> InsertFront(16); InsertRear(33); InsertRear(40); DeleteFront(); InsertRear(25); </pre>
Option A:	33,40,25
Option B:	16,33,25
Option C:	16,33,40
Option D:	25,33,40
6.	Which of the following statements about stacks is incorrect?
Option A:	Stacks can be implemented using linked lists
Option B:	Stacks are first-in, first-out (FIFO) data structures
Option C:	New nodes can only be added to the top of the stack
Option D:	The last node (at the bottom) of a stack has a null (0) link
7.	<p>What operation the following pseudo code indicates :</p> <pre> void func(Queue Q) { if(Q not empty) { int i=delete(Q); func(Q); insert(Q,i); } } </pre>
Option A:	Reverses queue elements
Option B:	Keeps queue unchanged
Option C:	Deletes front element from queue
Option D:	Deletes all elements from queue
8.	<p>What is the output of the following code, if linked list contains elements 16,37,28,49:</p> <pre> void fun1(struct Node* head) { if (head == NULL) return; fun1(head->next); printf("->%d", head->data); } </pre>
Option A:	->16->37->28->49
Option B:	->49->28->37->16
Option C:	->37->28->49->16
Option D:	->28->49->37->16
9.	How many pointers are contained as data members in the nodes of a circular,

	doubly linked list of integers with seven nodes?
Option A:	7
Option B:	8
Option C:	14
Option D:	15
10.	Which is not the property of Linear data structures ?
Option A:	Contiguous allocation
Option B:	Sequential access
Option C:	Static or dynamic allocation
Option D:	Abstract Data type
11.	<p>Consider the DAG with Consider $V = \{1, 2, 3, 4, 5, 6\}$, shown below. Which of the following is not a breadth first search sequence for the graph?</p>  <pre> graph TD 1((1)) --> 2((2)) 1((1)) --> 3((3)) 2((2)) --> 4((4)) 2((2)) --> 5((5)) 3((3)) --> 4((4)) 3((3)) --> 6((6)) 4((4)) --> 6((6)) </pre>
Option A:	1 2 3 4 5 6
Option B:	1 3 2 4 6 5
Option C:	1 3 2 6 4 5
Option D:	3 2 4 1 6 5
12.	A binary search tree is created by inserting the numbers 2, 6, 0, 1, 9, 8, 4, 7, 3, 5. What is the post-order traversal sequence of the resultant tree?
Option A:	0 1 2 3 4 5 6 7 8 9
Option B:	0 2 4 3 1 6 5 9 8 7
Option C:	1 0 3 5 4 7 8 9 6 2
Option D:	1 0 3 4 5 6 7 8 9 2
13.	<p>What the following code do:</p> <pre> ptr=head; while(ptr!=NULL) { tr=ptr->next->next; } </pre>
Option A:	Traverse list
Option B:	Traverse even position nodes
Option C:	Traverse odd position nodes
Option D:	Deletes odd position nodes
14.	<p>Select the operation performed by the following code segment with respect to binary tree:</p> <pre> void func(struct Node* p) { if (p == NULL) return; else </pre>

	<pre> { struct Node* temp; func(p->left); func(p->right); temp = p->left; p->left = p->right; p->right = temp; } </pre>
Option A:	find the minimum element in a binary search tree
Option B:	find the maximum element in a binary search tree
Option C:	Interchange of nodes
Option D:	Converts tree into its mirror image
15.	<p>If you insert 75 into the following binary search tree using the algorithm that keeps the tree height-balanced by doing rotations, what tree do you get?</p> <pre> graph TD 60((60)) --- 40((40)) 60 --- 70((70)) 40 --- 25((25)) 70 --- 65((65)) 70 --- 80((80)) </pre>
Option A:	Left child of 65
Option B:	Right child of 65
Option C:	Right child of 40
Option D:	Left child of 80
16.	How many nodes will be created in a B-tree by inserting the keys : 11,14,17,20,27,31,41,29,75,30 (Assume ORDER 5) ?
Option A:	4
Option B:	5
Option C:	6
Option D:	7
17.	Which of the following statement is incorrect with respect to graphs?
Option A:	A sequence of vertices that connect two nodes in a graph is called a path.
Option B:	Degree of vertex in a graph is the number of edges that touch it.
Option C:	A tree is a graph with cycles.
Option D:	In complete graph, every vertex is directly connected to every other vertex
18.	What is the worst case for linear search?
Option A:	Search key is available at first location
Option B:	Search key is available at last location
Option C:	Search key is available at middle of array
Option D:	Search key is available anywhere in the array
19.	In a Doubly linked list with 2 pointers namely, 'prev' and 'next', and a pointer 'Temp' pointing to some node except first or last node, which of the following statement will delete the element pointed by 'Temp'?

Option A:	Temp->prev->next=Temp->next ; Temp->next->prev=Temp->prev; free(temp);
Option B:	Temp->prev->next=Temp->prev ; Temp->next->prev=Temp->next; free(temp);
Option C:	Temp->prev->prev=Temp->next ; Temp->next->next=Temp->prev; free(temp);
Option D:	Temp->prev->prev=Temp->prev ; Temp->next->next=Temp->next; free(temp);
20.	Max .no. of nodes in a binary tree with level 6 are
Option A:	32
Option B:	63
Option C:	64
Option D:	31

Q2	Solve any Four out of Six	5 marks each
A	Consider marks of 5 subjects of a student represented as singly linked list. Write a C program to compute the total and percentage of the student.	
B	An array contains the elements – 8,13,17,26,44,56,88,97. Using binary search algorithm, trace the steps followed to find numbers 56 & 9. At each step, show the contents of low, high & mid and array after each iteration	
C	Create a Binary Search Tree for the following sequence and write all the 3 traversal sequences from resultant BST: 45,39,56,12,34,78,32,10,89,54,67,81.	
D	Use linear probing, insert the following keys in a hash table of size 11: 15,85,90,54,67,43,76. Find the number of collisions.	
E	Illustrate topological sorting for the following graph: 	
F	Define circular queue. Assume a circular queue with a capacity 6, currently having the elements 50 and 70 at locations 2 and 3 respectively. Show with example, the queue full and queue empty conditions by performing necessary operations on circular queue.	

Q3.	Solve any Two Questions out of Three	10 marks each												
A	Create a AVL tree for the sequence: I, N, F, O, R, M, A, T, G. Consider the characters to arrange in alphabetic sequence. Show the tree after each insertion with balance factors.													
B	Given the following frequencies for characters, find the Huffman code for all the characters: <table border="1" data-bbox="454 1825 1220 1926"> <tr> <td>Character</td> <td>S</td> <td>T</td> <td>I</td> <td>N</td> <td>G</td> </tr> <tr> <td>Frequency</td> <td>9</td> <td>16</td> <td>2</td> <td>30</td> <td>12</td> </tr> </table>	Character	S	T	I	N	G	Frequency	9	16	2	30	12	
Character	S	T	I	N	G									
Frequency	9	16	2	30	12									
C	Define recursion. Differentiate between iteration and recursion. Write a C program to check whether a string is palindrome or not, with the help of stack data structure.													

University of Mumbai
Examination 2021 under cluster __ (Lead College: __)
Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Computer Engineering

Curriculum Scheme: Rev 2019

Examination: SE Semester III

Course Code: CSC301 and Course Name: Engineering Mathematics III

Time: 2 hour

Max. Marks: 80

Question Number	Correct Option
Q1.	C
Q2.	D
Q3.	A
Q4	C
Q5	B
Q6	C
Q7	D
Q8.	D
Q9.	A
Q10.	B
Q11.	B
Q12.	D
Q13.	C
Q14.	A
Q15.	D
Q16.	B
Q17.	C
Q18.	C
Q19.	D
Q20.	C

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Curriculum Scheme: Rev 2019 'C' Scheme

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Time: 2 hour

Max. Marks: 80

Question Number	Correct Option
Q1.	B
Q2.	A
Q3.	D
Q4	C
Q5	A
Q6	C
Q7	D
Q8.	C
Q9.	A
Q10.	C
Q11.	A
Q12.	A
Q13.	A
Q14.	B
Q15.	A
Q16.	D
Q17.	B
Q18.	C
Q19.	A
Q20.	D

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Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	$L[\sinh 2t]$ is equal to
Option A:	$\frac{2}{s^2 + 4}$
Option B:	$\frac{4}{s^2 - 4}$
Option C:	$\frac{2}{s^2 - 4}$
Option D:	$\frac{4}{s^2 + 4}$
2.	$L[5t^3 + \cos 3t - e^{2t}]$ is equal to
Option A:	$\frac{30}{s^4} - \frac{s}{s^2 + 9} - \frac{1}{s - 2}$
Option B:	$\frac{15}{s^4} + \frac{s}{s^2 + 9} - \frac{1}{s - 2}$
Option C:	$\frac{15}{s^4} - \frac{s}{s^2 + 9} - \frac{1}{s - 2}$
Option D:	$\frac{30}{s^4} + \frac{s}{s^2 + 9} - \frac{1}{s - 2}$
3.	$L[e^{4t} \sin 3t]$ is equal to
Option A:	$\frac{3}{(s - 4)^2 + 9}$
Option B:	$\frac{3}{(s + 4)^2 + 9}$
Option C:	$\frac{3}{(s - 4)^2 + 3}$
Option D:	$\frac{3}{(s + 4)^2 + 3}$

4.	If $L[f(t)] = \phi(s)$, then $L[\frac{1}{t} f(t)]$ is equal to
Option A:	$\int_0^{\infty} \phi(s) ds$
Option B:	$\int_s^{\infty} \frac{\phi(s)}{s} ds$
Option C:	$\int_s^{\infty} \phi(s) ds$
Option D:	$\int_0^{\infty} \frac{\phi(s)}{s} ds$
5.	$L^{-1} \left[\frac{s-b}{(s-b)^2+a^2} \right]$ is equal to
Option A:	$e^{-bt} \cos at$
Option B:	$e^{bt} \cos at$
Option C:	$e^{-bt} \sin at$
Option D:	$e^{bt} \sin at$
6.	If $L[f_1(t)] = \phi_1(s)$, $L[f_2(t)] = \phi_2(s)$ then By the Convolution Theorem $L^{-1}[\phi_1(s) \cdot \phi_2(s)] =$
Option A:	$\int_0^{\infty} f_1(u) \cdot f_2(t-u) du$
Option B:	$\int_0^t f_1(u) \cdot f_2(u) du$
Option C:	$\int_0^t f_1(u) \cdot f_2(t-u) du$
Option D:	$\int_0^{\infty} f_1(u) \cdot f_2(u) du$
7.	If $L^{-1}[\phi(s)] = f(t)$ then $L^{-1}[\phi''(s)] =$
Option A:	$-\frac{1}{t} f(t)$
Option B:	$\frac{1}{t} f(t)$
Option C:	$-t^2 f(t)$
Option D:	$t^2 f(t)$

8.	$L^{-1}[\log(s + a)] =$
Option A:	$\frac{1}{t}e^{at}$
Option B:	$\frac{1}{t}e^{-at}$
Option C:	$-\frac{1}{t}e^{at}$
Option D:	$-\frac{1}{t}e^{-at}$
9.	If the Fourier series of $f(x) = \frac{1}{2}(\pi - x)$ in $[0, 2\pi]$ is $\frac{a_0}{2} + \sum_{n=1}^{\infty}[a_n \cos nx + b_n \sin nx]$ then what is the value of a_0 .
Option A:	0
Option B:	-1
Option C:	1
Option D:	N
10.	If the Fourier Series of $f(x) = \begin{cases} -\pi & -\pi < x < 0 \\ x & 0 \leq x < \pi \end{cases}$ is $f(x) = \frac{-\pi}{4} + \frac{1}{\pi} \sum \frac{(-1)^n - 1}{n^2} \cos nx + \sum \frac{1 - 2(-1)^n}{n} \sin nx$ then the series $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ is equal to
Option A:	$\frac{\pi^2}{8}$
Option B:	$-\frac{\pi^2}{8}$
Option C:	$\frac{\pi^2}{4}$
Option D:	$-\frac{\pi^2}{4}$
11.	If $f(x)$ is an even function in $(-\pi, \pi)$ then in the Fourier series expansion of $f(x)$ in $(-\pi, \pi)$, following is true.
Option A:	$a_n = 0$
Option B:	$b_n = 0$
Option C:	$a_n = b_n = 0$
Option D:	$a_0 = b_n = 0$
12.	Determine the constant 'a' if $f(z) = (ax^3 - 6xy^2 + 3x^2 - 3y^2 + x) + i(6x^2y - 2y^3 + 6xy + y)$ is analytic.
Option A:	3
Option B:	4
Option C:	-2
Option D:	2
13.	If $(x) = (x^3 - 3xy^2) + i(3x^2y - y^3)$, find its complex derivative.
Option A:	$f'(z) = 3(y^2 - x^2) + i6xy$
Option B:	$f'(z) = 3(x^2 + y^2) + i6xy$
Option C:	$f'(z) = 3(x^2 - y^2) + i6xy$

Option D:	$f'(z) = 3(x^2 + y^2) - i6xy$								
14.	If $f(z) = u(x, y) + iv(x, y)$ is an analytic function then select the correct option.								
Option A:	Curves $u = c_1$ & $v = c_2$ intersects orthogonally.								
Option B:	Curves $u = c_1$ & $v = c_2$ never intersects.								
Option C:	Curves $u = c_1$ & $v = c_2$ are straight lines.								
Option D:	Curves $u = c_1$ & $v = c_2$ are same.								
15.	If the values of two variables deviate in the same direction then the correlation is said to be								
Option A:	Linear correlation								
Option B:	Zero correlation								
Option C:	Negative correlation								
Option D:	Positive correlation								
16.	Karl Pearson's Coefficient of Correlation (r) is given by the following formula								
Option A:	$\frac{E(XY) - E(X)E(Y)}{\sqrt{[E(X^2) + (E(X))^2][E(Y^2) + (E(Y))^2]}}$								
Option B:	$\frac{E(XY) - E(X)E(Y)}{\sqrt{[E(X^2) - (E(X))^2][E(Y^2) - (E(Y))^2]}}$								
Option C:	$\frac{E(X)E(Y) - E(XY)}{\sqrt{[E(X^2) - (E(X))^2][E(Y^2) - (E(Y))^2]}}$								
Option D:	$\frac{E(XY) + E(X)E(Y)}{\sqrt{[E(X^2) + (E(X))^2][E(Y^2) + (E(Y))^2]}}$								
17.	If the regression lines are $x + 6y = 6$ & $3x + 2y = 10$ find \bar{x}, \bar{y} .								
Option A:	$\bar{x} = 3, \bar{y} = 2$								
Option B:	$\bar{x} = 2, \bar{y} = 1/2$								
Option C:	$\bar{x} = 3, \bar{y} = 1/2$								
Option D:	$\bar{x} = 1, \bar{y} = 2$								
18.	If two events A & B are independent then following statement is true.								
Option A:	$P(A \cap B) = P(A) + P(B)$								
Option B:	$P(A \cup B) = P(A) \cdot P(B)$								
Option C:	$P(A \cap B) = P(A) \cdot P(B)$								
Option D:	$P(A \cup B) = P(A) + P(B)$								
19.	Suppose the probability distribution of a random variable x is given by								
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">P(X=x)</td> <td style="text-align: center;">k</td> <td style="text-align: center;">$k + \frac{1}{7}$</td> <td style="text-align: center;">2k</td> </tr> </table>	X	1	2	3	P(X=x)	k	$k + \frac{1}{7}$	2k
X	1	2	3						
P(X=x)	k	$k + \frac{1}{7}$	2k						
	Obtain k.								
Option A:	-3/7								
Option B:	3/7								
Option C:	-3/14								

Option D:	3/14
20.	Suppose two fair dice are thrown and sum of the numbers on dice is noted. What is the probability that the sum can be equal to 6, 7, 8 or 9?
Option A:	2/9
Option B:	4/9
Option C:	5/9
Option D:	7/9

Subjective/descriptive questions

Q2 (20 Marks)	Solve any Four out of Six 5 marks each					
A	Find $L \left[\frac{\cos 2t \sin t}{e^t} \right]$					
B	Find $L^{-1} \left\{ \frac{s+2}{s^2-4s+13} \right\}$					
C	Find the Fourier Series of $f(x)$ where $f(x) = x^3$ in $(-\pi, \pi)$.					
D	Determine whether the function $f(z) = (x^3 - 3xy^2 + 3x) + i(3x^2y - y^3 + 3y)$ is analytic. If so find its derivative.					
E	Fit a straight line to the following data					
	x	0	1	2	3	4
	y	1	1.8	3.3	4.5	6.3
F	The distribution function of a random variable X is given by $F(x) = 1 - (1+x)e^{-x}$, $x \geq 0$. Obtain the probability density function (pdf) of X.					

Q3 (20 Marks)	Solve any Four out of Six 5 marks each					
A	Find $L[(1 + te^{-t})^3]$					
B	Find $L^{-1} \left\{ \frac{1}{s(s^2+a^2)} \right\}$					
C	Find the half range cosine series for $f(x) = \begin{cases} 2 & 0 < x < \frac{a}{2} \\ -2 & \frac{a}{2} < x < a \end{cases}$					
D	Show that the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic.					
E	Compute a Spearman's coefficient of rank correlation for the given data					
	x	3	6	4	5	7
	y	2	4	5	3	6
F	A random variable X has following probability distribution					
	X	-2	0			
	P(X=x)	1/3	1/2	1/6		
	What is the moment generating function of X					

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Curriculum Scheme: Rev 2019 'C' Scheme

Examination: SE Semester III

Course Code: CSC301 and Course Name: Engineering Mathematics III

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The Laplace Transform of $t.e^{at}$
Option A:	$\frac{1}{s}$
Option B:	$\frac{1}{(s-a)^2}$
Option C:	$\frac{1}{(s+a)^2}$
Option D:	$\frac{1}{s^2}$
2	Find $L\left(\frac{e^{-t} \sin t}{t}\right)$
Option A:	$\cot^{-1}(s+1)$
Option B:	$\tan^{-1}(s+1)$
Option C:	$\tan^{-1}(s-1)$
Option D:	$\cot^{-1} s$
3	Given $f(t) = \frac{\sin t}{t}$, find $L\{f'(t)\}$
Option A:	$s \cot^{-1} s$
Option B:	$s \cot^{-1} s + 1$
Option C:	$\tan^{-1} s - 1$
Option D:	$s \cot^{-1} s - 1$
4	Find the Laplace transform of $\int_0^t \frac{\sin u}{u} du$
Option A:	$\frac{1}{s} \tan^{-1} s$
Option B:	$\cot^{-1} s$
Option C:	$\frac{1}{s} \cot^{-1} s$
Option D:	$\tan^{-1} s$

5	Find $L^{-1}\left[\frac{s+2}{s^2+4s+7}\right]$
Option A:	$e^{-2t} \cdot \cos\sqrt{3}t$
Option B:	$e^{-2t} \cdot \cos\sqrt{2}t$
Option C:	$e^{-2t} \cdot \cos^2 t$
Option D:	$e^{-2t} \cdot \sin\sqrt{3}t$
6	Find $L^{-1}\left[\frac{3s+4}{s^2+16}\right]$
Option A:	$4 \cdot \sin 4t + \cos 4t$
Option B:	$\cos 4t + \sin 3t$
Option C:	$3 \cdot \cos 4t + \sin 4t$
Option D:	$\sin 3t + \cos 4t$
7	Find the Inverse Laplace transform of $\frac{1}{s(s+a)}$
Option A:	$\frac{1+e^{-at}}{a}$
Option B:	e^{-at}
Option C:	$e^{-at} + 1$
Option D:	$\frac{1-e^{-at}}{a}$
8	If $L\{f_1(t)\} = F_1(s)$ and $L\{f_2(t)\} = F_2(s)$ then by Convolution theorem $L^{-1}[F_1(s) * F_2(s)]$
Option A:	$\int_0^{\infty} f_1(u) \cdot f_2(t-u) du$
Option B:	$\int_0^t f_1(u) \cdot f_2(u) du$
Option C:	$\int_0^t f_1(u) \cdot f_2(t-u) du$
Option D:	$\int_0^{\infty} f_1(u) \cdot f_2(u) du$
9	In half range <i>sine</i> Fourier series, we assume the function to be
Option A:	Odd function
Option B:	Even function
Option C:	Both even and odd
Option D:	Can be anything

10	The Fourier co-efficient a_n for the function $f(x) = x^2$ in $(0, 2\pi)$ is given by
Option A:	$\frac{n}{4\pi}$
Option B:	$\frac{3\pi}{n^2}$
Option C:	$\frac{4\pi}{n}$
Option D:	$\frac{3\pi}{n^3}$
11	If $f(x) = \cos x$ defined in $(-\pi, \pi)$ then the value Fourier coefficient b_n is
Option A:	0
Option B:	π
Option C:	$\frac{\pi}{(n^2 - 1)}$
Option D:	$\frac{2\pi}{(n^2 - 1)} [(-1)^n - 1]$
12	If $f(z) = e^z$ is an analytic function, then real part is given by
Option A:	$e^x \cos y$
Option B:	$\cos y$
Option C:	$-e^x \sin y$
Option D:	$\sin y$
13	A function $u(x, y)$ is harmonic if and only if,
Option A:	$u_{xx} + u_{yy} = 0$
Option B:	$u_x + u_y = 0$
Option C:	$u_{xy} + u_{yx} = 0$
Option D:	$u_x - u_y = 0$
14	If $f(z)$ is an analytic and $ f(z) $ is constant, then $f(z)$ is
Option A:	Harmonic
Option B:	constant
Option C:	orthogonal
Option D:	conjugate
15	A random variable X has probability distribution with $E(X)=1.5$, $E(X^2)=3$ then then variance is
Option A:	0.75
Option B:	1.5
Option C:	3
Option D:	5.25

16	A continuous random variable X has the probability density function $f(x) = kx^2, 0 \leq x \leq 2$. Determine k
Option A:	$\frac{5}{8}$
Option B:	$\frac{2}{8}$
Option C:	$\frac{8}{3}$
Option D:	$\frac{3}{8}$
17	If X_1 has mean 4 and variance 9 and X_2 has mean -2 variance 4, and the two are independent, find $V(2X_1 + X_2 - 3)$
Option A:	3
Option B:	41
Option C:	14
Option D:	36
18	The limits for coefficient of correlation are
Option A:	$-1 \leq r \leq 2$.
Option B:	$-1 \leq r \leq 0$.
Option C:	$-1 \leq r \leq 1$.
Option D:	$0 \leq r \leq 1$.
19	If $b_{yx} = 0.7764$, $b_{xy} = 1.2321$ then coefficient of correlation
Option A:	0.9781
Option B:	0.6291
Option C:	1.2307
Option D:	0.0023
20	If the tangent of the angle made by the line of regression of y on x is 0.6 and $\sigma_y = 2\sigma_x$, find the correlation coefficient between x and y .
Option A:	$r = 0.25$
Option B:	$r = 0.15$
Option C:	$r = 0.2$
Option D:	$r = 0.3$

Subjective / Descriptive questions

Q2 (20 Marks)	Solve any Four out of Six. 5 marks each
A	Find the Laplace transform of $\cos t \cdot \cos 2t \cdot \cos 3t$
B	Using convolution theorem find the Inverse Laplace transform of $\frac{s^2}{(s^2 + a^2)^2}$
C	Find the Fourier expansion of $f(x) = x + x^2$; $-\pi \leq x \leq \pi$ and $f(x + 2\pi) = f(x)$
D	Find k & then $E(X)$, if X has the probability density function $f(x) = \begin{cases} kx(2-x), & 0 \leq x \leq 2, k > 0 \\ 0, & \text{otherwise} \end{cases}$
E	Find an analytic function $f(z)$ whose imaginary part is $e^{-x}(y \sin y + x \cos y)$
F	Obtain the rank correlation coefficient from the following data $X : 10, 12, 18, 18, 15, 40$ $Y : 12, 18, 25, 25, 50, 25$

Q3 (20 Marks)	Solve any Four out of Six. 5 marks each
A	By using Laplace transform, evaluate $\int_0^{\infty} e^{-t} \left(\frac{\cos 3t - \cos 2t}{t} \right) dt$
B	Find the inverse Laplace transform of $\tan^{-1} \left(\frac{2}{s^2} \right)$
C	Find the orthogonal trajectory of the family of curves $x^3 y - xy^3 = c$
D	A random variable X has the following probability function $\begin{array}{ccccccc} X & : & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ P(X = x) & : & k & 2k & 3k & k^2 & k^2 + k & 2k^2 & 4k^2 \end{array}$ Find i) k and ii) $P(X < 5)$
E	Obtain the expansion of $f(x) = x(\pi - x)$; $0 < x < \pi$ as a half-range cosine series.
F	Fit a straight line of the form $y = a + bx$ to the following data & estimate the value of y for $x = 3.5$ $x : 0 \quad 1 \quad 2 \quad 3 \quad 4$ $y : 1 \quad 1.8 \quad 3.3 \quad 4.5 \quad 6.3$