Roll No:
Application No:
Name:
Exam Date: **07-Oct-2020**
Exam Time: **15:00-18:00**
Examination: **1. Course Code - M. Tech.;M.P.H.;P.G. Diploma in Bigdata**
2. Field of Study - Statistical Computing (Data Science) (MTST)

Registered Photo

Exam Day Photo

SECTION 1 - PART A

Question No.1 (Question Id - 61)

How many minimum number of states are required in the DFA (over alphabets {a, b}), accepting all strings with the number of a's divisible by 4 and number of b's divisible by 5 ?

(A) ◯ **20 (Correct Answer)**
(B) ◯ 9
(C) ◯ 7
(D) ◯ 5

Question No.2 (Question Id - 63)

The Ackermann's function is defined by
A(0, y) = y+1
A(x+1, 0) = A(x, 1)
A(x+1, y+1) = A(x, A(x+1, y))
Then A(2, 1) is :

(A) ◯ **5 (Correct Answer)**
(B) ◯ 7
(C) ◯ 8
(D) ◯ 10

Question No.3 (Question Id - 4)

When Anuj saw Manish, he recalled, "He is the son of the father of my daughter's mother." Who is Manish in relation to Anuj ?

(A) ◯ **Brother-in-law (Correct Answer)**
(B) ◯ Brother
(C) ◯ Cousin
(D) ◯ Uncle

Question No.4 (Question Id - 15)

A man and women decide to meet at a certain location. If each person independently arrives at a time uniformly distributed between 12 noon and 1:00 pm. the probability that the first to arrive has to wait longer than 10 minutes is _____.

(A) ◯ 35/36
(B) ◯ **25/36 (Correct Answer)**
(C) ◯ 1/36
(D) ◯ 1/35

Question No.5 (Question Id - 11)

If A and B are independent events and P(A)=1/3 and $P(\bar{B}) = 1/4$ then the value of P(AUB) is :

(A) ◯ **5/6 (Correct Answer)**
(B) ◯ 3/5
(C) ◯ 1/6
(D) ◯ 1/12

Question No.6 (Question Id - 24)

A smart phone manufacturing company uses screen shield glasses at a constant rate of 25000 per year. Their ordering cost is □ 100 per order. Each screen shield glass cost □ 200 and the inventory carrying charge is 10% of the unit cost of screen shield glass. What is the Economic order quantity for the company ?

(A) ◯ 10,000 units

(B) ◯ **500 units (Correct Answer)**
(C) ◯ 250 units
(D) ◯ can not be determined

Question No.7 (Question Id - 50)
The main ( ) function returns an integer to :
(A) ◯ compiler
(B) ◯ **operating system (Correct Answer)**
(C) ◯ system screen
(D) ◯ main ( ) function

Question No.8 (Question Id - 59)
Consider the language $L_1 = \{0^i1^j \mid i \neq j\}$, $L_2 = \{0^i1^j \mid i = j\}$, $L_3 = \{0^i1^j \mid i = 2j + 1\}$, $L_4 = \{0^i 1^j \mid i \neq 2j\}$.

Which one of the following statements is **true** ?

(A) ◯ Only L_2 is context free
(B) ◯ Only L_2 and L_3 are context free
(C) ◯ Only L_1 and L_2 are context free
(D) ◯ **All are context free (Correct Answer)**

Question No.9 (Question Id - 42)
Linked List is not suitable for :
(A) ◯ Insertion Sort
(B) ◯ **Binary Search (Correct Answer)**
(C) ◯ Radix Sort
(D) ◯ Polynomial Manipulation

Question No.10 (Question Id - 69)
What is the minimum number of gates required to implement the Boolean function (AB+C) if we have to use only 2 - input NOR gates ?

(A) ◯ 2
(B) ◯ **3 (Correct Answer)**
(C) ◯ 4
(D) ◯ 5

Question No.11 (Question Id - 44)

Match **List - I** with **List - II**

List - I	List - II
A. Greedy Approach	I. Travelling Salesman
B. Dynamic Programming	II. Merge Sort
C. Divide and Conquer	III. Matrix Chain Multiplication
D. NP Complete	IV. Prims Algorithm

Choose the **correct** answer from the options given below:

(A) ◯ A - III, B - I, C - II, D - IV
(B) ◯ A - IV, B - II, C - I, D - III
(C) ◯ A - II, B - III, C - I, D - IV
(D) ◯ **A - IV, B - III, C - II, D - I (Correct Answer)**

Question No.12 (Question Id - 57)

Match **List - I** with **List - II :**

List - I	List - II
A. Disk Scheduling	I. Round Robin
B. Batch Processing	II. SCAN
C. Time Sharing	III. LIFO
D. Interrupt Processing	IV. FIFO

Choose the **correct** answer from the options given below :

(A) ◯ A - III, B - IV, C - II, D - I

(B) ○ A - IV, B - III, C - II, D - I
(C) ○ **A - II, B - IV, C - I, D - III (Correct Answer)**
(D) ○ A - III, B - IV, C - I, D - II

Question No.13 (Question Id - 19)

Let the quality of a software module be judged by the parameter $x = \frac{\text{number of bugs}}{\text{number of lines of code}}$. The goal of a software project is to achieve the desired output with x being less than 5 bugs per million lines of code. The quality assurance team gets a sample of several different parts of code and estimates the number of errors in each. What type of hypothesis testing will detect if this quality level is not reached ?

(A) ○ Non-parametric tests
(B) ○ Two-sample tests
(C) ○ **One-tailed tests (Correct Answer)**
(D) ○ Qualitative tests

Question No.14 (Question Id - 28)

The solution of the differential equation
$(x-a)\frac{dy}{dx}+3y=12(x-a)^3, x>a>0$
(A) ○ y=2(x-a)+c/(x-a)
(B) ○ $y=2(x-a)^2+c/(x-a)^2$
(C) ○ $y=2(x-a)^3+c/(x-a)$
(D) ○ **$y=2(x-a)^3+c/(x-a)^3$ (Correct Answer)**

Question No.15 (Question Id - 49)

Match **List - I** with **List - II**

List - I	**List - II**
A. void pointer	I. Present in every object
B. this pointer	II. Accessing destroyed data
C. pointer to function	III. Point to any type of variable with proper type casting
D. wild pointer	IV. void (*f(void));

Choose the **correct** answer from the options given below :

(A) ○ A - IV, B - III, C - I, D - II
(B) ○ A - II, B - III, C - I, D - IV
(C) ○ A - III, B - I, C - II, D - IV
(D) ○ **A - III, B - I, C - IV, D - II (Correct Answer)**

Question No.16 (Question Id - 38)

Let F be a finite field. Then F[x] is :
(A) ○ Not an Integral Domain.
(B) ○ **Never a field. (Correct Answer)**
(C) ○ Sometimes a field.
(D) ○ Always a field.

Question No.17 (Question Id - 58)

A CFG is said to be in Chomsky Normal Form (CNF), if all the productions are of the form A → BC or A → a. Let G be a CFG in CNF. To derive a string of terminals of length x, the number of productions to be used is :

(A) ○ **2x - 1 (Correct Answer)**
(B) ○ 2x
(C) ○ 2x + 1
(D) ○ 2^x

Question No.18 (Question Id - 65)

Let A = {1, 2, 3, 4}. Let R = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (3, 4), (4, 3), (4, 4)}. Determine whether the relation is :

A. reflexive

B. irreflexive

C. symmetric

D. asymmetric

E. Transitive

Choose the **correct** answer from the options given below :

(A) ○ A, B only
(B) ○ A, B, C only
(C) ○ **A, C, E only (Correct Answer)**
(D) ○ A, D, E only

Question No.19 (Question Id - 26)

The value of $\lim_{x \to 0} x^x$ is :

(A) ○ 0
(B) ○ -1
(C) ○ **1 (Correct Answer)**
(D) ○ ∞

Question No.20 (Question Id - 13)

If X is a Poisson random variable with parameter λ then the value of moment generating functions is _____.

(A) ○ **exp {λ (e^t-1)} (Correct Answer)**
(B) ○ exp {$e^{\lambda t}$-1}
(C) ○ exp {λ ($e^{\lambda t}$-1)}
(D) ○ exp {λ^2 (e^t-1)}

Question No.21 (Question Id - 22)

Which of the following methods can be used to obtain initial basic feasible solution of a transportation problem ?

(A) ○ **North West Corner Rule (Correct Answer)**
(B) ○ Hungarian Method
(C) ○ Charne's Perturbation Method
(D) ○ Wolfe's Method

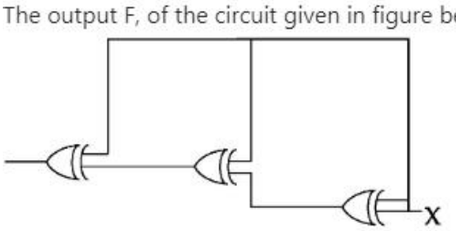
Question No.22 (Question Id - 53)

If there are 32 segments each of size 1K bytes, then the logical address should have _____.

(A) ○ 13 bits
(B) ○ 14 bits
(C) ○ **15 bits (Correct Answer)**
(D) ○ 16 bits

Question No.23 (Question Id - 73)

The output F, of the circuit given in figure below is given by :



(A) ○ 1
(B) ○ **0 (Correct Answer)**
(C) ○ X
(D) ○ $\bar{X}$

Question No.24 (Question Id - 31)

Consider the system :

x+2y+z=3
ay+5z=10
2x+7y + az = b

The values of 'a' for which the system has a unique solution is :

(A) ○ a ≠ 5
(B) ○ a ≠ - 3

(C) ○ **a ≠ 5 and a ≠ - 3 (Correct Answer)**
(D) ○ None of the above

Question No.25 (Question Id - 45)
The postfix expression corresponding to expressions 5+6 *7-9 is :
(A) ○ **5 6 7 * + 9 - (Correct Answer)**
(B) ○ 5 6 + 7 * 9 -
(C) ○ 5 6 7 9 * + -
(D) ○ None

Question No.26 (Question Id - 1)
Six children A, B, C, D, E and F are sitting in a straight line. E and D have two children between them. There are three children between B and F. A is to the immediate left of E, F is to the immediate left of D and C is not on either extreme ends. Which of them are on the extreme ends ?

(A) ○ E and F
(B) ○ **B and D (Correct Answer)**
(C) ○ D and C
(D) ○ A and B

Question No.27 (Question Id - 10)
The following is a pair of words that have a certain relationship to each other,
Knife : Chopper
Which of the following pairs have the same relationship as the original pair of words above ?

(A) ○ Walking : Fitness
(B) ○ Swim : Float
(C) ○ Scissors : Cloth
(D) ○ **Quilt : Blanket (Correct Answer)**

Question No.28 (Question Id - 2)
In a code language, 256 means 'you are good', 637 means 'we are bad' and 358 means 'good and bad'. Find the code for 'and'.

(A) ○ 2
(B) ○ 5
(C) ○ **8 (Correct Answer)**
(D) ○ 3

Question No.29 (Question Id - 18)
The below question has been dropped and full marks are awarded.

Let the cumulative distribution of a standard normal random variable be $\phi(x)$. Let X be normally distributed with mean m and variance σ^2. Then the cumulative distribution function of X, F_X (a) is given by :

(A) ○ $\phi(a-\mu)$
(B) ○ $\phi(\mu-a)$
(C) ○ $\phi\left(\frac{\mu-a}{\sigma}\right)$
(D) ○ $\phi\left(\frac{a-\mu}{\sigma}\right)$

Question No.30 (Question Id - 67)
How many 2 digit numbers greater than 40 can be formed by using the digits 1, 2, 3, 4, 6, 7, when repetition is allowed ?

(A) ○ 15
(B) ○ **18 (Correct Answer)**
(C) ○ 21
(D) ○ 24

Question No.31 (Question Id - 70)

Simplification of the following Boolean function F

$F = \bar{A}\bar{B}\bar{D} + \bar{A}CD + \bar{A}BC$

using the following "don't care" condition d,

$d = \bar{A}B\bar{C}D + ACD + A\bar{B}\bar{D}$

in sum of product, is _____.

(A) ○ $F = \bar{A}C + CD + \bar{B}\bar{D}$

(B) ○ $F = \bar{A}\bar{C} + \bar{B}D$

(C) ○ $F = \bar{A}C + \bar{B}\bar{D}$ **(Correct Answer)**

(D) ○ $F = AC + \bar{B}\bar{D}$

Question No.32 (Question Id - 27)

The value of $\int_0^{\pi/2} \sqrt{\tan x}\ dx$ is :

(A) ○ $\pi/2$

(B) ○ $\pi/(2\sqrt{2})$

(C) ○ $\pi/\sqrt{2}$ **(Correct Answer)**

(D) ○ π

Question No.33 (Question Id - 40)

Let R be the set of all commutative rings and define
R_1={r ∈ R|r is an Integral Domain}
R_2={r ∈ R|r is a PID}
R_3={r ∈ R|r is a UFD}
Which of the following statements is **true** ?

(A) ○ $R_1 \subseteq R_2 \subseteq R_3$

(B) ○ $R_3 \subseteq R_2 \subseteq R_1$

(C) ○ **$R_2 \subseteq R_3 \subseteq R_1$ (Correct Answer)**

(D) ○ $R_3 \subseteq R_1 \subseteq R_2$

Question No.34 (Question Id - 35)

Let T : $R^2 \rightarrow R^3$ be a linear transformation defined as :
$T(x_1, x_2) = (x_1, x_1 + x_2, x_2)$
Rank and Nullity of the Linear transformation are :

(A) ○ Rank = 1 Nullity = 1

(B) ○ **Rank = 2 Nullity = 0 (Correct Answer)**

(C) ○ Rank = 2 Nullity = 1

(D) ○ Rank = 0 Nullity = 2

Question No.35 (Question Id - 39)

Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**.
Assertion A :
Every maximal ideal of a commutative ring R is a prime ideal.
Reason R :
M is a maximal ideal in the commutative ring R if and only if the quotient ring R/M is a field. We know that every field is an integral domain and for a prime ideal P of R, R/P is an integral domain. Therefore, M is a prime ideal of R.
In the light of the above statements, choose the **most appropriate** answer from the options given below.

(A) ○ Both **A** and **R** are correct and **R** is the correct explanation of **A**.

(B) ○ Both **A** and **R** are correct, but **R** is NOT the correct explanation of **A**.

(C) ○ **A is correct, but R is not correct. (Correct Answer)**

(D) ○ **A** is not correct, but **R** is correct.

Question No.36 (Question Id - 68)

$(8620)_{10}$ in BCD is _____.

(A) ○ $(0100\ 0110\ 0010\ 0000)_{BCD}$

(B) ○ **$(1000\ 0110\ 0010\ 0000)_{BCD}$ (Correct Answer)**

(C) ○ $(0111\ 1000\ 1100\ 0000)_{BCD}$

(D) ○ $(1000\ 0111\ 0101\ 0000)_{BCD}$

Question No.37 (Question Id - 33)

Let V={(z_1, z_2, z_3) : z_1, z_2, z_3 ∈ C} = C^3 be a vector space over C. Which of the following is a subspace of V.

(A) ○ W_1 ={(z_1, z_2, z_3) : z_1 is a Real No. and z_2 ∈ C}
(B) ○ **W_2 ={(z_1, z_2, z_3) : $z_1+z_2=0$ and z_1, z_2 ∈ C} (Correct Answer)**
(C) ○ W_3 ={(z_1, z_2, z_3) : $z_1+z_2=1$ and z_1, z_2 ∈ C}
(D) ○ W_4 ={(z_1, z_2, 5) : z_1, z_2 ∈ C}

Question No.38 (Question Id - 5)

The below question has been dropped and full marks are awarded.

A man is facing Northwest. He turns 908 in the clockwise direction and then 1358 in the anti-clockwise direction. What direction is he facing now ?

(A) ○ East
(B) ○ West
(C) ○ North
(D) ○ South

Question No.39 (Question Id - 51)

A page fault occurs when :

(A) ○ The page is corrupted by application software
(B) ○ The page is in main memory
(C) ○ **The page is not in main memory (Correct Answer)**
(D) ○ One tries to divide a number by zero

Question No.40 (Question Id - 8)

The first two objects in the following are related in some way.
Light : Sun : : Heat : ____
Choose the best option among the following which will establish the same relationship in the other two objects.

(A) ○ Electricity
(B) ○ Moon
(C) ○ **Fire (Correct Answer)**
(D) ○ Star

Question No.41 (Question Id - 56)

Match **List - I** with **List - II**.

List - I	List - II
A. Critical Region	I. Hoare's Monitor
B. Wait/Signal	II. Mutual Exclusion
C. Working Set	III. Principle of Locality
D. Deadlock	IV. Circular Wait

Choose the **correct** answer from the options given below.

(A) ○ **A - II, B - I, C - III, D - IV (Correct Answer)**
(B) ○ A - II, B - I, C - IV, D - III
(C) ○ A - I, B - II, C - III, D - IV
(D) ○ A - I, B - II, C - IV, D - III

Question No.42 (Question Id - 52)

Which of the following Page Replacement algorithms suffer(s) from Belady's anomaly ?

(A) ○ Optimal replacement
(B) ○ **FIFO (Correct Answer)**
(C) ○ LRU
(D) ○ Both optimal replacement and LRU

Question No.43 (Question Id - 29)

Let $f'(x) = \frac{1}{(3-x^2)}$ and f (0)=1. An interval in which f (1) lies is :

(A) ○ $\frac{1}{3} \le f(1) \le \frac{1}{2}$

(B) ○ $\frac{4}{3} \leq f(1) \leq \frac{3}{2}$ **(Correct Answer)**

(C) ○ $\frac{2}{3} \leq f(1) \leq \frac{3}{2}$

(D) ○ $\frac{1}{3} \leq f(1) \leq \frac{3}{2}$

Question No.44 (Question Id - 60)

Let G be the grammar defined by :
G = ({s},{a},{s → ss}, s)
where s is the start symbol and a is the terminal symbol.
Then language generated by G is :

(A) ○ $L(G) = \{s^n | n \geq 0\}$

(B) ○ $L(G) = \{s^{2n} | n \geq 1\}$

(C) ○ $L(G) = \{a^n | n \geq 1\}$

(D) ○ $L(G) = \varnothing$ **(Correct Answer)**

Question No.45 (Question Id - 36)

Let * be a binary operation on set of positive integers Z>0, given by :

$a * b = \frac{\text{lcm}(a, b)}{\text{gcd}(a, b)}$

A. * is commutative.

B. * is associative.

C. There exists a positive integer u such that a*u=a for all positive integers a.

D. Given a positive integer a, there exists a positive integer b such that (a*b)*a=a.

Choose the **correct** answer from the options given below.

(A) ○ A, B and C only

(B) ○ B, C and D only

(C) ○ **C, D and A only (Correct Answer)**

(D) ○ A, B, C and D only

Question No.46 (Question Id - 3)

Fill in the missing number in the series :
4, 3, 12, 9, 2, 18, 3, __, 21

(A) ○ 5

(B) ○ 4

(C) ○ 3

(D) ○ **7 (Correct Answer)**

Question No.47 (Question Id - 12)

The mean and variance of binomial distribution are 4 and 4/3, respectively then the value of n is _____.

(A) ○ 4

(B) ○ 3

(C) ○ 5

(D) ○ **6 (Correct Answer)**

Question No.48 (Question Id - 34)

Let $\alpha = (1, -2, 3)$ be any vector of R^3 and β be any unit vector orthogonal to α. Then the values of β are :

(a) $\left(\frac{2}{2\sqrt{3}}, \frac{-2}{2\sqrt{3}}, \frac{-2}{2\sqrt{3}}\right)$ (b) $\left(\frac{1}{\sqrt{3}}, \frac{\sqrt{2}}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

(c) $\left(0, \frac{3}{\sqrt{13}}, \frac{2}{\sqrt{13}}\right)$ (d) $(6, -6, 6)$

Choose the correct answer from the options given below.

(A) ○ **A and C only (Correct Answer)**

(B) ○ A only

(C) ○ C and D only

(D) ○ B only

Question No.49 (Question Id - 37)

Let G be a group, H be a subgroup of G and a, b ∈ G. Define a relation ~ on G by a ~ b if and only if $ab^{-1} \in H$. Then the relation ~ is :

(A) ○ Reflexive and Symmetric but not Transitive.
(B) ○ Symmetric and Transitive but not Reflexive.
(C) ○ Transitive and Reflexive but not Symmetric.
(D) ○ **Reflexive, Symmetric and Transitive. (Correct Answer)**

Question No.50 (Question Id - 16)

The below question has been dropped and full marks are awarded.

The t-statistic for a sample with sample size n, sample mean $\bar{x}$, sample variance s^2, population mean m and population variance σ^2 is :

(A) ○ $t = \frac{\bar{x} - \mu}{\sigma}$
(B) ○ $t = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$
(C) ○ $t = \frac{\bar{x} - \mu}{s}$
(D) ○ $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

Question No.51 (Question Id - 32)

Consider following subspaces of $\mathbf{R}^5$
U = span (u_1, u_2, u_3) = span {(1, 3, -2, 2, 3), (1, 4, -3, 4, 2), (2, 3, -1, -2, 9)}
W = span (w_1, w_2, w_3) = span {(1, 3, 0, 2, 1), (1, 5, -6, 6, 3), (2, 5, 3, 2, 1)}
Then dimension of U+W is :

(A) ○ 1
(B) ○ 2
(C) ○ **3 (Correct Answer)**
(D) ○ 4

Question No.52 (Question Id - 46)

The correct syntax of copy constructor for class X is :
(A) ○ X(X)
(B) ○ **X(X&) (Correct Answer)**
(C) ○ X(X*)
(D) ○ X( )

Question No.53 (Question Id - 72)

The content of shift register is 1101. The register is shifted six times to the right with serial input 101101. The content of register after shifting the sixth time and the output are _____ and _____, respectively.

(A) ○ 1101, 1
(B) ○ 1101, 0
(C) ○ **1011, 0 (Correct Answer)**
(D) ○ 1011, 1

Question No.54 (Question Id - 14)

If X is a random variable with mean μ then the variance of X, denoted by var (X) is defined by _____.

(A) ○ var (X) = $E(X) - [E(X)]^2$
(B) ○ **var (X) = $E(X^2) - [E(X)]^2$ (Correct Answer)**
(C) ○ var (X) = $[E(X^2)]^2 + [E(X)]^2$
(D) ○ var (X) = $E(X^2) + [E(X)]^2$

Question No.55 (Question Id - 71)

Consider the following Boolean function of four variables.
f(w, x, y, z) = ∑(1, 3, 4, 6, 9, 11, 12, 14)
The function is :

(A) ○ Independent of one variable
(B) ○ **Independent of two variables (Correct Answer)**
(C) ○ Independent of three variables
(D) ○ Independent of four variables

Question No.56 (Question Id - 25)

A company has five jobs on hand. Each of these jobs must be processed through three machines in the order ABC. Processing times (in hours) for each job are given in the table below :

Job		J1	J2	J3	J4	J5
Machine A	:	15	16	10	18	15
Machine B	:	9	6	5	3	8
Machine C	:	11	13	12	13	17

The optimal sequence of these five jobs that minimizes the total elapsed time is given by :

(A) ○

J1	J2	J3	J4	J5

(B) ○

J3	J5	J1	J2	J4

(Correct Answer)

(C) ○

J3	J4	J2	J1	J5

(D) ○

J5	J1	J2	J4	J3

Question No.57 (Question Id - 74)

In a positive triggered JK flip flop, a low J and a low K produces :

(A) ○ high state
(B) ○ low state
(C) ○ toggle state
(D) ○ **no change (Correct Answer)**

Question No.58 (Question Id - 64)

Which one of the following is a tautology ?

(A) ○ $p \wedge \sim p$
(B) ○ **$p \vee p \leftrightarrow p$ (Correct Answer)**
(C) ○ $p \rightarrow (p \rightarrow q)$
(D) ○ None of the above

Question No.59 (Question Id - 47)

What is the use of making a base class as virtual ?

(A) ○ Making a derived class as abstract
(B) ○ **Remove duplication of member variables (Correct Answer)**
(C) ○ Avoid duplication of member functions
(D) ○ Making base class as private to derived class

Question No.60 (Question Id - 23)

For M/M/1/∞/F_cF_s Queueing System, expected number of customers in the system in steady state is given by :

Here $\frac{1}{\lambda}$ is the mean interarrival time and $\frac{1}{\mu}$ is the mean service time and l < m.

(A) ○ $\frac{\lambda}{\mu - \lambda}$ **(Correct Answer)**
(B) ○ $1 - \frac{\lambda}{\mu}$
(C) ○ $\frac{\lambda^2}{\mu(\mu - \lambda)}$
(D) ○ $\frac{\lambda^2}{\mu - \lambda}$

Question No.61 (Question Id - 21)

The below question has been dropped and full marks are awarded.

Consider the following linear programming problem :

Max $Z = 2x_1 + x_2$
subject to
$x_1 + x_2 \leq 2$
$-4x_1 + x_2 \geq 4$
$x_1, x_2 / 0$

This problem has :

(A) ○ Unique optimal solution
(B) ○ Alternate optimal solution

(C) ○ Unbounded solution
(D) ○ No feasible solution

Question No.62 (Question Id - 20)
The sampling distribution of the mean is :
(A) ○ Binomial Distribution
(B) ○ Exponential Distribution
(C) ○ **Normal Distribution (Correct Answer)**
(D) ○ $\varkappa^2$ Distribution

Question No.63 (Question Id - 75)
Suppose only one multiplexer and one inverter are allowed to be used to implement any Boolean function of n variables. What is the minimum size of the multiplexer needed ?

(A) ○ 2^n line to 1 line
(B) ○ 2^{n+1} line to 1 line
(C) ○ **2^{n-1} line to 1 line (Correct Answer)**
(D) ○ 2^{n-2} line to 1 line

Question No.64 (Question Id - 41)
In a B-tree of order-5, elements are inserted in following order :
7 13 19 20 16 14 25 30 40
What will be the value(s) at root node ?
(A) ○ 16
(B) ○ 14, 16
(C) ○ **19 (Correct Answer)**
(D) ○ None

Question No.65 (Question Id - 55)
A computer has 11 tape drives with n processes competing for them. Each process may need 3 tape drives. For which value(s) of n will the system be free of deadlocks ?
A. 3

B. 5

C. 7

D. 9

Choose the **correct** answer from the options given below.

(A) ○ **A and B only (Correct Answer)**
(B) ○ A only
(C) ○ A, B and C only
(D) ○ A, B, C and D

Question No.66 (Question Id - 9)
Reena is twice as old as Sunita. Three years ago, she was three times as old as Sunita How old is Reena now ?

(A) ○ 6 years
(B) ○ 7 years
(C) ○ 8 years
(D) ○ **12 years (Correct Answer)**

Question No.67 (Question Id - 17)

A biased coin is suspected to have the probability, $p = \frac{2}{3}$ of obtaining heads when tossed. If you have the data of the coin, which of the following tests can be used to prove the hypothesis that $p = \frac{2}{3}$?

A. $\varkappa^2$ - test

B. t - test

C. z - test

D. F - test

Choose the **correct** answer from the options given below.

(A) ○ A only
(B) ○ **A and B only (Correct Answer)**
(C) ○ A, B and C only
(D) ○ A, B, C and D only

Question No.68 (Question Id - 30)

What is the area of the region enclosed between the curves $y=\sqrt{x}$ and $y=x^2$?

(A) ○ $\frac{1}{2}$ square units
(B) ○ $\frac{1}{3}$ square units **(Correct Answer)**
(C) ○ $\frac{2}{3}$ square units
(D) ○ 1 square units

Question No.69 (Question Id - 48)

Which one of the following operator cannot be overloaded ?

(A) ○ **dot operator (.) (Correct Answer)**
(B) ○ plus operator (+)
(C) ○ (&) ampersand operator
(D) ○ ( ) function call operator

Question No.70 (Question Id - 7)

If the 5^{th} of the month falls 4 days after Sunday, what will be the day on the 16th of the month ?

(A) ○ Tuesday
(B) ○ **Monday (Correct Answer)**
(C) ○ Wednesday
(D) ○ Sunday

Question No.71 (Question Id - 43)

Match **List - I** with **List - II.**

List - I	List - II
A. External Sort	I. Linear Probing
B. Hashing	II. LSD
C. Priority Queue	III. Radix
D. Multikey Sorting	IV. Heap

Choose the **correct** answer from the options given below:

(A) ○ **A - III, B - I, C - IV, D - II (Correct Answer)**
(B) ○ A - IV, B - II, C - I, D - III
(C) ○ A - I, B - IV, C - II, D - III
(D) ○ A - I, B - II, C - IV, D - III

Question No.72 (Question Id - 54)

Consider the table below.

Process	P_1	P_2	P_3	P_4	P_5
Admission time	0	2	3	4	8
Service time	3	3	5	2	3

As per this table, the mean turnaround time $(\overline{ta})$ and mean weighted turnaround time $(\overline{w})$ using HRN scheduling policy is :

(A) ○ $\overline{ta}$ = 5.8 and $\overline{w}$ = 2.8
(B) ○ $\overline{ta}$ = 8.8 and $\overline{w}$ = 4.8
(C) ○ $\overline{ta}$ = 5.8 and $\overline{w}$ = 1.8 **(Correct Answer)**
(D) ○ None of the above

Question No.73 (Question Id - 62)

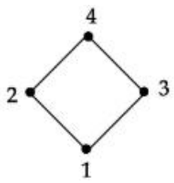
Which of the following is **true** for the language $\{a^p | p \text{ is prime}\}$?

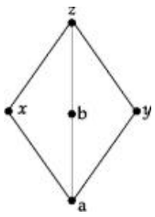
(A) ○ It is not accepted by TM
(B) ○ It is regular, but not context free
(C) ○ It is context free, but not regular
(D) ○ **It is neither context free nor regular, but accepted by TM**

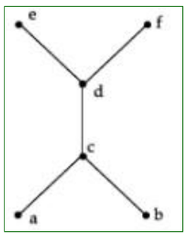
(Correct Answer)

Question No.74 (Question Id - 66)
Determine which one of the posets is **not** lattice.

(A) ○ 

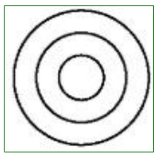
(B) ○ 

(C) ○ 

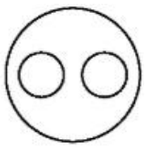
(D) ○ 

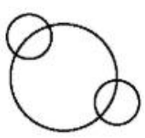
(Correct Answer)

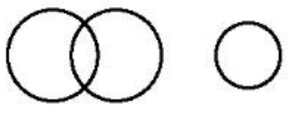
Question No.75 (Question Id - 6)
Which one of the following Venn diagram correctly illustrate the relationship among the classes Carrot, Food, Vegetable ?

(A) ○ 

(Correct Answer)

(B) ○ 

(C) ○ 

(D) ○ 

SECTION 2 - MTST

Question No.1 (Question Id - 98)
A spectrum of 30 MHz is allocated to a wireless FDD cellular system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if the system uses seven-cell reuse.

(A) ○ **150 Channels Approx. (Correct Answer)**
(B) ○ 85 Channels Approx.
(C) ○ 50 Channels Approx.

(D) ○ 65 Channels Approx.

Question No.2 (Question Id - 76)

Match **List - I** with **List - II**.

List - I	List - II
A. Bit	I. Application Layer
B. Frame	II. Transport Layer
C. Packet	III. Network Layer
D. Segment	IV. Data Link Layer
E. Data	V. Physical Layer

Choose the **correct** answer from the options given below :

(A) ○ A - I, B - II, C - III, D - IV, E - V
(B) ○ A - II, B - III, C - IV, D - V, E - I
(C) ○ **A - III, B - IV, C - V, D - II, E - I (Correct Answer)**
(D) ○ A - V, B - IV, C - III, D - II, E - I

Question No.3 (Question Id - 84)
Which of the following calls never returns an error ?

(A) ○ getpid
(B) ○ **fork (Correct Answer)**
(C) ○ ioctl
(D) ○ open

Question No.4 (Question Id - 82)
File Transfer Protocol (FTP) is built on _____ architecture.
(A) ○ **Peer to Peer (Correct Answer)**
(B) ○ Client-server
(C) ○ Both Peer to Peer and Client-server
(D) ○ Neither Peer to Peer nor Client-server

Question No.5 (Question Id - 92)
If D is the distance between Co-channel cells and R be the cell radius, Co-channel reuse ratio is given by :

(A) ○ **D^2/R (Correct Answer)**
(B) ○ D/R
(C) ○ D*R
(D) ○ D/R^2

Question No.6 (Question Id - 85)
Consider the following program :

```
main( )
{
    int p[2];
    pipe(p);
    fork( );
}
```

Which of these statements are **true** about this program ?

A. The pipe will be recognized only in the parent process

B. p[0] is the file descriptor of the write end of the pipe

C. There will be four file descriptors in the memory

D. The pipe will be shared by both the parent and child processes

Choose the **correct** answer from the options given below.

(A) ○ A and C only
(B) ○ **B and C only (Correct Answer)**
(C) ○ C and D only
(D) ○ A only

Question No.7 (Question Id - 90)
Sam Sam is example of which attack ?

(A) ◯ **Spam (Correct Answer)**
(B) ◯ Worm
(C) ◯ Ransomware
(D) ◯ Black hole

Question No.8 (Question Id - 95)
Which of the following is **not** a part of characteristic of 4G network ?
(A) ◯ Fully converged services
(B) ◯ Multirate management
(C) ◯ **Software Dependency (Correct Answer)**
(D) ◯ Diverse User Devices

Question No.9 (Question Id - 99)
For a path loss exponent of n = 4, find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal-to-interference ratio of 15 dB is minimum required for satisfactory forward channel performance of a cellular system. There are six-channel cells in the first tier, and all of them are at the same distance from the mobile.

(A) ◯ $\frac{D}{R} = \sqrt{36}; N = 12$
(B) ◯ $\frac{D}{R} = \sqrt{12}; N = 4$ **(Correct Answer)**
(C) ◯ $\frac{D}{R} = \sqrt{24}; N = 8$
(D) ◯ $\frac{D}{R} = \sqrt{21}; N = 7$

Question No.10 (Question Id - 89)

Match **List - I** with **List - II**.

List - I	List - II
A. RC4	I. Integrity
B. SHA-512	II. IP Sec
C. DSS	III. Mobile Security
D. AH	IV. Digital Signature

Choose the **correct** answer from the options given below.

(A) ◯ A - I, B - II, C - III, D - IV
(B) ◯ **A - IV, B - I, C - II, D - III (Correct Answer)**
(C) ◯ A - III, B - I, C - IV, D - II
(D) ◯ A - II, B - III, C - IV, D - I

Question No.11 (Question Id - 77)
Which of the following protocols use both TCP and UDP ?

(A) ◯ DNS
(B) ◯ **Telnet (Correct Answer)**
(C) ◯ FTP
(D) ◯ SMTP

Question No.12 (Question Id - 96)
Which of the following indicates the number of input bits that the current output is dependent upon ?

(A) ◯ Constraint length
(B) ◯ Code length
(C) ◯ **Search window (Correct Answer)**
(D) ◯ Information rate

Question No.13 (Question Id - 88)
Perform the encryption using the RSA Algorithm and find out the value of ciphertext ‘C’. If P = 17, Q = 11 and M = 88.

(A) ◯ **10 (Correct Answer)**
(B) ◯ 11
(C) ◯ 12
(D) ◯ None of the above

Question No.14 (Question Id - 80)

Which of the following are unique characteristics of half duplex Ethernet when compared to full duplex Ethernet ?

A. Half duplex Ethernet operates in a private collision domain

B. Half duplex Ethernet operates in a shared collision domain

C. Half duplex Ethernet has lower effective throughput

D. Half duplex Ethernet has higher effective throughput

E. Half duplex Ethernet operates in a private broadcast domain

Choose the **correct** answer from the options given below.

(A) ◯ **B and C only (Correct Answer)**
(B) ◯ C and D only
(C) ◯ D and E only
(D) ◯ A and E only

Question No.15 (Question Id - 87)

Find the correct statements according to key generation process in Data Encryption Standard (DES) Algorithms.

A. The key size used in DES after permuted choice one is 56 bits.

B. The key size used in DES after permuted choice 2 is 48 bits.

C. The key size used in DES Algorithm before left circular shift is 48 bits.

D. The key size used in DES Algorithm after left circular shift is 56 bits.

Choose the **correct** answer from the options given below.

(A) ◯ **A, B and C only (Correct Answer)**
(B) ◯ A, B and D only
(C) ◯ B, C and D only
(D) ◯ A, C and D only

Question No.16 (Question Id - 94)

Free space propagation model is to predict _____.

(A) ◯ Gain of Transmitter
(B) ◯ Gain of Receiver
(C) ◯ Transmitted Power
(D) ◯ **Received Signal Strength (Correct Answer)**

Question No.17 (Question Id - 93)

According to IEEE 802.11 MAC frame format, how many bits are used for sequence number ?

(A) ◯ 4
(B) ◯ 8
(C) ◯ 12
(D) ◯ **16 (Correct Answer)**

Question No.18 (Question Id - 86)

The value of Totient Function $\phi(231)$ is :

(A) ◯ **60 (Correct Answer)**
(B) ◯ 120
(C) ◯ 220
(D) ◯ 230

Question No.19 (Question Id - 100)

Match **List - I** with **List - II**.

List - I	List - II
A. Flat Fading	I. Coherence Time > Symbol Period
B. Frequency Selective Fading	II. Delay Spread < Symbol Period
C. Fast Fading	III. Coherence Time < Symbol Period
D. Slow Fading	IV. Delay Spread > Symbol Period

Choose the **correct** answer from the options given below.

(A) ◯ A - IV, B - II, C - III, D - I
(B) ◯ **A - II, B - IV, C - III, D - I (Correct Answer)**
(C) ◯ A - III, B - IV, C - II, D - I
(D) ◯ A - I, B - III, C - II, D - IV

Question No.20 (Question Id - 79)
Assuming that DHCP snooping is configured on a LAN switch, only clients having specific _____ can access the network.

(A) ◯ MAC address
(B) ◯ IP address
(C) ◯ Neither MAC nor IP address
(D) ◯ **Both MAC and IP address (Correct Answer)**

Question No.21 (Question Id - 83)
Which of the following are **not** filter commands ?
(A) ◯ date
(B) ◯ sort
(C) ◯ **cat (Correct Answer)**
(D) ◯ grep

Question No.22 (Question Id - 81)
Fork function returns :
(A) ◯ Process ID of child in child process
(B) ◯ **0 in child process and process ID of child in parent (Correct Answer)**
(C) ◯ 1 in child process and 0 in parent process
(D) ◯ Process ID of parent in child process

Question No.23 (Question Id - 97)
For a cluster size of 12 and a Co-channel reuse ratio of 6, the value of *i* and *j* are respectively, where *i* and *j* are integer that determine the relative location of channel cells.

(A) ◯ $i = 1$ and $j = 1$
(B) ◯ $i = 1$ and $j = 2$
(C) ◯ **$i = 2$ and $j = 2$ (Correct Answer)**
(D) ◯ $i = 1$ and $j = 3$

Question No.24 (Question Id - 78)
If an Ethernet port on a router was assigned an IP address of 172.16.112.1/25, what would be the valid subnet address of the host ?

(A) ◯ 172.16.0.0
(B) ◯ **172.16.112.0 (Correct Answer)**
(C) ◯ 172.16.96.0
(D) ◯ 172.16.128.0

Question No.25 (Question Id - 91)
In a CDMA system, link performance for each user _____ as the number of users _____.

(A) ◯ Decreases, Decreases

(B) ◯ Increases, Increases
(C) ◯ **Increases, Decreases (Correct Answer)**
(D) ◯ Decreases, Increases

SECTION 3 - MTDT

Question No.1 (Question Id - 117)

One source of the data in data warehouse is the _____.

(A) ○ operational environment

(B) ○ **formal environment (Correct Answer)**

(C) ○ informal environment

(D) ○ technology environment

Question No.2 (Question Id - 106)

_____ is a special case of uniform-cost search.

(A) ○ Depth-First search

(B) ○ **Breadth-first search (Correct Answer)**

(C) ○ Backtracking search

(D) ○ Depth-limited search

Question No.3 (Question Id - 118)

Data scrubbing is a process to _____.

(A) ○ reject data from data warehouse and to create the necessary indexes

(B) ○ load the data in the data warehouse and to create the necessary indexes

(C) ○ **upgrade the quality of data after it is moved into a data warehouse (Correct Answer)**

(D) ○ upgrade the quality of data before it is moved into a data warehouse

Question No.4 (Question Id - 105)

Consider the following schemas :
Client = (cust_name, banker_name)
Customer = (cust_name, street, cust_city)
Which of the following queries finds the clients of banker 'ABC' and the city they live in ?

A. $\pi_{client.cust\_name.cust\_city}(\sigma_{client.cust\_name = customer.cust\_name}(\sigma_{banker\_name = "ABC"}(client \times customer)))$

B. $\pi_{cust\_name.cust\_city}(\sigma_{banker\_name = "ABC"}(client \times customer))$

C. $\pi_{client.cust\_name.cust\_city}(\sigma_{banker\_name = "ABC"}(\sigma_{client.cust\_name = customer.cust\_name}(client \times customer)))$

D. $\pi_{cust\_name.cust\_city}(\pi_{banker\_name = "ABC"}(client \times customer))$

Choose the **correct** answer from the options given below.

(A) ○ **A and C only (Correct Answer)**

(B) ○ A and B only

(C) ○ C and D only

(D) ○ B and D only

Question No.5 (Question Id - 120)

Which of the following is not a data discretization method ?

(A) ○ Histogram analysis

(B) ○ **Cluster analysis (Correct Answer)**

(C) ○ Data compression

(D) ○ Binning

Question No.6 (Question Id - 123)

Given below are two statements :

Statement I :

Data fragmentation is a critical problem in decision tree algorithms.

Statement II :

Finding an optimal decision tree is an NP-complete problem.

In the light of the above statements, choose the **most appropriate** answer from the options given below.

(A) ○ Both **Statement I** and **Statement II** are correct.

(B) ○ **Both Statement I and Statement II are incorrect. (Correct Answer)**

(C) ○ **Statement I** is correct but **Statement II** is incorrect.

(D) ○ **Statement I** is incorrect but **Statement II** is correct.

Question No.7 (Question Id - 116)

_____ describes the data contained in the data warehouse.

(A) ○ Relational data

(B) ○ Operational data

(C) ◯ **Metadata (Correct Answer)**
(D) ◯ Informational data

Question No.8 (Question Id - 102)
The constraint "an employee's salary cannot exceed □ 2,00,000" is _____.

(A) ◯ **Referential constraint (Correct Answer)**
(B) ◯ Integrity constraint
(C) ◯ Foreign constraint
(D) ◯ Infeasible constraint

Question No.9 (Question Id - 108)
Choose the undesirable properties of knowledge.

A. Voluminous

B. Difficult to characterize

C. Variability

D. Atomic

Choose the **correct** answer from the options given below

(A) ◯ **A and B only (Correct Answer)**
(B) ◯ C and D only
(C) ◯ A, B and C only
(D) ◯ A, B, C and D only

Question No.10 (Question Id - 104)
Which of the following is advantage of a view ?
(A) ◯ Data Security
(B) ◯ Derived Columns
(C) ◯ Hiding of Complex queries
(D) ◯ **All of the above (Correct Answer)**

Question No.11 (Question Id - 113)
Select example of deterministic algorithm.
(A) ◯ Principal Component Analysis
(B) ◯ **K - means (Correct Answer)**
(C) ◯ Both Principal Component Analysis and K-means
(D) ◯ Neither of Principal Component Analysis and K-means

Question No.12 (Question Id - 101)
DML is provided for :
(A) ◯ Description of logical structure of a database
(B) ◯ Addition of new structure in the database
(C) ◯ Manipulation and processing of the database
(D) ◯ **None of the above (Correct Answer)**

Question No.13 (Question Id - 103)
Which normal form is considered adequate for relational database design ?

(A) ◯ 2NF
(B) ◯ **3NF (Correct Answer)**
(C) ◯ 4NF
(D) ◯ BCNF

Question No.14 (Question Id - 112)
Underfitting in machine learning is :
(A) ◯ High Bias and Low Variance
(B) ◯ **High Bias and High Variance (Correct Answer)**
(C) ◯ Low Bias and High Variance
(D) ◯ Low Bias and Low Variance

Question No.15 (Question Id - 114)
How can you prevent a K-means clustering algorithm from getting stuck in a bad local optimal ?

(A) ◯ set the same seed value for each run

(B) ○ use multiple random initializations
(C) ○ **both 1 and 2 (Correct Answer)**
(D) ○ neither of 1 and 2

Question No.16 (Question Id - 119)
Given below are two statements :

Statement I :

Strategic value of data mining is technology sensitive.

Statement II :

Full materialization in data cube suffers from the curse of dimensionality.

In the light of the above statements, choose the **most appropriate** answer from the options given below.

(A) ○ Both **Statement I** and **Statement II** are correct.
(B) ○ Both **Statement I** and **Statement II** are incorrect.
(C) ○ **Statement I** is correct but **Statement II** is incorrect.
(D) ○ **Statement I is incorrect but Statement II is correct. (Correct Answer)**

Question No.17 (Question Id - 109)
How many types of entities are there in knowledge representation ?

A. Facts

B. Symbols

C. Information

D. Nomenclature

Choose the **correct** answer from the options given below

(A) ○ **A and D only (Correct Answer)**
(B) ○ A and B only
(C) ○ B, C and D only
(D) ○ A, B and C only

Question No.18 (Question Id - 110)
Recursive Best-First Search (RBFS) algorithm :

A. Mimics standard best-first search using only linear space.

B. Is not optimal.

C. Uses f-limit variable to keep track of the f-value of the best alternative path available from any ancestor at the current node.

D. Generates less nodes in comparison to the iterative-deepening A*(IDA*) Algorithm.

Choose the **correct** answer from the options given below

(A) ○ A and B only
(B) ○ A and C only
(C) ○ **B and C only (Correct Answer)**
(D) ○ C and D only

Question No.19 (Question Id - 122)
Given below are two statements :

Statement I :

Noise objects can be outliers.

Statement II :

Outliers are always noise objects.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(A) ○ Both **Statement I** and **Statement II** are correct.
(B) ○ Both **Statement I** and **Statement II** are incorrect.
(C) ○ **Statement I is correct but Statement II is incorrect. (Correct Answer)**

(D) ○ **Statement I** is incorrect but **Statement II** is correct.

Question No.20 (Question Id - 107)

A simple reflex agent :

(A) ○ Uses condition-action rule to take actions.

(B) ○ **Maintains some sort of internal state that depends on the percept history. (Correct Answer)**

(C) ○ Always keeps track of goal.

(D) ○ Uses utility function as performance measure.

Question No.21 (Question Id - 111)

Which one of the following are regression tasks ?

(A) ○ Predict age of a person

(B) ○ **Predict whether a document is relevant (Correct Answer)**

(C) ○ Find the gender of a person analysing his writing style

(D) ○ Predict the country from where the person comes from

Question No.22 (Question Id - 115)

Which of the following is **true** ?

(A) ○ Linear regression error value has to be normally distributed but in case of logistic regression it is not the case

(B) ○ Logistic regression error value has to be normally distributed but in case of linear regression it is not the case

(C) ○ **Both linear and logistic regression error values have to be normally distributed (Correct Answer)**

(D) ○ Both linear regression and logistic regression error values are not to be normally distributed

Question No.23 (Question Id - 124)

In apriori algorithm of association rule mining, each frequent k-item set produces _____ valid association rules.

(A) ○ $2^k - 1$

(B) ○ $2^k - 2$

(C) ○ $2^k + 2$

(D) ○ **$2^k + 1$ (Correct Answer)**

Question No.24 (Question Id - 125)

Consider the similarity matrix of a dataset consisting of five points $\{p_1, p_2, p_3, p_4, p_5\}$ as shown below :

	p_1	p_2	p_3	p_4	p_5
p_1	1.00	0.10	0.41	0.55	0.35
p_2	0.10	1.00	0.64	0.47	0.98
p_3	0.41	0.64	1.00	0.44	0.85
p_4	0.55	0.47	0.44	1.00	0.76
p_5	0.35	0.98	0.85	0.76	1.00

What are the two clusters produced by complete link hierarchical clustering ?

(A) ○ {1} and {2, 3, 4, 5}

(B) ○ **{1, 4} and {2, 3, 5} (Correct Answer)**

(C) ○ {1, 2} and {3, 4, 5}

(D) ○ {5} and {1, 2, 3, 4}

Question No.25 (Question Id - 121)

The value set {brown, black, blue, green, red} is an example of :

(A) ○ **Continuous attribute (Correct Answer)**

(B) ○ Ordinal attribute

(C) ○ Nominal attribute

(D) ○ Numeric attribute

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