2012 CA

**Test Paper Code: CA** 

Time: 3 Hours Max. Marks: 300

### **INSTRUCTIONS**

#### A. General:

- 1. This Booklet is your Question Paper. It contains **20** pages and has 100 questions.
- 2. The Question Booklet **Code** is printed on the right-hand top corner of this page.
- 3. The Question Booklet contains blank spaces for your rough work. No additional sheets will be provided for rough work.
- 4. Clip board, log tables, slide rule, calculator, cellular phone or any other electronic gadget in any form are <u>NOT</u> allowed.
- 5. Write your **Name** and **Registration Number** in the space provided at the bottom.
- 6. All answers are to be marked only on the machine gradable Objective Response Sheet **(ORS)** provided along with this booklet, as per the instructions therein.
- 7. The Question Booklet along with the Objective Response Sheet **(ORS)** must be handed over to the Invigilator before leaving the examination hall.
- 8. Refer to Special Instruction/Useful Data on reverse of this sheet.

## B. Filling-in the ORS:

- 9. Write your Registration Number in the boxes provided on the upper left-hand-side of the **ORS** and darken the appropriate bubble under each digit of your Registration Number using a **HB pencil**.
- 10. Ensure that the **code** on the **Question Booklet** and the **code** on the **ORS** are the same. If the codes do not match, report to the Invigilator immediately.
- 11. On the lower-left-hand-side of the **ORS**, write your Name, Registration Number, and Name of the Test Centre and put your signature in the appropriate box with ball-point pen. Do not write these anywhere else.

### C. Marking of Answers on the ORS:

- 12. Each question has **4 choices** for its answer: (A), (B), (C) and (D). Only **ONE** of them is the correct answer.
- 13. On the right-hand-side of **ORS**, for each question number, darken with a **HB Pencil** ONLY one bubble corresponding to what you consider to be the most appropriate answer, from among the four choices.
- 14. There will be **negative marking** for wrong answers.

### **MARKING SCHEME:**

- (a) For each correct answer, you will be awarded 3 (Three) marks.
- (b) For each wrong answer, you will be awarded -1 (Negative one) mark.
- (c) Multiple answers to a question will be treated as a wrong answer.
- (d) For each un-attempted question, you will be awarded **0** (**Zero**) mark.

Name				
Registration Number				

# **Special Instructions/ Useful Data**

- $\mathbb{N}$  denotes the set of natural numbers  $\{1, 2, 3, \dots\}$
- $\mathbb{Z}$  denotes the set of integers
- $\mathbb{Q}$  denotes the set of rational numbers
- $\mathbb{R}$  denotes the set of real numbers
- $\mathbb C$  denotes the set of complex numbers

$$A \setminus B = \{x \in A \mid x \notin B\}$$
 for two sets  $A$  and  $B$ 

LPP denotes Linear Programming Problem

Max f denotes the maximum of f

Min f denotes the minimum of f

- x' denotes the complement of a Boolean variable x
- f' denotes the first derivative of a function f
- $f_x$  denotes the partial derivative of  $\frac{\partial f}{\partial x}$  of f
- $f_{y}$  denotes the partial derivative of  $\frac{\partial f}{\partial y}$  of f
- $\nabla f$  denotes the gradient of a function f

For all C programs, assume that all standard library functions are accessible.

- Q.1 Who created the first free email service on the Internet?
  - (A) B. W. Kernighan

(B) Bill Gates

(C) N. Karmakar

- (D) Sabeer Bhatia
- Q.2 Let  $S = \{x \in \mathbb{Q} \mid x^2 \in \{1, 20, 21\}\}$ . Then the number of elements in the set S is
  - (A) 1

(B) 2

(C) 4

(D) 6

- Q.3 The rank of the matrix  $\begin{vmatrix} 1 & 2 & 4 & 1 & -2 \\ 2 & 3 & 7 & 1 & -2 \\ 1 & 0 & 2 & -1 & 2 \\ 1 & 1 & 1 & 2 & 4 \end{vmatrix}$  is
  - (A) 1

(B) 2

(C) 3

(D) 4

- Q.4 Mega FLOPS stands for
  - (A) 10<sup>9</sup> floating point operations per second
  - (B) 10<sup>5</sup> fixed point operations per second
  - (C) 10<sup>6</sup> floating point operations per second
  - (D)  $10^{12}$  fixed point operations per second
- The set  $S = \{(x, y) \in \mathbb{R}^2 | x \notin \mathbb{Q} \text{ or } y \notin \mathbb{Z} \}$  is Q.5
  - $(A) (\mathbb{R} \setminus \mathbb{Q}) \times (\mathbb{R} \setminus \mathbb{Z}) \qquad (B) (\mathbb{R} \times \mathbb{R}) \times (\mathbb{Q} \setminus \mathbb{Z}) \qquad (C) (\mathbb{R} \setminus \mathbb{Q}) \times \mathbb{R} \qquad (D) \mathbb{R} \times (\mathbb{R} \setminus \mathbb{Z})$

- The number  $20^6 13^6$  is divisible by Q.6
  - (A) 11
- (B) 5

- (C) 13
- (D) 6

- Q.7 The inverse of the matrix  $\begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 8 & 2 \end{vmatrix}$  is
  - (A)  $\begin{bmatrix} 10 & -6 & 1 \\ -2 & -1 & 0 \\ -7 & -5 & -1 \end{bmatrix}$ (C)  $\begin{bmatrix} 10 & -6 & -1 \\ -2 & 1 & 0 \\ -7 & 5 & 1 \end{bmatrix}$

- (B)  $\begin{bmatrix} 10 & -6 & 1 \\ -2 & -1 & 0 \\ -7 & -5 & 1 \end{bmatrix}$ (D)  $\begin{bmatrix} 10 & -6 & 1 \\ -2 & 1 & 0 \\ 7 & 5 & -1 \end{bmatrix}$

	<ul><li>(A) f is one-one.</li><li>(C) f is one-one and</li></ul>	l on-to.	<ul><li>(B) f is on-to.</li><li>(D) f is neither one-of-</li></ul>	one nor on-to.				
Q.9	The number of distinct 3 digit numbers greater than 100 where no digit repeats itself is							
	(A) 504	(B) 648	(C) 326	(D) 210				
Q.10	The digit at the unit	place of the number 19 <sup>25</sup>	is					
	(A) 1	(B) 3	(C) 5	(D) 9				
Q.11	The differential equa		$\cos x,  x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$					
	(A) $y = (x+c)\cos x$ (C) $y = (x+c)\sin x$		(B) $y = (x+c)\sec x$ (D) $y = (x+c)\csc x$	x				
Q.12	Consider the function $f(x) = -x^4 + 2x^3 - 1$ . What is the absolute truncation error for evaluation of $f'(x)$ at $x = 0.5$ by the first order forward difference scheme using a step size, $h = 0.5$ ?							
	(A) $\frac{5}{8}$	(B) $\frac{1}{2}$	(C) $\frac{1}{3}$	(D) $\frac{8}{5}$				
Q.13	Consider the following LPP							
	Max $f = 5$ subject to $x + 5y \le 50$ $6x + 3y \le 3$ $x \le 5, x \ge 0$	), 36,						
	The number of extreme points of the feasible region are							
	(A) 4	(B) 5	(C) 6	(D) 7				
Q.14	Solution of the initial value problem $(2\cos y + 3x)dx - x\sin y dy = 0$ , $y(1) = 0$ is							
	(A) $x^2 \cos y + y^3 = 1$ (C) $x^2 \cos y + x^3 = 2$		(B) $x^2 \sin y + y^3 = 0$ (D) $y^2 \sin x + y^3 = 0$					

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Let  $f: \mathbb{R} \to \mathbb{R}$  be defined by  $f(x) = x^2 + 4x + 5$ . Then which of the following statements is

Q.8

Q.15	Let $\alpha$ be a real numb of complex numbers i		$\setminus \{0\}    z  = \alpha $ . Then $G$	is a group under multiplication	1			
	(A) $\alpha = 0$	(B) $\alpha$ < 1	(C) $\alpha > 1$	(D) $\alpha = 1$				
Q.16	Order the following p	rocessors in the in-	creasing order of speed.					
	M1: 486,	M2: 8085,	M3: Dual core,	M4: Pentium III				
	(A) M1 M2 M3 M4	(B) M2 M1 M4	M3 (C) M1 M2 M4	1 M3 (D) M1 M3 M4 M2				
Q.17	Which of the following	g statements is TR	RUE?					
	<ul><li>(A) There exists a fiel</li><li>(B) There exists a fiel</li><li>(C) There exists a fiel</li><li>(D) There exists a fiel</li></ul>	d with 100 elemend with 500 elemen	ts.					
Q.18	A particular solution of		equation $\frac{d^{4}y}{dx^{4}} + 3\frac{d^{3}y}{dx^{3}} - \frac{d^{2}y}{dx^{2}} = 2e^{x}$					
	is							
	$(A) \frac{1}{3} x^3 e^x$	$(B) \frac{1}{2} x^3 e^x$	(C) $\frac{1}{6}x^3e^x$	$(D) \frac{2}{3} x^3 e^x$				
Q.19	For an LPP, if the con	straints are	$x + y \le 3$ ,					
	$-x + 3y \le 5,$							
	$y \ge 0, x \ge 0$							
	then which one of the following point is NOT a feasible point?							
	(A) $(3,0)$	(B) $(1,2)$	(C) $(2,4)$	(D) $\left(0, \frac{5}{3}\right)$				
Q.20	The volume of the tetr	rahedron bounded	by the planes $z = 0, x =$	0, y = 0  and  y + z - x = 1  is				
	(A) 1/6	(B) 6	(C) 1	(D) 1/3				
Q.21	Aadhar Unique Identification (UID) number is of							
	(A) 10 digits	(B) 12 digits	(C) 14 digits	(D) 16 digits				

O.22The general solution of the nonhomogeneous differential equation  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = 150\cos 3x$ is (A)  $c_1 e^{-3x} + c_2 e^{4x} - 7\cos 3x - \sin 3x$ (B)  $c_1 e^{3x} + c_2 e^{-4x} - 7\cos 3x + \sin 3x$ 

(C)  $c_1 e^{3x} + c_2 e^{-4x} + 7\cos 3x + \sin 3x$ 

(D)  $c_1 e^{3x} + c_2 e^{-4x} - 7\cos 3x - \sin 3x$ 

Q.23 Which of the following is/are main memory of a computer?

> P: RAM, Q: Hard disk, R: CDROM, S: Pen drive

(A) P and Q only (B) Q only (C) P only (D) P, R, and S only

Q.24 The boundary value problem

$$\frac{d^2y}{dx^2} + \pi^2 y = 0, \quad y(0) = 0, \ y(1) = 0$$

has

(A) two solutions (B) no solution

(C) unique solution (D) infinitely many solutions

Suppose  $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ ,  $\vec{b} = \hat{i} + \hat{k}$  and  $\vec{c} = \hat{i} - \hat{j} + 3\hat{k}$ . Then  $\vec{a} \times (\vec{b} \times \vec{c})$  is Q.25

(B)  $8\hat{i} - 4\hat{i}$ (C)  $8\hat{i} + 8\hat{j}$ (A)  $8\hat{i} + 4\hat{i}$ (D)  $8\hat{i} - 8\hat{i}$ 

The Newton-Raphson method is used to find a real root of  $f(x) = x^3 - x + 1 = 0$  with initial Q.26 approximation  $x_0 = 1$ . Then the second approximation  $x_2$  is

(B)  $\frac{5}{8}$ (A)  $\frac{1}{2}$ (C) 2 (D) 3

Q.27 SMS stands for

> (A) Short Message Service (B) Secured Message Service (C) Short Mail Service (D) Secured mail Service

Q.28 What is the probability of getting an even number or a number less than 5, in tossing a fair die?

(C)  $\frac{5}{6}$ (A)  $\frac{2}{3}$ (B)  $\frac{1}{3}$ (D)  $\frac{1}{6}$ 

Q.29	Rabindranath Tagore won the Nobel prize in Literature for his book entitled						
	<ul><li>(A) War and Peace</li><li>(C) Gitanjali</li></ul>		<ul><li>(B) Malgudi Days</li><li>(D) Durgeshnandini</li></ul>				
Q.30 Which company is the leader in computer networking?							
	(A) Wipro	(B) Cisco	(C) Oracle	(D) TCS			
Q.31	For the table						
		x	0 1 2 3				
		f(x)	1 2 9 28				
	the divided difference	f[1,2,3] is					
	(A) 6	(B) 13	(C) 3	(D) 1			
Q.32	Which one of the follo	wing is equivalent to	o 8 Giga bytes?				
	(A) $2^{23}$ bytes	(B) 2 <sup>33</sup> bytes	(C) $2^{43}$ bytes	(D) 2 <sup>53</sup> bytes			
Q.33	The decimal value of (	$(25)_8 \times (25)_8$ is					
	(A) 5625	(B) 8175	(C) 3267	(D) 4515			
Q.34	The value of the integ	$\operatorname{ral} \int_{0}^{2} (1 + 5x - 100x^{2}) dx$	$dx$ by Simpson's $\frac{1}{3}$ rd rule	is			
	(A) -288	(B) $-\frac{764}{3}$	(C) 288	(D) 289			
Q.35	Which one of the follo	wing stands for LA	N?				
	(A) Local Area Netwo (C) Large Area Netwo		(B) Logical Area Ne (D) Least Area Netv				
Q.36	The Boolean expression	on $(x+y)(x+y')$ is	equivalent to				
	(A) x + y	(B) y	(C) <i>xy</i>	(D) <i>x</i>			
Q.37	ISP stands for						
	<ul><li>(A) Internet Security P</li><li>(C) Internet Service Pr</li></ul>		<ul><li>(B) Intelligent Servi</li><li>(D) Intelligent Servi</li></ul>	_			

Q.38	Let $f(x, y) = cos(xy) + x cos y$ . Then the value of $f_x(2, \pi/2) + f_y(2, \pi/2)$ is			
	(A) 0	(B) -2	(C) 2	(D) 4
Q.39	If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ , $\vec{b} = \hat{i}$ vector $\vec{b}$ is	$-2\hat{j} + 2\hat{k} \text{ and } \vec{c} = 4\hat{i} - 3$	$3\hat{j} + 2\hat{k}$ , then the projection	on of $\vec{a} + \vec{b}$ on the
	(A) $\frac{20}{3}$	(B) 20	(C) $\frac{20}{9}$	(D) $\frac{8}{3}$
Q.40	For what value of $\alpha$ , t	he vectors $2\hat{i} + \hat{j} + \hat{k}$ , $\alpha$	$\hat{i} + 2\hat{j} + 2\hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$	are coplanar?
	(A) 1	(B) 2	(C) 4	(D) 8
Q.41	The next term in the se	quence of ternary number	er 10, 20, 100, 110, is	
	(A) 120	(B) 111	(C) 112	(D) 101
Q.42	The 9's complement of	of 123456789 is		
	(A) 876543211	(B) 876543210	(C) 987654321	(D) 012345678
Q.43	What is the largest uns	igned integer that can be	expressed with <i>n</i> bits?	
	(A) $2^{n-1}$	(B) $2^n - 1$	(C) $2^n + 1$	(D) $2^{n+1}$
Q.44	Suppose $f(x) = x^3 + 2$ x = -1, 0, 1 is	$x^2 + x + 1$ . Then the poly	nomial that interpolates t	the value of $f$ at
	(A) $4x^2 + 4x + 1$ (C) $2x^2 + 2x + 1$		(B) $x^2 + x + 1$ (D) $3x^2 + 3x + 1$	
Q.45	A search engine is			
	(A) a machine (C) a movie		(B) a web site (D) a map used for driv	ving

Q.46 The Lagrange form of the interpolating polynomial that fits the data

x	0	1	2
f(x)	1	2	5

is

(A) 
$$\frac{1}{2}(x-1)(x-2)-2x(x+2)+\frac{5}{2}x(x-1)$$

(B) 
$$\frac{1}{2}(x-1)(x-2)+2x(x+2)+\frac{5}{2}x(x-1)$$

(C) 
$$2(x-1)(x-2)+\frac{1}{2}x(x+2)+\frac{2}{5}x(x-1)$$

(D) 
$$2(x-1)(x-2)-\frac{1}{2}x(x+2)+\frac{2}{5}x(x-1)$$

Q.47 The function f(x, y) = xy defined on  $x^2 + y^2 \le 1$  has

- (A) both maximum and minimum values
- (B) only maximum value
- (C) only minimum value
- (D) neither maximum nor minimum value

Q.48 The area of the region enclosed by the parabola  $x^2 = 4ay$  and the line x = 2a with x-axis is

$$(A) \frac{4}{3}a^2$$

(B) 
$$\frac{3}{2}a^2$$

(C) 
$$\frac{3}{4}a^2$$

(D) 
$$\frac{2}{3}a^2$$

Q.49 Consider the system of linear equations

$$x - 2y + z = 3$$
$$2x + \alpha z = -2$$

$$-2x + 2y + \alpha z = 1$$

In order to have unique solution to this linear system of equations the value of  $\alpha$  should not be equal to

(A) 
$$-\frac{2}{3}$$

(B) 
$$\frac{2}{3}$$

(C) 
$$\frac{4}{3}$$

(D) 
$$-\frac{4}{3}$$

Q.50	The quadratic approximation of $f$	$(x, y) = \cos x \cos y$	about the point (	(0,0)	is
	1	( , ) /	· · · · · · · · · · · · · · · · · · ·	, - <i> </i>	-

(A) 
$$1 + \frac{1}{2}(x^2 - y^2)$$

(B) 
$$1 + \frac{1}{2}(x^2 + y^2)$$

(C) 
$$1 - \frac{1}{2} (x^2 - y^2)$$

(D) 
$$1 - \frac{1}{2}(x^2 + y^2)$$

# Q.51 Consider the following two lists:

## List I

List II

- 1: Mouse
- P: Input device
- 2: Modem
- Q: External memory
- 3: Pen drive
- R: Web browser

4: Opera

S: Network device

The correct match is

(A) 
$$1 \rightarrow R$$
,  $2 \rightarrow S$ ,  $3 \rightarrow P$ ,  $4 \rightarrow Q$ 

(B) 
$$1 \rightarrow P$$
,  $2 \rightarrow S$ ,  $3 \rightarrow Q$ ,  $4 \rightarrow R$ 

(C) 
$$1 \rightarrow S$$
,  $2 \rightarrow R$ ,  $3 \rightarrow Q$ ,  $4 \rightarrow P$ 

(D) 
$$1 \rightarrow P$$
,  $2 \rightarrow Q$ ,  $3 \rightarrow S$ ,  $4 \rightarrow R$ 

Q.52 The matrix 
$$\begin{bmatrix} -1 & 2 & 2 \\ 2 & 2 & -1 \\ 2 & -1 & 2 \end{bmatrix}$$
 has

- (A) all positive eigenvalues
- (B) all negative eigenvalues
- (C) some positive eigenvalues and some negative eigenvalues
- (D) one zero eigenvalue
- Q.53 An integrating factor of the differential equation

$$2\sinh x \cos y \, dx - \cosh x \sin y \, dy = 0$$

is

- (A)  $\cosh x$
- (B)  $\sinh x$
- (C)  $\sin x$
- (D)  $\cos x$
- Q.54 The random variable **X** follows the Poisson distribution with variance 4. The mean of this Poisson distribution is
  - (A) 2

(B)4

- (C) 16
- (D) 8
- Q.55 Two balls are drawn in succession from a box containing 30 red, 20 white, 10 blue and 15 orange balls; replacement being made after each draw. The probability that neither is orange is
  - (A)  $\frac{16}{25}$
- (B)  $\frac{9}{25}$
- (C)  $\frac{1}{25}$
- (D)  $\frac{24}{25}$

- Let the function f has the values  $f_0, f_1, f_2$  at equidistant nodal points  $x_0, x_1, x_2$  where  $x_i = x_0 + ih$ , i = 1, 2. Then, the divided difference  $f[x_0, x_1, x_2]$  is equal to
  - (A)  $\frac{\nabla f_2}{2h}$
- (B)  $\frac{\Delta f_0}{2h}$
- (C)  $\frac{\Delta^2 f_0}{2h^2}$  (D)  $\frac{\nabla f_1}{2h}$
- Q.57 Let  $\sigma = (1,3,5,7,9,10)(2,4,6,8)$  be a permutation in  $S_{10}$ . Then the smallest positive integer m such that  $\sigma^m = Id$ , the identity permutation, is
  - (A) 24
- (B) 6

(C) 4

(D) 12

Consider the following two lists: Q.58

List I	List II
1: TFT	P: Visual display unit
2: RAM	Q: Volatile memory
3: ROM	R: Non-volatile memory
4: CRT	S: Non-writable memory

The correct match is

- (A)  $1 \rightarrow P$ ,  $2 \rightarrow Q$ ,  $3 \rightarrow S$ ,  $4 \rightarrow R$
- (C)  $1 \rightarrow S$ ,  $2 \rightarrow Q$ ,  $3 \rightarrow S$ ,  $4 \rightarrow P$
- (B)  $1 \rightarrow P$ ,  $2 \rightarrow R$ ,  $3 \rightarrow Q$ ,  $4 \rightarrow S$ (D)  $1 \rightarrow P$ ,  $2 \rightarrow Q$ ,  $3 \rightarrow S$ ,  $4 \rightarrow P$
- A base 12 number system is called duodecimal. It uses the symbols 0, 1, 2, ..., 9, A, and B, Q.59 where A and B are the symbols used to represent 10 and 11 respectively. What is the duodecimal equivalent of the decimal number 1594?
  - (A) A09
- (B) A0A
- (C) B0A
- (D) B0B

Q.60 A particular solution of the differential equation

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} = x e^x$$

is

(A) 
$$-\frac{x^2}{2}e^x + (x-1)e^x$$

(B) 
$$-\frac{x^2}{2}e^{-x} + (x-1)e^{-x}$$

(C) 
$$\frac{x^2}{2}e^x - (x-1)e^x$$

(D) 
$$\frac{x^2}{2}e^{-x} - (x-1)e^{-x}$$

- The equation for the tangent plane to the surface  $2x^3y xz^2 = -3$  at the point (1, -1, 1) is Q.61
  - (A) 7x-2y+2z=11

(B) 2x-7y+2z=11

(C) 2x + 7y - 2z = 11

(D) 7x + 2y - 2z = 11

Q.62	The minimum distan	e plane $x+3y-z=11$	in $\mathbb{R}^3$ is					
	(A) 10	(B) 1	(C) $\sqrt{11}$	(D) 11				
Q.63	Let $\sigma$ be a 6-cycle i	$n S_{12}$ . Then $\sigma^i$ is also 6-	cycle if the value of i	is				
	(A) 2	(B) 3	(C) 5	(D) 12				
Q.64	The book entitled, '7	The Discovery of India'	was written by					
	(A) Abul Kalam Aza (C) Rajendra Prasad	ad	(B) Jawaharlal N (D) Sarvepalli Ra					
Q.65	Consider the followi	ng two lists:						
	<ul><li>2: Logical pr</li><li>3: Procedural</li></ul>	programming	List II P: C language Q: Prolog R: C++ S: Lisp					
	Which one of the following is correct match?							
	(A) $1 \rightarrow P$ , $2 \rightarrow Q$ , $3$ (C) $1 \rightarrow P$ , $2 \rightarrow R$ , $3$		(B) $1 \rightarrow P$ , $2 \rightarrow Q$ (D) $1 \rightarrow S$ , $2 \rightarrow Q$					
Q.66	What is the octal equ	nivalent of the hexadecir	nal number ABC?					
	(A) 5674	(B) 5314	(C) 5275	(D) 5274				
Q.67	The fourth order line	ar differential equation	having $e^{-x}$ , $xe^{-x}$ , cos	$2x$ , $\sin 2x$ as solutions is				
	(A) $\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + 5$ (B) $\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + 8$ (C) $\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + 3$ (D) $\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + 4$	$\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4y = 0$ $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 2y = 0$						
Q.68	The probability of ge	etting a total of 9 at least	once in two tosses of	a pair of fair dice is				
	(A) $\frac{600}{729}$	(B) $\frac{128}{729}$	(C) $\frac{601}{729}$	(D) $\frac{64}{81}$				

Q.69	If the matrix	$\begin{bmatrix} a \\ b \end{bmatrix}$	$\begin{bmatrix} b \\ 2 \end{bmatrix}$	has eigenvalues 1 and 3, then the value of $(a,b)$ is
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- (A)(1,2)
- (B) (2,1)
- (C)(-1,2)
- (D) (-2,1)

Q.70 The value of the integral 
$$\int_{0}^{9} \frac{dy}{\sqrt{y}\sqrt{1+\sqrt{y}}}$$
 is

(A)4

- (B)  $4(\sqrt{10}-1)$
- (C) 8

(D) 12

Q.71 The truth table of a binary operator ⊙ is given below:

x	у	$x \odot y$
0	0	0
0	1	0
1	0	1
1	1	0

Which one of the following is equivalent to  $x \odot y$ ?

- (A) x' y'
- (B) xy

- (C) x'y
- (D) xy'

Q.72 Suppose 
$$\vec{a} + \vec{b} = 2\hat{i} + 2\hat{j} + 3\hat{k}$$
,  $\vec{a} - \vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$  represent diagonals of a parallelogram whose sides are  $\vec{a}$  and  $\vec{b}$ . Then the area of the triangle formed by the sides  $\vec{a}$ ,  $\vec{b}$  and  $\vec{a} + \vec{b}$  is

- (A)  $\frac{1}{4}\sqrt{189}$
- (B)  $\frac{1}{4}\sqrt{198}$  (C)  $\frac{1}{4}\sqrt{179}$
- (D)  $\frac{1}{4}\sqrt{197}$

(B)  $Q^+ = T'Q' + TQ$ (D)  $Q^+ = T' + Q'$ 

(A)  $Q^{+} = T + Q$ (C)  $Q^{+} = TQ' + T'Q$ 

Q.74 The integral 
$$\int_{-1}^{1} f(x) dx$$
 where  $f$  is continuous on [-1,1], is approximated by the formula

$$\int_{-1}^{1} f(x) dx \simeq \alpha f\left(-\frac{1}{\sqrt{2}}\right) + \beta f\left(\frac{1}{\sqrt{2}}\right).$$

Suppose the approximation is exact for all polynomials of degree  $\leq 1$ . Then the value of  $\alpha$  is

- (A) -1
- (B) 1

- (C)  $\frac{1}{\sqrt{2}}$
- (D)  $-\frac{1}{\sqrt{2}}$

Q.75	Let $g(x) = \frac{1}{1 - x + x^2}$ and $a_o + a_1 x + a_2 x^2 + a_3 x^3 + \dots$ be the Taylor series of the function $g$ around 0. Then the value of $a_3$ is								
	(A) 0	(B) 1	(C) -1	(D) 3					
Q.76	Which of the following	g is/are forbidden input(s	) for SR flip-flip?						
	P: $S = 1$ , $R = 1$ Q: $S = 0$ , $R = 0$								
	(A) P only	(B) Q only	(C) both P and Q	(D) neither P nor Q					
Q.77		onstant, is used to find a	$(\sin x_n) + R \cos x_n$ real root of some function gent with an initial approx	• •					
	(A) $\tan x - R$	(B) $\cot x - R$	(C) $\sin x - R$	(D) $\cos x - R$					
Q.78	The area of the surface about $y$ -axis is	generated by rotating th $x = a \cos^3 \theta,  y = 0$	e hypocycloid $a \sin^3 \theta$ , $0 \le \theta \le \pi$						
	$(A) \frac{12}{5} \pi a^2$	$(B) \frac{5}{12} \pi a^2$	(C) $\frac{6}{5}\pi a^2$	(D) $\frac{5}{6}\pi a^2$					
Q.79	What is the output of a the output during the cu		t clock cycle, when J =	1, $K = 1$ ? Assume, Q is					
	(A) 1	(B) 0	(C) Q	(D) Q'					
Q.80	What are the values of the variables i, j, and k after execution of the following program segment?  int i=1, j=2, k=3; i += j += k;								
	(A) $i = 3$ , $j = 5$ , $k = 6$		(B) $i = 3$ , $j = 6$ , $k = 5$						
	(A) $i = 3$ , $j = 3$ , $k = 0$ (C) $i = 6$ , $j = 3$ , $k = 5$		(B) $i=3$ , $j=6$ , $k=3$ (D) $i=6$ , $j=5$ , $k=3$						
Q.81	What is the content of t	the array after execution	of the following program	n segment?					
		l, 2, 3, 4}, i; <4; ++i) a[i] = a	ı[i] + a[i-1];						

 $(B)\;\{1\,,\;\;2\,,\;\;3\,,\;\;4\,\}$ 

(D) {4, 3, 2, 1}

(A) {0, 1, 2, 3}

(C) {1, 3, 6, 10}

The eigenvectors of the matrix  $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$  are

$$(A) \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$$

$$(B)\begin{pmatrix}1\\0\\0\end{pmatrix},\begin{pmatrix}0\\1\\0\end{pmatrix},\begin{pmatrix}0\\0\\1\end{pmatrix}$$

$$(C) \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$

$$(D)\begin{pmatrix}1\\0\\0\end{pmatrix},\begin{pmatrix}0\\1\\0\end{pmatrix},\begin{pmatrix}1\\1\\1\end{pmatrix}$$

#### Q.83 Consider the following C function:

```
void fun2(int n) {
     while (n > 0) {
          printf("%d", n%10);
          n = n/10;
     }
}
```

What is the output of fun2(475)?

- (A) 475
- (B) 543
- (C)754
- (D) 574

#### Q.84 Consider the following algorithm:

- (1) for i = 1 to p do
- for j = 1 to q do (2)
- (3) for k = 1 to r do
- c[i,j] = c[i,j] + a[i,k] \* b[k,j];**(4)**

How many times line (4) is executed?

$$(B)p + q + r$$
  $(C)pqr$ 

Q.85 Consider the following C function:

```
int fun1(int n) {
        int x=0;
        while (n > 1) {
               n = n/2;
        return (x);
}
```

What is the return value of fun1(31)?

(A)3

(B)4

(C) 5

(D) 6

Q.86 Let A be a 3×3 matrix whose sum of the diagonal elements is  $\frac{1}{2}$  and the determinant is  $-\frac{1}{2}$ . If 1 is an eigenvalue of A, then the eigenvalues of  $(A^{-1})^2$  are

- (A) 1, 1, 4
- (B)  $\frac{1}{4}$ , 1, 1
- (C) 1,1,2 (D)  $\frac{1}{2}$ ,1,1

Q.87 Let  $S_1 = \{(x, y, z) \in \mathbb{R}^3 | x + y + z = 0\}$  and  $S_2 = \{(x, y, z) \in \mathbb{R}^3 | x^2 + y^2 - z^2 \le 1\}$ . Then the set  $S_1 \cap S_2$  is

- (A) convex but not bounded.
- (B) bounded but not convex.
- (C) bounded and convex.
- (D) neither bounded nor convex.

Q.88 The number of different Boolean functions with 3 inputs and 4 outputs is

- (A) 64
- (B) 127
- (C) 128
- (D) 144

Q.89 What is the output of the following program fragment?

- (A) aaa
- (B) bbb
- (C) ccc
- (D) outputs nothing

Q.90 The solution of the following LPP

$$Max f = x + 5y$$

subject to

$$2x + y \ge 10$$
,

$$4x + 3y \le 24$$
,

$$y \le 2x, y \ge 0$$

is

(A) 27.5

(B) 26.4

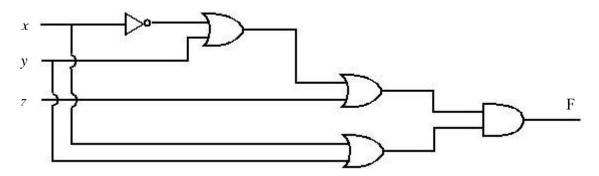
(C) 23

(D) 6

Q.91 Let  $f: \mathbb{R} \to \mathbb{R}$  be the function defined by  $f(x) = \begin{cases} x^2 & \text{if } x \in \mathbb{Q} \\ x & \text{if } x \notin \mathbb{Q} \end{cases}$ . Then the function f is

- (A) differentiable on  $\mathbb{R}$ .
- (B) differentiable only at 0.
- (C) differentiable only at 1.
- (D) is continuous at 0 but NOT differentiable at 0.

Q.92 Consider the following logic circuit:



What is the output F?

(A) 
$$x + yz$$

(B) 
$$y + xz$$

(C) 
$$z + xy$$

(D) 
$$x + y + z$$

Q.93 Suppose  $\phi_1$  and  $\phi_2$  are two linearly independent solutions of the differential equation

$$\frac{d^2y}{dx^2} + a_1 \frac{dy}{dx} + a_2 y = 0$$

where  $a_1$  and  $a_2$  are constants. Then  $\phi_1$  and  $\phi_2$  have

- (A) odd number of common zeros
- (B) exactly one common zero
- (C) no common zeros
- (D) at most two common zeros

Q.94	Which one	e is equivalent to $xyz + xyz' + xy'z +$	xy'z'?		
	(A) x	(B) x'	(C) $y + z$	(D) <i>yz</i>	
Q.95	In the following segment of C program				
		IENT);			
	<b>STAMENT</b> represents a missing string. Which one of the following is an appropriate string?				
		s a prime number" s an odd number"	(B) "x is an even (D) "the value of		
Q.96	Let $W_1 = \{(x, y, z, w) \in \mathbb{R}^4   x + y + z = 0 \text{ and } 6x + 7y + 8z = 0\}$ and				
	•	$W_2 = \{(x, y, z, w) \in \mathbb{R}^4   x + 2y + 3z = 0 \text{ and } 2x + 3y + 4z = 0\}$ . Then the dimension of the subspace $W_1 + W_2$ is			
	(A) 1	(B) 2	(C) 4	(D) 3	
Q.97	The composite Trapezoidal rule is used to compute $\int_{0}^{1} e^{-x} dx$ with an error of at most $\frac{1}{12}$				
	How many points should be used?				
	(A) 11	(B) 9	(C) 8	(D) 7	
Q.98	Consider the following C function:				
	<pre>float f(float x) { float sum=1.0,term=1.;   int n=1;   while(n&lt;50)   { term=x*term/n;     sum+=term;     n++;   } return sum; }</pre>				
	The return	The return value of the function f (1.0) is the approximate value of			

 $(C)\cos(1.0)$ 

(D) e

(B)  $\sin (1.0)$ 

(A) 0.0

Q.99 The length of the one arc of the cycloid

$$x = a(t - \sin t), \quad y = a(1 - \cos t)$$

is

- (A) 8a
- (B) 4*a*
- (C)  $4\sqrt{2} a$  (D)  $2\sqrt{2} a$

Q.100 Consider the following C function:

```
void f(int x,int y)
{ int d;
  if(x>0)
  { d=x%y;
    f(x/y,y);
    printf("%d",d);
  else return;
```

The output for f(100, 16) is

- (A) 11
- (B) 64
- (C) 82
- (D) 110

End of the paper

A

## **SPACE FOR ROUGH WORK**

A

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A

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