INSTRUCTIONS

1. You have opted for English as medium of question paper. This test Booklet contains one hundred and twenty (20 Part' A' +40 Part 'B' +60 Part 'C') Multiple Choice Questions (MCQs). You are required to answer a maximum of 15, 25 and 20 questions from part 'A' 'B' and 'C' respectively. If more than required number of questions are answered, only first 15, 25 and 20 questions in Parts 'A' 'B' and 'C' respectively, will be taken up for evaluation.
2. Each question in Part 'A' carries 2 marks, Part 'B' 3 marks and Part 'C' 4.75 marks respectively. There will be negative marking @0.5 marks in Part 'A' and @ 0.75 marks in Part 'B' for each wrong answer and no negative marking for Part 'C'.
3. Below each question in Part 'A' and 'B', four alternatives or responses are given. Only one of these alternatives is the "correct" option to the question. You have to find, for each question, the correct or the best answer. In Part 'C' each question may have "**ONE**' or '**MORE**' correct options in Part 'C'. Credit in a question shall be given only on idenfication of 'ALL' the correct options in Part 'C'. No credit shall be allowed in a question if any incorrect option is marked as correct answer.

Part - A

1. What is the value of $(1+3+5+7+...+4033+7983\times 2017)$?

   1. 20170000 2. 20172017
   3. 20171720 4. 20172020

2. The following sum is :
   $1+1-2+3-4+5-6+....-20=?$

   1. 10 2. −10
   3. −11 4. −9

3. In a group of 11 persons, each shakes hand with every other once and only once. What is the total number of such handshakes ?

   1. 110 2. 121
   3. 55 4. 66

4. Suppose (i) " $A*B$ " means "*A* is the father of *B*", (ii) " $A\Delta B$ " means "*A* is the husband of *B*", (iii) " $A\nabla B$ " means "*A* is the wife of *B*" and (iv) " $A\square B$ ", means "*A* is the sister of *B*". Which of the following represents "*C* is the father-in-law of the sister of *D*" ?

   1. $C\nabla E*F\square D$ 2. $C*E\nabla F\square D$
   3. $C\Delta E*F\square D$ 4. $C*E\Delta F\square D$

5. In a 100m race *A* beats *B* by 10m. *B* beats *C* by 5m. By how many meters does *A* beat *C* ?

   1. 15.0m 2. 5.5m
   3. 10.5m 4. 14.5m

6. When a farmer was asked as to how many animals he had, he replied that all but two were cows, all but two were horses and all but two were pigs. How many animals did he have ?

1. 3 2. 6
3. 8 4. 12

7. Nine-eleventh of the members of a parliamentary committee are men. Of the men, two-thirds are from the Rajya Sabha. Further, $\frac{7}{11}$ of the total committee members are from the Rajya Sabha. What fraction of the total number are women from the Lok Sabha ?

1. $\frac{1}{11}$ 2. $\frac{6}{11}$
3. $\frac{2}{11}$ 4. $\frac{3}{11}$

8. A librarian is arranging a thirteen-volume encyclopaedia on the shelf from left to right in the following order of volume numbers 8, 11, 5, 4, 9, 1, 7, 6, 10, 3, 12, 2. In this pattern, where should the volume 13 be placed ?

1. Leftmost
2. Rightmost
3. Between 10 and 3
4. Between 9 and 1

9. $4^0 + 4^2 + \frac{1}{4^2} + 4^{\frac{1}{2}} + \frac{1}{4^{\frac{1}{2}}}$ equals :

1. 40 2. $4^{2\frac{1}{2}} + 4^{-2\frac{1}{2}}$
3. $19\frac{9}{16}$ 4. $22\frac{9}{16}$

10. What is the last digit of $(2017)^{2017}$?

1. 1 2. 3
3. 7 4. 9

11. The university needs to appoint a new Vice Chancellor which will be based on seniority Ms. West is less senior to Mr. North but more senior to Ms. East. Mr. South is senior to Ms. West but junior to Mr. North. If the senior-most declines the assignment, then who will be the new Vice Chancellor of the University ?

1. Mr. North 2. Ms. East
3. Ms. West 4. Mr. South

12. The prices of diamonds having a particular colour and clarity are tabulated below :

Weight of diamond (in carats)	Price of diamond (in rupees/carats)
0.25	1lakh
0.5	2lakh
1	4lakh
2	8lakh

How many 0.25 carat diamonds can be purchased for the price of a 2 carat diamond ?

1. 8 2. 16
3. 32 4. 64

13. In a sequence of 24 positive integers, the product of any two consecutive integers is 24. If the 17^{th} member of the sequence is 6, the 7^{th} member is

1. 24 2. 4
3. 6 4. 17

14. Mohan lent Geeta as much money as she already had. She then spent Rs. 10. Next day he again lent as much money as Geeta now had and she spent Rs. 10 again. On the

third day, Mohan again lent as much money as Geeta now had, and she again spent Rs. 10. If Geeta was left with no money at the end of the third day, how much money did she have initially ?

1. Rs. 11.25 2. Rs. 10
3. Rs. 7.75 4. Rs. 8.75

15. What is the last digit of 7^{73} ?

1. 7 2. 9
3. 3 4. 1

16. If all the angles of a triangle are prime numbers, which of the following could be one such angle ?

1. 89° 2. 79°
3. 59° 4. 29°

17. A water tank that is 40% empty holds 40 L more water than when it is 40% full. How much water does it hold when it is full ?

1. 100 L 2. 75 L
3. 120 L 4. 200 L

18. How much gold and copper (in *g*) respectively are required to make a 120g bar of 22 carat gold ?

1. 90 and 30 2. 100 and 20
3. 110 and 10 4. 120 and 0

19. Vishal needs to measure the area of a rectangular carpet. However, he does not have a ruler, so he uses a shoe instead. He finds that the shoe fits exactly 15 times along one edge of the carpet and 10 times along another. He later measures the shoe and finds that it is 28 cm long. What is the area of the carpet ?

1. 117600 cm^2 2. 150 cm^2
3. 4200 cm^2 4. 22500 cm^2

20. Areas of the three rectangles inside the full rectangle are given in the diagram

	8
12	4

What is the area of the full rectangle ?

1. 36 2. 48
3. 72 4. 96

Part - B

Unit – 1

21. Let $\Delta = \begin{vmatrix} 1+x_1y_1 & 1+x_1y_2 & 1+x_1y_3 \\ 1+x_2y_1 & 1+x_2y_2 & 1+x_2y_3 \\ 1+x_3y_1 & 1+x_3y_2 & 1+x_3y_3 \end{vmatrix}$ the value of Δ is

1. $x_1x_2x_3 + y_1y_2y_3$ 2. $x_1y_1 + x_2y_2 + x_3y_3$
3. $x_1x_2x_3y_1y_2y_3$ 4. 0

22. The sum of squares of all eigen values of the matrix $\begin{bmatrix} -1 & 0 & 0 & 0 & -2 \\ 0 & -1 & 0 & -2 & 0 \\ 0 & 0 & -3 & 0 & 0 \\ 0 & -2 & 0 & -1 & 0 \\ -2 & 0 & 0 & 0 & -1 \end{bmatrix}$ is

1. an even prime
2. an odd prime
3. not a prime
4. is square of a prime

23. Let $S = \left\{ A = \left[a_{ij}\right]_{n\times n} : a_{ij} \in \mathbb{R},\ A^2 = A \text{ and } \det(A) \neq 0 \right\}$ then the cardinality of set S is

1. 0 2. 1

3. $\aleph_0$ 4. c

24. Let $S \subseteq \mathbb{R}$ be a non-empty set and $m^*(S)$ denotes the outer measure of S then which of the following is true :

1. If S is uncountable then $m^*(S)=0$
2. If $m^*(S)=0$ then S is uncountable
3. If $m^*(S)=0$ then S is countable
4. None of these

25. Let A be a 10×15 real matrix then the dimension of solution space of the system $Ax=0$ can not be equal to

1. 4 2. 5
3. 6 4. 7

26. Which of the following series is not conditionally convergent

1. $\sum_{n=1}^{\infty}\frac{(-1)^n}{4n+5}$ 2. $\sum_{n=2}^{\infty}\frac{(-1)^n}{\log n}$
3. $\sum_{n=1}^{\infty}\frac{(-1)^n}{\sqrt{n}}$ 4. $\sum_{n=2}^{\infty}\frac{(-1)^n\cdot n}{4n+5}$

27. Let $S_1=\{f \mid f:[a,b]\to\mathbb{R}$ is a Lipschitz function $\}$ and $S_2=\{f \mid f:[a,b]\to\mathbb{R}$ is a function of bounded variation $\}$ then which of the following is true :

1. S_1 is a subset of S_2
2. S_2 is a subset of S_1
3. S_1 is a proper subset of S_2
4. S_2 is a proper subset of S_1

28. Let $f(x)=\begin{cases} e^{\frac{-1}{x^2}} & x\neq 0 \\ 0 & x=0 \end{cases}$ is a function from $\mathbb{R}$ to $\mathbb{R}$ then

1. f is not continuous on 0
2. f is continuous but not differentiable at $x=0$
3. $f'(0)$ exist but $f''(0)$ does not exist
4. $f''(0)$ exist

29. Let $\sum_{n=1}^{\infty}a_n$ be a positive term divergent series then

1. there exists a positive integer k such that the series $\sum_{n=1}^{\infty}a_n^k$ is convergent
2. for all positive integers k the series $\sum_{n=1}^{\infty}a_n^k$ is divergent
3. Both are true
4. Both are false

30. Consider the following statements :

P : there exists a one-one function from a set S to $\mathbb{N}$

Q : there exists a onto function from $\mathbb{N}$ to the set S

Which of the following is true :

1. $P\Rightarrow Q$ 2. $Q\Rightarrow P$
3. $P\Leftrightarrow Q$ 4. $P \not\Leftrightarrow Q$

31. Let J denotes the Jordan canonical form of a matrix whose characteristic polynomial and minimal polynomial are $(x-2)^4(x-3)^3$ and $(x-2)^3(x-3)^2$ respectively then the number of non zero entries in J is

1. 8 2. 9
3. 10 4. 11

32. Let $f:\mathbb{R}^2 \to \mathbb{R}$ be defined as $f(x,y) = x^3 + 4xy^2$ then the directional derivative of f at $(1,-1)$ in the direction $(-1,1)$ is

1. 8 2. 9
3. 10 4. None

Unit - II

33. If f is an entire function then

1. $\overline{f(z)} = f(\overline{z}) \ \forall\ z \in \mathbb{C}$
2. $\overline{f(z)} \neq f(\overline{z}) \ \forall\ z \in \mathbb{C}$
3. Both are true
4. Both are false

34. The value of the integral $\int_C \frac{1}{(z^2+4)^2} dz$ where C denotes the circle $|z-i| = 2$ is

1. $\frac{\pi}{2}$ 2. $\frac{\pi}{4}$
3. $\frac{\pi}{8}$ 4. $\frac{\pi}{16}$

35. The image of the disc $|z| \le 1$ under the bilinear transformation $f(z) = i\frac{1-z}{1+z}$ is

1. $x \ge 0$ 2. $y \ge 0$
3. $|z| \le 1$ 4. None

36. The domain of convergence of the series $\sum_{n=0}^{\infty}\left(\frac{z}{1-z}\right)^n$ is

1. interior of a disc
2. exterior of a disc
3. a half plane
4. None of these

37. If $\tau(n)$ denotes the number of positive divisors of n then $\tau(n)$ is even if

1. n is a perfect square
2. n is a not a perfect square
3. $n \ge 1000$
4. n is even

38. Upto isomorphism the number of abelian groups of order 997 is

1. 4 2. 3
3. 2 4. 1

39. Which of the following is not an integral domain

1. $\mathbb{Z}_{223}[i]$ 2. $\mathbb{Z}_{227}[i]$
3. $\mathbb{Z}_{229}[i]$ 4. $\mathbb{Z}_{239}[i]$

40. Let R be a commutative ring with unity and U be a maximal ideal of R then

1. $U[x]$ must be a maximal ideal of $R[x]$
2. $U[x]$ cannot be a maximal ideal of $R[x]$
3. $U[x]$ may be a maximal ideal of $R[x]$
4. $U[x]$ is not an ideal of $R[x]$

Unit - III

41. Solution of the integral equation $\sin x = \int_0^x e^{x-t} u(t)\,dt$ is

1. $\cos x$ 2. $\sin x$

3. $\cos x - \sin x$ 4. $\cos x + \sin x$

42. Solution of the differential equation

$y'' + y = \dfrac{1}{(1+\sin x)}$ is

1. $y(x) = c_1 \cos x + c_2 \sin x - 1 + \sin x$
   $- x\cos x + \sin x \log(1+\sin x)$
2. $y(x) = c_1 \cos x + c_2 \sin x - 1 + \sin x$
   $+ x\cos x + \sin x \log(1+\sin x)$
3. $y(x) = c_1 \cos x + c_2 \sin x - 1 + \sin x$
   $+ x\cos x - \sin x \log(1+\sin x)$
4. None

43. Let $x_1(t)$ and $x_2(t)$ defined on $[0,2]$ be twice continuously differential functions satisfying $x''(t) + x'(t) + x(t) = 0$. Let $W(t)$ be the wronskian of x_1 and x_2 and satisfy $W(1) = 0$. Then

1. $W(t) \neq 0$ for $x \in [0,2]$
2. $W(t) > 0$ for $x \in [1,2]$
3. $W(t) < 0$ for $x \in [0,1]$
4. $W(t) = 0 \ \forall \ x \in [0,2]$

44. $Z = x f(x+y) + g(x+y)$ then corresponding PDE is

1. $\dfrac{\partial^2 z}{\partial x^2} - \dfrac{\partial^2 z}{\partial x \partial y} + \dfrac{\partial^2 z}{\partial y^2} = 0$
2. $\dfrac{\partial^2 z}{\partial x^2} - 2\dfrac{\partial^2 z}{\partial x \partial y} + \dfrac{\partial^2 z}{\partial y^2} = 0$
3. $\dfrac{\partial^2 z}{\partial x^2} + 2\dfrac{\partial^2 z}{\partial x \partial y} + \dfrac{\partial^2 z}{\partial y^2} = 0$
4. $\dfrac{\partial^2 z}{\partial x^2} - 2\dfrac{\partial^2 z}{\partial x \partial y} - \dfrac{\partial^2 z}{\partial y^2} = 0$

45. If $u_x - u_y = 9$ passes through $(s, s, 3s)$, then number of solution of the this PDE where $0 < s < 1$ is

1. No solution 2. Unique solution
3. Infinite solution 4. None

46. The functional

$\int_0^1 (1+x^2)(y')^2\, dx,\ y(0) = 0,\ y(1) = 1$

possesses

1. Strong maxima
2. Weak maxima but not strong maxima
3. Strong minima
4. Weak minima but not strong minima

47. Consider a body of unit mass falling freely from rest under gravity with velocity *v*. If the air resistance retards the acceleration by *cv* where *c* is constant, then

1. $v = \dfrac{g}{c}\left[1 + e^{ct}\right]$ 2. $\dfrac{g}{c}\left[1 + e^{-ct}\right]$
3. $v = \dfrac{g}{c}\left[1 - e^{-ct}\right]$ 4. $V = \dfrac{g}{c}\left[1 - e^{ct}\right]$

48. Consider the initial value problem $\dfrac{dy}{dx} = x + y,\ y(0) = 1$. Then approximate value of the solution $y(x)$ at $x = 0.2$, using improved Euler method, with $h = 0.2$ is

1. 1.11 2. 1.20
3. 1.25 4. 1.48

Unit-4

49. For a random variable *X*, with $E(X) > 0$, the coefficient of variation ρ is defined as $\rho = \dfrac{\sigma_X}{E(X)}$ where σ_X^2 is the variance of *X*. Suppose $X_1, X_2, ..., X_n$ are independent

samples from a normal population with mean 2 and unknown coefficient of variation ρ. It is desired to test $H_0 : \rho \le 5$ against $H_1 : \rho > 5$. The likelihood ratio test is of the form : Reject H_0 if

1. $\sum (X_i - 2)^2 > C$
2. $\sum (X_i - 2)^2 < C$
3. $\frac{\sum (X_i - \bar{X})^2}{\bar{X} - 2} > C$
4. $\frac{\sum (X_i - \bar{X})^2}{\bar{X} - 2} < C$

50. $(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)$ are data on X-cultivable land in a district and Y-the area actually under cultivation, both measured in square feet. Let $\hat{\alpha}, \hat{\beta}$ be the least squares estimates of α, β in the model $Y = \alpha + \beta x + \varepsilon$, where ε is the random error. If the data are converted to square meters, then
1. $\hat{\alpha}$ may change but $\hat{\beta}$ will not.
2. $\hat{\beta}$ may change but $\hat{\alpha}$ will not.
3. both $\hat{\alpha}$ and $\hat{\beta}$ may change.
4. Neither $\hat{\alpha}$ nor $\hat{\beta}$ will change.

51. Suppose in a one-way analysis of variance model, the sum of squares of all the group means is 0 (Assume that all the observations are not same). Then the value of the usual F-test statistic for testing the equality of means
1. cannot be determined from the above information.
2. is undefined.
3. is 0.
4. is 1.

52. Let $(X_1, X_2, \ldots, X_p)$ be a random vector with mean $\underset{\sim}{\mu}$ and a positive definite dispersion matrix $\sum$. Then the coefficient vector $(l_1, l_2, \ldots, l_p)$ of the first principal component $\sum_{i=1}^{p} l_i X_i$ is
1. the vector of all the eigenvalues of $\sum$.
2. the eigenvector corresponding to the smallest eigenvalue of $\sum$.
3. the eigenvector corresponding to the largest eigenvalue of $\sum$.
4. the vector of all the eigenvalues of $\sum^{-1}$.

53. A simple random sample (without replacement) of size n is drawn from a finite population of size $N (\ge 7)$. What is the probability that the 4th population unit is included in the sample but the 6th population unit is not included in the sample ?
1. $\frac{n(n-1)}{N(N-1)}$
2. $\frac{n(N-n)}{N(N-1)}$
3. $\frac{(n-1)(N-n+1)}{N(N-1)}$
4. $\frac{n}{N}$

54. (v, b, r, k, λ) are the standard parameters of a balanced incomplete block design (*BIBD*). Which of the following (v, b, r, k, λ) can be parameters of a *BIBD* ?
1. $(v, b, r, k, \lambda) = (44, 33, 9, 12, 3)$
2. $(v, b, r, k, \lambda) = (17, 45, 8, 3, 1)$
3. $(v, b, r, k, \lambda) = (35, 35, 17, 17, 9)$
4. $(v, b, r, k, \lambda) = (16, 24, 9, 6, 3)$

55. Consider an $M / M / 1$ Queue with arrival rate λ and service rate μ with $\mu > \lambda$. What is the probability that no customer exited the system before time 5?
1. $\frac{\mu e^{-5\lambda} - \lambda e^{-5\mu}}{\mu - \lambda}$
2. $e^{-5\lambda} - e^{-5\mu}$
3. $e^{-5\lambda} + (1 - e^{-5\lambda}) \frac{e^{-5\mu}}{5\mu}$

4. $e^{-5\mu}+(1-e^{-5\mu})\frac{e^{-5\lambda}}{5\lambda}$

56. There are two boxes. Box 1 contains 2 red balls and 4 green balls. Box 2 contains 4 red balls and 2 green balls. A box is selected at random and a ball is chosen randomly from the selected box. If the ball turns out to be red, what is the probability that Box 1 had been selected ?

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{2}{3}$
4. $\frac{1}{6}$

57. For any two events *A* and *B*, which of the following relations always holds ?

1. $P^2(A\cap B^C)+P^2(A\cap B)+P^2(A^C)\geq\frac{1}{3}$
2. $P^2(A\cap B^C)+P^2(A\cap B)+P^2(A^C)=\frac{1}{3}$
3. $P^2(A\cap B^C)+P^2(A\cap B)+P^2(A^C)=1$
4. $P^2(A\cap B^C)+P^2(A\cap B)+P^2(A^C)\leq\frac{1}{3}$

58. Suppose customers arrive in a shop according to a Poisson process with rate 4 per hour. The shop opens at 10 : 00 am. If it is given that the second customer arrives at 10 : 40 am, what is the probability that no customer arrived before 10 : 30 am ?

1. $\frac{1}{4}$
2. e^{-2}
3. $\frac{1}{2}$
4. $e^{-\frac{1}{2}}$

59. Suppose $X_1, X_2,...., X_n$ is a random sample from a distribution with probability density function $f(x)=3x^2 I_{(0,1)}(x),$ where

$$I_{(0,1)}(z)=\begin{cases}1 & \text{if } z\in(0,1)\\ 0 & \text{otherwise}\end{cases}.$$

What is the probability density function $g(y)$ of $Y=\min\{X_1,X_2,....,X_n\}$?

1. $g(y)=3ny^{3n-1}I_{(0,1)}(y)$
2. $g(y)=1-(1-y^3)^n I_{(0,1)}(y)$
3. $g(y)=(1-y^3)^n I_{(0,1)}(y)$
4. $g(y)=3ny^2(1-y^3)^{n-1}I_{(0,1)}(y)$

60. $X_1, X_2,...., X_n$ are independent and identically distributed $N(\theta,1)$ random variables, where θ takes only integer values i.e., $\theta\in\{...,-2,-1,0,1,2,...\}$. Which of the following is the maximum likelihood estimator of θ ?

1. $\overline{X}$
2. Integer closest to $\overline{X}$
3. Integer part of $\overline{X}$,(Largest integer $\leq \overline{X}$)
4. median of $(X_1, X_2,...., X_n)$

Part – C

Unit - I

61. Let $f:\mathbb{R}\to\mathbb{R}$ be a function such that $f(x+y)=f(x)+f(y)\ \forall\ x,y\in\mathbb{R}$ then which of the following is/are not true :

1. either *f* is continuous everywhere or it is continuous nowhere.
2. f is continuous on $\mathbb{R}$ iff it is continuous at zero.
3. f must be of the form $f(x)=kx$ for some $k\in\mathbb{R}$.
4. All of the above options are false.

62. Which of the following is/are true :

1. Every sequence contains a monotonic subsequence
2. Every limit point of the sequence is the limit point of the range set of sequence
3. If a sequence has a unique limit point then it must be the limit of the sequence
4. If $(a_{2n}),(a_{2n+1}),(a_{8n})$ are convergent then the sequence a_n is convergent

63. For the series $\sum_{n=1}^{\infty}\left(\frac{nx}{1+n^2x^2}-\frac{(n-1)x}{1+(n-1)^2x^2}\right)$ which of the following is/are not true :
   1. the series is uniformly convergent on $[0,1]$
   2. this series can be integrated term by term on $[0,1]$
   3. the series is convergent on $[0,1]$ but not uniformly convergent
   4. the sum function of this series is identically zero function on $[0,1]$

64. Let $A=\{(x,y):x^2+y^2=1\}\cup\{(x,y):(x-1)^2+y^2=1\}\subseteq\mathbb{R}^2$ then
   1. A is connected
   2. A is path connected
   3. A is compact
   4. $A^\circ=\phi$

65. Let (X,d) be a metric space and $d(a,A)$ denotes the distance between the point a and the subset $A\subseteq X$ then which of the following is/are true :
   1. if $d(a,A)=0$ then $a\in A$.
   2. if $d(a,A)=0$ then $a\notin A$.
   3. if $d(a,A)\neq 0$ then $a\in A$.
   4. if $d(a,A)\neq 0$ then $a\notin A$.

66. Let $f_n(x)=(\sin x)^{2n}$ then the sequence $f_n(x)$
   1. converges uniformly on $\mathbb{R}$
   2. converges pointwise to a continuous function but not uniformly on $\mathbb{R}$
   3. converges pointwise to a non-continuous function on $\mathbb{R}$
   4. does not converge on $\mathbb{R}$

67. Which of the following functions is/are uniformly continuous on $(0,\infty)$
   1. $f(x)=x\sin\left(\frac{1}{x}\right)$
   2. $\sin^2 x$
   3. $\sin\left(\frac{1}{x}\right)$
   4. $f(x)=\sqrt{x}$

68. Which of the following integrals is/are convergent
   1. $\int_0^\infty e^{-mx}\,dx\,(m>0)$
   2. $\int_a^\infty \frac{x}{1+x^2}\,dx$
   3. $\int_1^2 \frac{dx}{\sqrt{x-1}}$
   4. $\int_0^2 \frac{dx}{2x-x^2}$

69. If A and B are two $n\times n$ real matrices such that $I-AB$ is invertible then
   1. $I-BA$ is invertible
   2. $I-BA$ is not invertible

3. $I - BA$ may or may not be invertible
4. $I - BA$ is invertible and
$(I - BA)^{-1} = I + B(I - AB)^{-1} A$

70. Consider the matrices $P = \begin{bmatrix} 2 & 2 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 3 \end{bmatrix}$ and $Q = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ then which of the following is/are not true :
1. P and Q are similar over $\mathbb{R}$
2. P is diagonalizable over $\mathbb{R}$
3. Q is Jordan canonical form of P.
4. Q is diagonalizable over $\mathbb{R}$

71. Let $A = \begin{bmatrix} 1 & 0 & 2 & 1 \\ 1 & 1 & 4 & 1 \\ 3 & 1 & 8 & 3 \end{bmatrix}$ then which of the following is/are basis of solution space of the system $Ax = 0$
1. $\left\{ \begin{pmatrix} -2 \\ -2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} -1 \\ 0 \\ 0 \\ 1 \end{pmatrix} \right\}$
2. $\left\{ \begin{pmatrix} -5 \\ -4 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} -4 \\ -2 \\ 1 \\ 2 \end{pmatrix} \right\}$
3. $\left\{ \begin{pmatrix} 2 \\ 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} \right\}$
4. $\left\{ \begin{pmatrix} -2 \\ -2 \\ 1 \\ 0 \end{pmatrix} \right\}$

72. Let A is a 3×4 matrix such that the system $Ax = b$ is consistent for every $b \in \mathbb{R}^3$ then
1. Rows of A are L.I.
2. Rows of A are L.D.
3. Columns of A are L.I.
4. Columns of A are L.D.

73. Let V be a finite dimensional vector space. Let W_1 and W_2 be two non-trivial subspaces of V such that $V = W_1 \oplus W_2$. Let $T : V \to V$ be a linear operator defined by $T(u_1 + u_2) = u_1$ where $u_1 \in W_1$ and $u_2 \in W_2$ then
1. T is idempotent
2. T is singular
3. $\text{Null}(T) = W_2$
4. The eigen values of T are 0 and 1

74. Let D denote the differential operator i.e., $D(f(t)) = \frac{df}{dt}$ on a vector space V spanned by $B = \{e^t, e^{2t}, te^{2t}\}$. Let $A = [a_{ij}]_{3\times3}$ be the matrix of D with respect to B then :
1. A is diagonalizable
2. eigen values of A are distinct
3. A is invertible
4. A is triangular matrix

75. The quadratic form $q(x, y) = ax^2 + bxy + cy^2$ is positive definite
1. if $a = 1, b = 4, c = 5$
2. if $a = 1, b = 5, c = 4$
3. if $a = -1, b = 0, c = 2$
4. iff $a > 0, b^2 - 4ac < 0$

76. The range of the quadratic form $q(x, y, z) = x^2 + 7y^2 - 8z^2 + 2xy + 3yz - 4zx$
1. contains the interval $(1, \infty)$
2. contains the interval $(-\infty, 1)$
3. contains all the natural numbers
4. does not contain the prime numbers

77. Consider the linear transformation $T:\mathbb{R}^5 \to \mathbb{R}^5$ defined by $T(x_1,x_2,x_3,x_4,x_5)=(x_2,x_1,x_3,x_4,x_5)$ then which of the following is/are true :
   1. T is diagonalizable over $\mathbb{R}$
   2. All the eigen values of T are distinct
   3. T has only two distinct eigen values
   4. Trace of T is 3

78. Which of the following is/are true :
   1. Every matrix is similar to its Jordan canonical form
   2. If two matrices are row-equivalent then they have same Jordan canonical form
   3. If Jordan canonical form of two matrices is same then both are row equivalent
   4. If Jordan canonical form of two matrices is same then they are similar

Unit – II

79. Let $C[0,1]$ be the ring of all real valued continuous functions on $[0,1]$. Which of the following is/are not true :
   1. The identically zero function is the only nilpotent element of $C[0,1]$
   2. There are two nilpotent elements in $C[0,1]$
   3. Every non zero prime ideal of $C[0,1]$ is a maximal ideal.
   4. $\{0\}$ is a prime ideal in $C[0,1]$

80. Which of the following is an integral domain
   1. $\mathbb{Q}[x]/\langle x^3+2x^2+x-1\rangle$
   2. $\mathbb{Q}[x]/\langle x^4+x+1\rangle$
   3. $\mathbb{Q}[x]/\langle x^3+x^2+x+1\rangle$
   4. $\mathbb{Q}[x]/\langle x^5+2x+4\rangle$

81. Which of the following is/are true :
   1. In a UFD an element is prime element then it is irreducible element also
   2. In a UFD an element is irreducible then it is prime element also
   3. If R is UFD then $R[x]$ is also UFD
   4. Out of three two are correct

82. In the group $\mathbb{Z}_{30}\times\mathbb{Z}_{20}$ there are
   1. 48 elements of order 15
   2. 6 subgroups of order 15
   3. 16 elements of order 10
   4. 4 subgroups of order 10

83. Let G be a group and $a\in G$ be an element such that $o(a^5)=12$ then which of the following can be the order of a
   1. 12
   2. 24
   3. 36
   4. 60

84. Let $f(z)=z^2$ then
   1. f maps first quadrant to upper half plane
   2. f maps upper half plane to upper half plane
   3. f maps upper half plane to complex plane $\mathbb{C}$
   4. f maps unit circle onto unit circle

85. Which of the following is/are not true :
   1. The multiplicative group of a finite field

is always cyclic

2. The additive group of a finite field is always cyclic
3. There exists a finite field of any given order
4. There exists a finite integral domain of any given order

86. Let f and g are two entire functions then

1. if $f\left(1+\frac{1}{n}\right)=g\left(1+\frac{1}{n}\right)$ for all $n\in\mathbb{N}$ then $g(z)=f(z)$ for all $z\in\mathbb{C}$
2. $\int_C \frac{f(z)}{(n+1)z-1}dz=0$ for all $n\in\mathbb{N}$ where $C=\{z\in\mathbb{C}:|z|=1\}$ then $f(z)=0$ for all $z\in\mathbb{C}$
3. If $g(z)=\overline{f(\overline{z})}$ then $g(z)=f(z)$
4. If $g(z)=\overline{f(\overline{z})}$ and $f(z)\in\mathbb{R}\ \forall\ z\in\mathbb{R}$ then $f(z)=g(z)$

87. The function $\sin\left(\frac{1}{\exp\left(\frac{1}{z}\right)}\right)$

1. has infinitely many poles
2. has infinitely many isolated essential singularities
3. has isolated essential singularity at $z=0$
4. has non-isolated essential singularity at $z=0$

88. Let $H^{+}=\{z\in\mathbb{C}:\operatorname{Im}(z)>0\}$

$H^{-}=\{z\in\mathbb{C}\ :\operatorname{Im}z<0\}$

$L^{+}=\{z\in\mathbb{C}:\operatorname{Re}(z)>0\}$

$L^{-}=\{z\in\mathbb{C}:\operatorname{Re}(z)<0\}$

Let $f(z)=\frac{2iz+3}{4iz-5i}$ then which of the following is/are not true :

1. f maps H^{+} to H^{+} and H^{-} to H^{-}
2. f maps H^{+} to H^{-} and H^{-} to H^{+}
3. f maps H^{+} to L^{+} and H^{-} to L^{-}
4. f maps H^{+} to L^{-} and H^{-} to L^{+}

89. Let G be an open set in $\mathbb{R}^n$. Two points $x,y\in G$ are said to be equivalent if they can be joined by a continuous path completely lying inside G. Number of equivalence classes is

1. only one.
2. at most finite.
3. at most countable.
4. can be finite, countable or uncountable.

90. Let (X,d) be a metric space. Then

1. An arbitrary open set G in X is a countable union of closed sets.
2. An arbitrary open set G in X cannot be countable union of closed sets if X is connected.
3. An arbitrary open set G in X is a countable union of closed sets only if X is countable.
4. An arbitrary open set G in X is a countable union of closed sets only if X is locally compact.

Unit - III

91. Solution of the integral equation

$$u(x)=2x-\pi+4\int_0^{\frac{\pi}{2}}\sin^2 x\,u(t)\,dt \text{ is/are}$$

1. $u(x)=2x-\pi+\frac{\pi}{\pi-1}\sin^2 x$
2. $u(x)=2x-\pi+\frac{\pi^2}{\pi-1}\sin^2 x$
3. $u(x)=2x-\pi-\frac{\pi}{\pi-1}\sin^2 x$
4. $u(x)=2x-\pi-\frac{\pi^2}{\pi-1}\sin^2 x$

92. For the linear system $\frac{dx}{dt} = 6x - 4y$

$\frac{dy}{dt} = x + 2y \qquad x(0) = 2,\ y(0) = 3$ which of the following is not true :

1. $x(t) = 2e^{4t} - 8te^{4t},\ y(t) = 3e^{4t} - 4te^{4t}$
2. $x(t) = 2e^{4t} + 8te^{4t},\ y(t) = 3e^{4t} - 4te^{4t}$
3. $x(t) = 2e^{4t} + 8te^{4t},\ y(t) = 3e^{4t} + 4te^{4t}$
4. $\lim_{t \to 0} x(t) = 2$ and $\lim_{t \to 0} y(t) = 3$

93. Let $y : \mathbb{R} \to \mathbb{R}$ and satisfy the O.D.E.

$$\left.\begin{array}{l} \frac{dy}{dx} = f(y) : x \in \mathbb{R} \\ y(0) = y(1) = 0 \end{array}\right\}$$ where $f : \mathbb{R} \to \mathbb{R}$ is a Lipschitz continuous function. Then which of the following false

1. y is strictly increasing
2. $y(x) = 0$ iff $x \in \{0,1\}$
3. y is bounded
4. $\frac{dy}{dx}$ is unbounded

94. For the differential equation $y'' + q(x)y = 0$ where $q(x)$ is continuous and $q(x) < 0$ for all x. Which of the following is true for non-trivial solution $y(x)$

1. $y(x)$ have atleast one zero on $\mathbb{R}$
2. If $y(x)$ zero in $\mathbb{R}$ then $y'(x)$ never zero
3. $y(x)$ can have atmost one zero on $\mathbb{R}$
4. If $y'(x)$ has zero in $\mathbb{R}$ then $y(x)$ never zero

95. Solution of the PDE

$(x^2 + 2y^2)p - xyq = xz$ is/are

1. $\phi(yz, yx^2 + y^4) = 0$
2. $\phi(yz, y^2x^2 + y^4) = 0$
3. $\phi(yz, yx^2 + y^2) = 0$
4. out of the three one is correct

96. Integral surface of the linear partial differential equation

$x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$

which contains the straight line $x + y = 0$, $z = 1$ is/are

1. $x^2 + y^2 + 2xyz - 2z + 2 = 0$
2. $x^2 + y^2 - 2z = (2xyz + 2)$
3. $x^2 + y^2 - 2xyz - 2z + 2 = 0$
4. None

97. For the PDE $x\frac{\partial^2 u}{\partial x^2} + y\frac{\partial^2 u}{\partial y^2} = 0$ which of the following is/are not true :

1. elliptic for $x < 0,\ y > 0$
2. hyperbolic for $x > 0,\ y > 0$
3. elliptic for $x > 0,\ y < 0$
4. hyperbolic for $x > 0,\ y < 0$

98. For the curve passing through $(1,0)$ and $(2,1)$ which minimizes $\int_1^2 \frac{\sqrt{1+y'^2}}{x}dx$ which of the following is true :

1. $x^2+(y+2)^2=5$
2. $x^2+(y-2)^2=5$
3. $x^2+(y+2)=5$
4. a circle

99. For the integral equation $y(x)=\frac{5x}{6}+\frac{1}{2}\int_0^1 xt\,y(t)dt$ which of the following is/are true :

1. $R(x,t,\lambda)=\frac{6}{5}xt$
2. $R(x,t,\lambda)=\frac{5}{6}xt$
3. $y(x)=x$
4. $y(x)=x^2$

100. Let $y(x)$ be a piecewise continuously differentiable function on $[0,2]$. Then the functional $J(y)=\int_0^2 (y'-1)^2(y'+1)^2\,dx$ attains minimum if $y=y(x)$ is

1. $y(x)=x,\ 0\le x\le 2$
2. $\begin{cases} 4x & 0\le x\le 1 \\ -x+5 & 1\le x\le 2 \end{cases}$
3. $y=\begin{cases} -x & , \quad 0\le x\le 1 \\ x-2 & , \quad 1\le x\le 2 \end{cases}$
4. $\begin{cases} x & 0\le x\le 1 \\ -x+2 & 1\le x\le 2 \end{cases}$

101. Let $y(t)$ satisfy the differential equation $y'=\lambda y,\ y(0)=1$. Then the backward Euler method, for $n\ge 1$ and $h>0$.

$\frac{y_n-y_{n-1}}{h}=\lambda y_n;\ y_0=1$ yields

1. a first order approximation to $e^{\lambda nh}$
2. a polynomial approximation to $e^{\lambda nh}$
3. a rational function approximation to $e^{\lambda nh}$
4. a Chebyshev polynomial approximation to $e^{\lambda nh}$

102. Consider a particle moving with co-ordinates $(x(t),\ y(t))$ on a smooth curve $\phi(x,y)=0$. If the particle moves from $(x(0),y(0))$ to $(x(\tau),y(\tau))$ for $\tau>0$ such that its kinetic energy is minimized then

1. $\frac{x'}{\phi_x}=\frac{y'}{\phi_y}$
2. $x'^2(0)+y'^2(0)=x'^2(\tau)+y'^2(\tau)$
3. $x'\phi_x+y\phi_y=0$
4. $x'^2(0)=x'^2(\tau)$

Unit - IV

103. Suppose $\overline{Y}$ is the sample mean of the study variables corresponding to a sample of size *n* using simple random sampling with replacement scheme and $\overline{Y}_{st}$ is the sample mean of the study variables corresponding to a sample of size *n* using stratified random sampling with replacement scheme under proportional allocation. Which of the following is/are sufficient condition/conditions for $Var(\overline{Y})=Var(\overline{Y}_{st})$?

1. All the stratum sizes are equal
2. All the stratum totals are equal
3. All the stratum means are equal
4. All the stratum variances are equal

104. We are given some balanced incomplete block designs (BIBDs) with parameters (v, b, r, k, λ) such that $\lambda = 1$ and $k = 1$ (are fixed). With which of the following values of v can one construct such a BIBD ?
1. $v = 15$
2. $v = 23$
3. $v = 25$
4. $v = 28$

105. A data set gave a 95% confidence interval (2.5, 3.6), for the mean μ of a normal population with known variance. Let $\mu_0 < 2.5$ be a fixed number. If we use the same data to test $H_0 : \mu = \mu_0 \quad H_1 : \mu \neq \mu_0$
1. H_0 would be necessarily rejected at $\alpha = .1$
2. H_0 would be necessarily rejected at $\alpha = .025$
3. For $\alpha = .1$, the information is not enough to draw a conclusion
4. For $\alpha = .025$, the information is not enough to draw a conclusion

106. Suppose T follows exponential distribution with unit mean. Which of the following statement(s) are correct ?
1. The hazard function of T is a constant function.
2. The hazard function of T^2 is a constant function.
3. The hazard function of T^3 is the identity function.
4. The hazard function of $\sqrt{2T}$ is the identity function.

107. Consider the linear programming problem (LPP) maximize $z = 3x + 5y$

Subject to $x + 5y \leq 10$

$2x + 2y \leq 5$

$x \geq 0, y \geq 0.$

Then
1. The LPP does not admit any feasible solutions.
2. There exists a unique optimal solution to the LPP.
3. There exists a unique optimal solution to the dual problem.
4. The dual problem has an unbounded solution.

108. A fair die is thrown two times independently. Let X, Y be the outcomes of these two throws and $Z = X + Y$. Let U be the remainder obtained when Z is divided by 6. Then which of the following statement(s) is/are true ?
1. X and Z are independent
2. X and U are independent
3. Z and U are independent
4. Y and Z are not independent

109. A and B plays a game of tossing a fair coin. A starts the game by tossing the coin once and B then tosses the coin twice, followed by A tossing the coin once and B tossing the coin twice and this continues until a head turns up. Whoever gets the first head wins the game. Then,
1. P (B Wins) > P (A Wins)
2. P (B Wins) = 2P (A Wins)
3. P (A Wins) > P (B Wins)
4. P (A Wins) =1– P (B Wins)

110. Consider the Markov Chain with state space $S = \{1, 2, ..., n\}$ where $n > 10$. Suppose that the transition probability matrix $P = \left((p_{ij})\right)$ satisfies

$p_{ij} > 0$ if $|i - j|$ is even

$p_{ij} = 0$ if $|i - j|$ is odd.

Then
1. The Markov chain is irreducible.
2. There exists a state i which is transient.
3. There exists a state i with period $d(i) = 1$.
4. There are infinitely many stationary distributions.

111. Let $\{X_i ; i \geq 1\}$ be a sequence of independent random variables each having a normal distribution with mean 2 and

variance 5. Then which of the following are true

1. $\frac{1}{n}\sum_{1=1}^{n} X_i$ converges in probability to 2.
2. $\frac{1}{n}\sum_{i=1}^{n} X_i^2$ converges in probability to 9.
3. $\left(\frac{1}{n}\sum_{i=1}^{n} X_i\right)^2$ converges in probability to 4.
4. $\sum_{i=1}^{n}\left(\frac{X_i}{n}\right)^2$ converges in probability to 0.

112. Let X be a random variable with a certain non-degenerate distribution. Then identify the correct statements
1. If X has an exponential distribution then median $(X) < E(X)$
2. If X has a uniform distribution on an interval $[a,b]$, then $E(X) <$ median (X)
3. If X has a Binomial distribution then $V(X) < E(X)$
4. If X has a normal distribution, then $E(X) < V(X)$

113. Suppose the probability mass function of a random variable X under the parameter $\theta = \theta_0$ and $\theta = \theta_1 (\neq \theta_0)$ are given by

x	0	1	2	3
$p_{\theta_0}(x)$	0.01	0.04	0.5	0.45
$p_{\theta_1}(x)$	0.02	0.08	0.4	0.5

Define a test ϕ such that

$\phi(x) = 1$ if $x = 0,1$

$= 0$ if $x = 2,3$

For testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$, the test ϕ is
1. a most powerful test at level 0.05
2. a likelihood ratio test at level 0.05
3. an unbiased test
4. test of size 0.05

114. $X_1, X_2, ..., X_n$ are independent and identically distributed as $N(\mu, \sigma^2), -\infty < \mu < \infty, \sigma^2 > 0$. Then
1. $\sum_{1}^{n} \frac{(X_i - \bar{X})^2}{n-1}$ is the Minimum Variance Unbaised Estimate of σ^2
2. $\sqrt{\sum_{1}^{n} \frac{(X_i - \bar{X})^2}{n-1}}$ is the Minimum Variance Unbaised Estimate of σ
3. $\sum_{1}^{n} \frac{(X_i - \bar{X})^2}{n}$ is the Maximum Likelihood Estimate of σ^2
4. $\sqrt{\sum_{1}^{n} \frac{(X_i - \bar{X})^2}{n}}$ is the Maximum Likelihood Estimate of σ

115. Let $X_1, X_2, ..., X_n$ be independent and identically distributed random variables each following uniform $(1-\theta, 1+\theta)$ distribution, $\theta > 0$. Define $X_{(1)} = \min\{X_1, X_2, ..., X_n\}, X_{(n)} =$ $\max\{X_1, X_2, ..., X_n\}$ and $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$.

Which of the following is true ?
1. $\left(X_{(1)}, \bar{X}, X_{(n)}\right)$ is sufficient for θ
2. $\frac{1}{2}\left(X_{(n)} - X_{(1)}\right)$ is unbiased for θ
3. $\frac{3}{n}\sum_{i=1}^{n}(X_i - 1)^2$ is unbiased for θ^2
4. $\frac{3}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is unbiased for θ^2

116. Suppose $X_1, X_2, ..., X_m$ are independent and identically distributed with common continuous distribution function $F(x)$ and $Y_1, Y_2, ..., Y_n$ are independent and identically distributed with common continuous distribution function $F(x-\theta)$. Also suppose X_i and Y_j are independent for all i, j. Consider the problem of testing $H_0 : \theta = 0$ against $H_1 : \theta > 0$.

Let $R_\alpha = \text{Rank}(X_\alpha)$, $\alpha = 1, 2, ..., m$ and

$R_{m+\beta} = \text{Rank}(Y_\beta)$, $\beta = 1,2,....,n$ among $X_1, X_2,....., X_m, Y_1, Y_2,..., Y_n$.

Define $U = \sum_{\alpha=1}^{m}\sum_{\beta=1}^{n} \psi\left(X_\alpha, Y_\beta\right)$, where

$\psi(a,b) = 1$ if $a < b$
$= 0$ if $a \geq b$.

Which of the following are true ?

1. $P[R_1 = n+m, R_2 = n+m-1, R_3 = n+ m-2,...., R_{m+n} = 1] = \frac{1}{(m+n)!}$ under H_0.
2. U and $\sum_{\alpha=1}^{m} R_\alpha$ are linearly related.
3. $E(U) = \frac{mn}{2}$ under H_0.
4. Right tailed test based on U is appropriate for testing H_0 against H_1.

117. θ is the probability of obtaining a head in the toss of a coin. The coin is tossed three times and we record
$Y = 1$ if all the three tosses result in heads
$Y = 2$ if all the three tosses result in tails
$Y = 3$ otherwise
If the prior density of θ is Beta (α, β), and $\hat{\theta}_i$ is the posterior mean of θ given $Y = i$, for $i = 1,2,$ then

1. $\hat{\theta}_1 > \hat{\theta}_2$
2. $\hat{\theta}_1 < \hat{\theta}_2$
3. The posterior density of θ given $Y = 3$ is a Beta density
4. The posterior density of θ given $Y = 3$ is not a Beta density

118. Suppose $X_1, X_2,...., X_k$ are independent and identically distributed standard normal random variables, and $\underline{X} = (X_1, X_2,...., X_k)^T$. If A is an idempotent $k \times k$ matrix, then which of the following statements are true ?

1. $\underline{X}^T A \underline{X}$ and $\underline{X}^T (I-A)\underline{X}$ are independent.
2. $\underline{X}^T A \underline{X}$ and $\underline{X}^T (I-A)\underline{X}$ are identically distributed if k is even and trace $(A) = \frac{k}{2}$.
3. $\frac{1}{2}\underline{X}^T A \underline{X}$ follows a gamma distribution if $A \neq 0$.
4. $\underline{X}^T (I-A)\underline{X}$ follows a chi-squared distribution if $A \neq I$.

119. For a data set $(x_1, y_1), (x_2, y_2),...., (x_n, y_n)$ the following two models were fitted using least square method.
Model 1: $y_i = \beta_0 + \beta_1 x_i$ $\quad i = 1,2,...,n$
Model 2: $y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2$ $\quad i = 1,2,...,n$
Let $\hat{\beta}_0, \hat{\beta}_1$ be least square estimates of β_0, β_1 from model 1 and $\beta_0^*, \beta_1^*, \beta_2^*$ be the least square estimates from model 2.

Let $A = \sum_{1}^{n}\left(Y_i - (\hat{\beta}_0 + \hat{\beta}_1 x_i)\right)^2$

$B = \sum_{1}^{n}\left(Y_i - (\beta_0^* + \beta_1^* x_i + \beta_2^* x_i^2)\right)^2$

Then

1. $A \geq B$
2. $A \leq B$
3. It can happen that $A = 0$ but $B > 0$
4. It can happen that $B = 0$ but $A > 0$

120. Let $\phi(x, y; \rho)$ be the density of bivariate normal distribution with mean vector $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ and Variance-Covariance matrix $\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$.

Consider a random vector $\begin{pmatrix} X \\ Y \end{pmatrix}$ having density $\frac{1}{2}\left(\phi\left(x, y; \frac{1}{2}\right) + \phi\left(x, y; -\frac{1}{2}\right)\right)$.

Then

1. Marginal distribution of both X and Y is standard normal.
2. Covariance $(X, Y) = 0$
3. X and Y are independent
4. (X, Y) has a bivariate normal distribution.

Answer Key

Part - A		Part - B				Part - C			
1.	1	21.	4	51.	3	61.	3,4	91.	2
2.	4	22.	2	52.	3	62.	1	92.	2,3
3.	3	23.	2	53.	2	63.	1	93.	1,2,4
4.	4	24.	4	54.	4	64.	1,2,3,4	94.	2,3,4
5.	4	25.	1	55.	1	65.	4	95.	2,4
6.	3	26.	4	56.	2	66.	3	96.	1
7.	1	27.	3	57.	1	67.	1,2,4	97.	1,2,3
8.	3	28.	4	58.	1	68.	1,3	98.	2,4
9.	3	29.	4	59.	4	69.	1,4	99.	1,3
10.	3	30.	3	60.	2	70.	2,4	100.	1,3,4
11.	4	31.	3			71.	1,2	101.	1,3
12.	4	32.	4			72.	1,4	102.	1,3
13.	3	33.	4			73.	1,2,3,4	103.	3
14.	4	34.	4			74.	3,4	104.	*
15.	1	35.	2			75.	1,4	105.	1,4
16.	1	36.	3			76.	1,2,3	106.	1,4
17.	4	37.	2			77.	1,3,4	107.	2,3
18.	3	38.	4			78.	1,4	108.	2,4
19.	1	39.	3			79.	1,3	109.	3,4
20.	2	40.	2			80.	1,2,4	110.	3,4
		41.	3			81.	1,2,3	111.	1,2,3,4
		42.	1			82.	1,2	112.	1,3
		43.	4			83.	1,4	113.	1,2,3,4
		44.	2			84.	1,3,4	114.	1,3,4
		45.	2			85.	2,3,4	115.	1,3
		46.	3			86.	1,2,4	116.	1,2,3,4
		47.	3			87.	3	117.	1,3
		48.	3			88.	1,2,3,4	118.	1,2,3,4
		49.	1			89.	3	119.	1,4
		50.	1			90.	1	120.	1,2