## Entrance Examination for Admission to the P.G. Courses in the Teaching Departments, 2022

CSS
DATA SCIENCE

## General Instructions

1. The Question Paper is having two Parts - Part 'A' Objective type (60\%) \& Part ' B ' Descriptive type (40\%).
2. Objective type questions which carry 1 mark each are to be ( $\checkmark$ ) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part ' $B$ '.
4. Negative marking : 0.25 marks will be deducted for each wrong answer in Part 'A'.
Time: 2 Hours
Max. Marks : 100
To be filled in by the Candidate

| Register <br> Number | in Figures |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | in words |  |  |  |  |  |  |  |  |



PART - A
(Objective Type)
Choose appropriate answer from the options in the questions. One mark each.
( $60 \times 1=60$ marks)

1. If $f(x)=x^{2}+4$ then range of $f(x)$ is given by?
a) $[0, \infty)$
b) $(-\infty, \infty) \backslash\{0\}$
c) $(4, \infty)$
d) $(0, \infty)$

2. What is the decimal equivalent of the binary number 10111 ?
a) 21
b) 42
c) 23
d) 39
3. If $f(x)=x-2$ and $g(x)=\sqrt{\left(x^{2}+1\right)}$, then $(g \circ f)(x)=$
a) $\sqrt{\left(x^{2}\right)-4 x+5}$
b) $x^{2}-4 x+5$
c) $x^{2}-1$
d) $\sqrt{\left(x^{2}+1\right)-2}$
4. The greatest integer function $f(x)=[x]$ is
a) One one and onto
b) One-one
c) One one into
d) Many-one
5. The maximum number of equivalence relations on the set $A=\{1,2,3\}$ are
a) 2
b) 5
c) 3
d) 1
6. If $S_{1}$ is the sum of an artithmetic progression of ' $n$ ' odd number of terms and $S_{2}$ is the sum of the terms of the series in odd places, then $\frac{S_{1}}{S_{2}}$
a) $\frac{n}{n+1}$
b) $\frac{n+1}{2 n}$
c) $\frac{n-1}{n}$
d) $\frac{2 n}{n+1}$
7. If $n(A)=20$ and $n(B)=30$ and $n(A \cup B)=40$ then $n(A \cap B)$ is?
a) 30
b) 10
C) 20
d) 40
8. What is the complexity of the bubble sort algorithm?
a) $O(n \log n)$
b) $O(\log n)$
c) $O(n)$
d) $O\left(n^{2}\right)$
9. The range of the function $f(x)=1+3 \cos 2 x$ is
a) $[2,4]$
b) $[-2,3]$
c) $[2,3]$
d) $[-2,4]$
10. The period of the function $f(x)=\sin x$ is
a) $\pi$
b) $2 \pi$
c) $3 \pi$
d) $\pi / 2$
11. $\int \frac{x+\sin x}{1+\cos x} d x$ is equal to
a) $x-\tan x+c$
b) $\quad \log |1+\cos x|+c$
c) $\quad \log |x+\sin x|+c$
d) $x \cdot \tan \frac{x}{2}+c$
12. If $f: \mathbb{R} \rightarrow \mathbb{R}$ satisfies $f(x+y)=f(x)+f(y)$ for all $x, y \in \mathbb{R}$ and $f(1)=7$, then $\sum_{r=1}^{n} f(r)$ is
a) $\frac{7 n}{2}$
b) $\frac{7(n+1)}{2}$
c) $7 n(n+1)$
d) $\frac{7 n(n+1)}{2}$
13. If the roots of the equation $x^{3}-12 x^{2}+39 x-28=0$ are in A.P, then their common difference will be
a) $\pm 2$
b) $\pm 4$
c) $\pm 1$
d) $\pm 3$
14. If the arithmetic's mean of $a$ and $b$ is $\frac{a^{n}+b^{n}}{a^{n-1}+b^{n-1}}$, then the value of $n$ is
a) 2
b) 0
c) 1
d) -1
15. In a polygon the number of diagonals is 54 . The number of sides of the polygon is
a) 27
b) 14
c) 12
d) 10
16. In how many different ways can five boys and five girls form a circle such that the boys and girls set alternate
a) 10 !
b) 2880
c) 4 !
d) 5 !
17. The number of values of $k$ for which the system of equation $(k+1) x+8 y=4 k$, $k x+(k+3) y=3 k-1$ has infinitely many solutions, is
a) 3
b) 2
c) 4
d) 1
18. If $f(x)=\left|\begin{array}{ccc}0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0\end{array}\right|$ then
a) $f(1)=0$
b) $f(0)=0$
c) $f(b)=0$
d) $f(a)=0$
19. Given that $A=\left[\begin{array}{cc}-5 & -3 \\ 2 & 0\end{array}\right]$ and $I=\left[\begin{array}{ll}1 & 0 \\ 0 & 1\end{array}\right]$, the value of $A^{3}$ is
a) $15 A+121$
b) $17 A+15 I$
c) $17 A+211$
d) $19 A+301$
20. If $A$ is a square matrix, then which of the following is the not symmertic?
a) $A A^{T}$
b) $A^{T} A$
c) $A-A^{T}$
d) $A+A^{T}$
21. The value of the determinant $\left|\begin{array}{ccc}x+1 & x+2 & x+4 \\ x+3 & x+5 & x+8 \\ x+7 & x+10 & x+14\end{array}\right|$ is
a) -2
b) $x^{2}$
c) 2
d) 0
22. If $a^{-1}+b^{-1}+c^{-1}=0$ such that $\left|\begin{array}{ccc}1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c\end{array}\right|=\lambda$ then the value of $\lambda$ is
a) -1
b) $-a b c$
c) $a b c$
d) $a+b+c$
23. A function $f$ from the set of natural numbers to integers defined by $f(n)=\left\{\begin{array}{l}\frac{n-1}{2}, \text { when } n \text { is odd } \\ -\frac{n}{2} \text { when } n \text { is even }\end{array}\right.$
a) neither one-one nor onto
b) one-one but not onto
c) one-one and not both
d) onto but not one-one
24. Which of the following is logically equivalent of $\sim(\sim p \Rightarrow q)$ ?
a) $\sim p \wedge \sim q$
b) $p \wedge q$
c) $\sim p \wedge q$
d) $p \wedge \sim q$
25. Let $R=\{(1,3),(4,2),(2,4),(2,3),(3,1)\}$ be a relation on the set $A=\{1,2,3,4\}$. The relation $R$ is
a) a function
b) not symmetric
c) transitive
d) reflexive
26. The graph of the function $y=f(x)$ is symmetrical about the line $x=2$, then
a) $f(2+x)=f(2-x)$
b) $\quad f(x)=f(-x)$
c) $\quad f(x+2)=f(x-2)$
d) $f(x)=-f(-x)$
27. The statement $p \rightarrow(q \rightarrow p)$ is equivalent to
a) $p \rightarrow(p \wedge q)$
b) $\quad p \rightarrow(p \leftrightarrow q)$
c) $p \rightarrow(p \rightarrow q)$
d) $p \rightarrow(p \vee q)$
28. If $A, B$ and $C$ are three sets such that $A \cap B=A \cap C$ and $A \cup B=A \cup C$, then
a) $B=C$
b) $A=C$
c) $A \cap B=\phi$
d) $A=B$
29. Consider the following statements $P$ : Suman is brilliant; $Q$ : Suman is rich $R$ : Suman is honest. The negation of the statement "Suman is brilliant and dishonest if and only is Suman is rich" can be expressed as
a) $\sim Q \leftrightarrow \sim P \wedge R$
b) $\quad \sim(Q \leftrightarrow(P \wedge \sim R))$
c) $\quad \sim(P \wedge \sim R) \leftrightarrow Q$
d) $\sim P \wedge(Q \leftrightarrow \sim R)$
30. If the system of linear equations $x+2 a y+a z=0 x+3 b y+b z=0 x+4 c y+c z=0$ has a non-zero solution, then $a, b, c$
a) are in G.P.
b) are in A.P.
c) are in H.P.
d) satisfy $a+2 b+3 c=0$
31. If $A$ and $B$ are square matrices of size $n \times n$ such that $A^{2}-B^{2}=(A-B)(A+B)$, then which of the following will be always true?
a) $A B=B A$
b) either of $A$ or $B$ is a identity matrix
c) $A=B$
d) either of $A$ or $B$ is a zero matrix
32. Let $A=\left[\begin{array}{ccc}5 & 5 \alpha & \alpha \\ 0 & \alpha & 5 \alpha \\ 0 & 0 & 5\end{array}\right]$. If $\left|A^{2}\right|=25$ then $|\alpha|$ equals
a) $\frac{1}{5}$
b) 5
C) 1
d) $5^{2}$
33. Let $P$ and $Q$ be $3 \times 3$ matrices with $P \neq Q$. If $P^{3}=Q^{3}$ and $P^{2} Q=Q^{2} P$, then determinant of $\left(P^{2}+Q^{2}\right)$ is equal to
a) -1
b) 1
c) 0
d) -2
34. If $A^{2}-A+I=0$, then the inverse of $A$ is
a) $A-I$
b) $A$
c) I-A
d) $A+I$
35. Total number of four digit odd numbers that can be formed using $0,1,2,3,5,7$ (using repetition allowed) are
a) 370
b) 216
c) 400
d) 720
36. The sum of integers from 1 to 100 than are divisible by 2 or 5 is
a) 3250
b) 3050
c) 3600
d) 3000
37. There are two urns. Urn $A$ has 3 distinct red balls and urn $B$ has 9 distinct blue balls. From each urn two balls are taken out at random and then transferred to the other. The number of ways in which this can be done is
a) 108
b) 3
c) 30
d) 60
38. At an election, a voter may vote for any number of candidates, not greater than the number to be elected. There are 10 candidates and 4 are of be elected. If a voter votes for at least one candidate, then the number of ways in which he can vote is
a) 5040
b) 385
c) 6210
d) 1110
39. The number of ways of distributing 8 identical balls in 3 distinct boxes so that none of the boxes is empty is
a) $3^{8}$
b) ${ }^{8} \mathrm{C}_{3}$
c) 21
d) 5
40. The real number $x$ when added to its inverse gives the minimum value of the sum at $x$-equal to
a) $\quad-2$
b) 1
c) -1
d) 2
41. If the function $f(x)=2 x^{3}-9 a x^{2}+12 a^{2} x+1$. Where $a>0$, attains its maximum and minimum at $p$ and $q$ respectively such that $p^{2}=q$, then a equals
a) $\frac{1}{2}$
b) 2
c) 3
d) 1
42. If $f$ is a real-valued differentiable function satisfying $|f(x)-f(y)| \leq(x-y)^{2}$, $x, y \in R$ and $f(0)=0$, then $f(1)$ equals
a) 2
b) 0
c) - 1
d) 1
43. The function $f(x)=\frac{x}{2}+\frac{2}{x}$ has a local minimum at
a) $x=1$
b) $x=-2$
c) $x=2$
d) $x=0$
44. The equation of the tangent to the curve $y=x+\frac{4}{x^{2}}$, that is parallel to the $x$-axis, is
a) $y=0$
b) $y=3$
c) $x=2$
d) $x=0$
45. Let $f: R \rightarrow R$ be defined by $f(x)=\left\{\begin{array}{l}k-2 x, \text { if } x \leq-1 \\ 2 x+3 \text {, if } x>-1\end{array}\right.$. If $f$ has a local minimum at $x=-1$, then a possible value of $k$ is
a) 1
b) -1
c) $-\frac{1}{2}$
d) 0
46. $\int_{0}^{10 \pi}|\sin x| d x$ is
a) 10
b) 20
c) 8
d) 18
47. $\int_{0}^{\sqrt{2}}\left[x^{2}\right] d x$ is
a) $\sqrt{2}-2$
b) $2+\sqrt{2}$
c) $\sqrt{2}-1$
d) $2-\sqrt{2}$
48. The value of the integral $I=\int_{0}^{1} x(1-x)^{n} d x$ is
a) $\frac{1}{n+1}$
b) $\frac{1}{n+2}$
c) $\frac{1}{n+1}+\frac{1}{n+2}$
d) $\frac{1}{n+1}-\frac{1}{n+2}$
49. If $\int \frac{\sin x}{\sin (x-\alpha)} d x=A x+B \log \sin (x-\alpha)+C$, then value of $(A, B)$ is
a) $(\sin \alpha, \cos \alpha)$
b) $(\cos \alpha, \sin \alpha)$
c) $(-\sin \alpha, \cos \alpha)$
d) $(-\cos \alpha, \sin \alpha)$
50. A problem in mathematics is given to three students $A, B, C$ and their respective probability of solving the problem is $\frac{1}{2}-\frac{1}{3}$ and $\frac{1}{4}$. Probability that the problem is solved is
a) $\frac{2}{3}$
b) $\frac{1}{2}$
c) $\frac{1}{3}$
d) $\frac{3}{4}$
51. $A$ and $B$ are events such that $P(A \cup B)=\frac{3}{4}, P(A \cap B)=\frac{1}{4}, P(\bar{A})=\frac{2}{3}$ then $P(\bar{A} \cap B)$ is
a) $5 / 12$
b) $4 / 5$
c) $5 / 4$
d) $3 / 8$
52. The probability that $A$ speaks truth is $\frac{4}{5}$, while this probability for $B$ is $\frac{3}{4}$. The probability that they contradict each other when asked to speak on a fact is
a) $\frac{3}{20}$
b) $\frac{1}{5}$
c) $\frac{4}{5}$
d) $\frac{7}{20}$
53. It is given that the events $A$ and $B$ are such that $P(A)=\frac{1}{4}, P(A \mid B)=\frac{1}{2}$ and $P(B \mid A)=\frac{2}{3}$. Then $P(B)$ is
a) $2 / 3$
b) $1 / 2$
c) $1 / 6$
d) $1 / 3$
54. A die thrown. Let $A$ be the event that the number obtained is greater than 3 . Let $B$ be the event that the number obtained is less than 5 then $P(A \cup B)$ is
a) $3 / 5$
b) 0
c) 1
d) $2 / 5$
55. If $C$ and $D$ are two events that $C \subset D$ and $P(D) \neq 0$. Then the correct statement is
a) $\quad P(C / D)=\frac{P(D)}{P(C)}$
b) $\quad P(C / D)=P(C)$
c) $P(C / D)<P(C)$
d) $\quad P(C / D) \geq P(C)$
56. If GCD of two number is 8 and LCM is 144 , then what is the second number if first number is 72 ?
a) 16
b) 24
c) 2
d) 3
57. LCM of two numbers is 130 . But their GCD is 23 . The numbers are in a ratio 1:6. Which is the largest number amongst the two?
a) 69
b) 138
c) 46
d) 23
58. What is the output of this statement "printf("\%d". $(a++)$ )"?
a) The value of $(a+1)$
b) Error message
c) The current value of a
d) Garbage
59. How many characters can a string hold when declared as follows? char name [20]:
a) 19
b) 17
c) 18
d) 20
60. What will the result of num variables after execution of the following statements? int num = 58;
num \% = 11;
a) 8
b) 5
c) 3
d) 11

## ANSWER SHEET - PART - A

| 1 | A | B | C | D | E | 21 | A | B | C | D | E |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | A | B | C | D | E | 22 | A | B | C | D | E |
| 3 | A | B | C | D | E | 23 | A | B | C | D | E |
| 4 | A | B | C | D | E | 24 | A | B | C | D | E |
| 5 | A | B | C | D | E | 25 | A | B | C | D | E |
| 6 | A | B | C | D | E | 26 | A | B | C | D | E |
| 7 | A | B | C | D | E | 27 | A | B | C | D | E |
| 8 | A | B | C | D | E | 28 | A | B | C | D | E |
| 9 | A | B | C | D | E | 29 | A | B | C | D | E |
| 10 | A | B | C | D | E | 30 | A | B | C | D | E |
| 11 | A | B | C | D | E | 31 | A | B | C | D | E |
| 12 | A | B | C | D | E | 32 | A | B | C | D | E |
| 13 | A | B | C | D | E | 33 | A | B | C | D | E |
| 14 | A | B | C | D | E | 34 | A | B | C | D | E |
| 15 | A | B | C | D | E | 35 | A | B | C | D | E |
| 16 | A | B | C | D | E | 36 | A | B | C | D | E |
| 17 | A | B | C | D | E | 37 | A | B | C | D | E |
| 18 | A | B | C | D | E | 38 | A | B | C | D | E |
| 19 | A | B | C | D | E | 39 | A | B | C | D | E |
| 20 | A | B | C | D | E | 40 | A | B | C | D | E |

## DATA SCIENCE

PART - B
(Descriptive Type)

Answer any eight questions.
( $8 \times 5=40$ Marks)

1. A function is defined as $y=2 x^{2}+3$, where $x=(-1,0,1,2,3)$.
(a) Calculate the output values for this function.
(b) Draw an arrow diagram for the function.
(c) Sketch the graph of $y=2 x^{2}+3$
2. Show that the Signum Function $f: R \rightarrow R$, given by
$f(x)=\left\{\begin{array}{l}1, \text { if } x>0 \\ 0, \text { if } x=0 \\ 1, \text { if } x<0\end{array}\right.$
is neither one-one nor onto.
3. An arithmetic progression has 3 as its first term. Also, the sum of the first 8 terms is twice the sum of the first 5 terms. Find the common difference.
4. Find the value of $m$ if,

$$
(10)^{9}+2(11)^{1}(10)^{8}+3(11)^{2}(10)^{7}+4(11)^{3}(10)^{6}+\ldots .+10(11)^{9}=m(10)^{9}
$$

5. Is there a number $b$ such that $\lim _{x \rightarrow-2} \frac{b x^{2}+15 x+15+b}{x^{2}+x-2}$ exists? If so, find the value of $b$ and the value of the limit.
6. Given $y=\frac{\sqrt{1+2 x} \sqrt[4]{1+4 x} \sqrt[6]{1+6 x} \ldots \sqrt[100]{1+100 x}}{\sqrt[3]{1+3 x} \sqrt[5]{1+5 x} \ldots \sqrt[7]{1+7 x} \ldots \sqrt[101]{1+101 x}}$ find $y^{\prime}$ at $x=0$.
7. Factorize $x^{7}-1$ into irreducible polynomial on $Z_{2}$.
8. Evaluate $\int \frac{x+1}{x^{2}+4 x+8} d x$.
9. If $p$ and $q$ are true and $r$ and $s$ are false statements, find the truth value of the following statements.
(a) $(p \wedge q) \vee r$
(b) $p \wedge(r \rightarrow s)$
(c) $(p \vee s) \leftrightarrow(q \wedge r)$
(d) $\sim(p \wedge \sim r) \vee(\sim q \vee s)$
10. Three machine $E_{1}, E_{2}, E_{3}$ in a certain factory produce $50 \%, 25 \%$ and $25 \%$, respectively, of the total daily output of electric tubes. It is known that $4 \%$ of the tubes produced one each of machines E1 and E2 are defective, and that 5\% of those produced on E3 are defective. If one tube is picked up at random from a day's production, calculate the probability that it is defective.
11. A car manufacturing factory has two plants, $X$ and $Y$. Plant $X$ manufactures $70 \%$ of cars and plant $Y$ manufactures $30 \%, 80 \%$ of the cars at plant $X$ and $90 \%$ of the cars at plant $Y$ are rated of standard quality. A car is chosen at random and is found to be of standard quality. What is the probability that it has come from plant X ?
12. Write down a program code to find the prime numbers from 2 to 100.
