Q.1) Attempt the following

[40 marks]

1) _____ variable is the variable which can assume finite or countably infinite number of values.

   a) continuous   b) discrete

   c) qualitative   d) Quantitative

2) Out of the following values, which one is not possible in probability?

   a) $P(x) = -0.5$ b) $P(x) = 0.5$

   c) $P(x) = 1$ d) $\sum xP(x) = 3$

3) The cumulative distribution function ranges from _____.

   a) 0 to ∞ b) 0 to 1

   c) -1 to 1   d) $-\infty$ to $+\infty$

4) For Probability mass function , following condition /conditions satisfied

   a) $P(x_i) \geq 0$ b) $\sum P(x_i) = 1$

   c) $P(x_i) \geq 0$ and $\sum P(x_i) = 1$ d) $P(x_i) \geq 0$ or $\sum P(x_i) = 1$

5) For discrete random variable, the expected value $E(x)$ = _____.

   a) $\sum x$ b) $\sum x\, P(x)$

   c) $\sum P(x) + x$ d) $\sum x\, P^2(x)$

6) Following distributions are for discrete random variable.

   a) Binomial distribution and Normal distribution

   b) Poisson distribution and Normal distribution

   c) Binomial distribution and Poisson distribution

   d) None of these

7) The parameters of binomial distribution are _____.

   a) n and p   b) p and q

   c) np and nq   d) np and npq

8) The parameters of the normal distribution are _____.

   a) μ and n   b) μ and σ

   c) np and nq   d) n and p

9) In a standard normal distribution, the value of mean is _____.

   a) Equal to zero   b) Less than zero

   c) Greater than zero   d) Exactly one

10) Chi-square distribution is _____.

   a) Positively skewed   b) Negatively skewed

   c) Highly positively skewed   d) Highly negatively skewed

11) In t distribution, the curve is _____.

   a) More peaked than normal curve   b) Less peaked than normal curve

   c) Same as normal curve   d) Difficult to compare with normal curve

12) In case of F-distribution, which of the following statement is true?

   a) It is the ratio of two independent sample variance

   b) It has only one parameter

   c) It is the ratio of two independent population variance

   d) It lies completely in second quadrant

13) Any hypothesis which is tested for the purpose of rejection under the assumption that it is true is called_____
   a) Null hypothesis
   b) Alternative hypothesis
   c) Statistical hypothesis
   d) Composite hypothesis

14) Testing $H_0: \mu = 25$ against $H_1: \mu \neq 25$ leads to____
   a) Two-tailed test
   b) Left-tailed test
   c) Right-tailed test
   d) Difficult to tell

15) The probability associated with committing type-I error is____
   a) β
   b) α
   c) $1 - \beta$
   d) $1 - \alpha$

16) When testing for serial randomness, we can use_____.
   a) Mann-Whitney U test
   b) sign test
   c) Run test
   d) Kruskal wallis test

17) Mann-Whitney U test is also called_____.
   a) Wilcoxon Rank Sum test
   b) Wilcoxon Signed Rank test
   c) Sign test
   d) Run test

18) Wilcoxon rank sum test compares____
   a) Two population
   b) Three or more Population
   c) A sample mean to population mean
   d) Difficult to tell

19) _____ is the process for which there are more than one possible outcomes with uncertainty.
   a) Probability
   b) Events
   c) Sample space
   d) Random Experiment

20) Events A and B are Exhaustive events if_____
   a) $A \cup B = \emptyset$
   b) $A \cup B = S$
   c) $A \cap B = \emptyset$
   d) $A \cap B = S$

Q.2) Attempt the following (Solve any two)   [10 Marks]

i) Define the following

   a) Axiomatic definition of Probability

   b) Classical definition of Probability

   c) Independent Event

ii) 5 Indians and 3 Americans stands in a row for photograph randomly. Find the probability that

   a) two extreme positions are occupied by Indians

   b) Americans are all together

iii) Define Probability density function for continuous random variable.

   Let X be continuous random variable with probability density function f(x) as,

$$f(x) = \begin{cases} cx^2(1-x), & 0 < x < 1 \\ 0 & , otherwise \end{cases}$$

Find the value of c.

iv) Define Cumulative distribution function for discrete random variable. Also state the properties of Cumulative distribution function.

Q.3) Attempt the following (Solve any two) [10 Marks]

i) If X is normal variate with mean 30 and variance 25. Find
   a) $p(X>42)$
   b) $p(X<28)$
   c) $p(32<X<40)$

ii) Define F distribution. Give all properties of F distribution.

iii) In population IQ scores are normally distributed with mean of 100. One of the School wants to know that whether their students have an IQ greater than population mean. They select a random sample of 15 students and find they have mean IQ of 109 with S.D. of 23. Test the hypothesis at 0.05.

iv) A discrete random variable X has following probability distribution

X	0	1	4	6
P(X)	1/4	3/16	5/16	1/4

Find E(X) and Var(X).

Q.4) Attempt the following (Solve any two) [10 Marks]

i) Differentiate between one-tailed test and two-tailed test.

ii) A professor of computer science in Mumbai observed that students are very brilliant but they lack of proper writing in university examination. He recorded the number of mistakes done by students, then he gave training of proper writing and recorded the number of mistakes done by same students again

Student	Number of errors before treatment	Number of errors after treatment
1	95	75
2	80	50
3	50	45
4	75	40
5	90	20
6	85	65
7	65	40
8	40	25

Using Wilcoxon signed rank test, check whether this difference is significant or not?

iii) Explain Run test with suitable example.

iv) A study was conducted to know the effect of protein diet, Albumin is the most abundant protein in blood, and its concentration in the serum is measured in grams per deciliter (gm/dL). The albumin levels of patients in 3 groups are shown below.

5% protein	10% protein	15% protein
3.1	3.8	4.0
2.6	4.1	5.5
2.9	2.9	5.0
	3.4	4.8
	4.2	

Using Kruskal Wallis test, Check where there exist statistically significant difference in serum albumin levels among patients in 3 different diet?

Q.5) Attempt the following (Solve any one) [05 Marks]

i) In the experiment of pea breeding, following frequencies of seeds were obtained.

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

Theory predicts that the frequency should be in the proportion 9:3:3:1. Examine the correspondence between theory and experiment.

ii) Explain the procedure of testing of hypothesis.

iii) A and b are two independent events with $P(A) = 0.5$, $P(B) = 0.4$ then find

a) $P(A \cap B)$

b) $P(A' \cap B')$

c) $P(A \cup B)$