PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
MSc(SS) DEGREE EXAMINATION DECEMBER 2023
(Second Semester)
Branch – **SOFTWARE SYSTEMS (five year integrated)**

PROBABILITY AND STATISTICS

Time: Three Hours Maximum: 50 Marks

SECTION – A (5 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks **(5 x 1 = 5)**

1. What is the chance that a leap year selected at random will contain 53 Sundays?
   (i) $\frac{2}{7}$ (ii) $\frac{7}{2}$ (iii) $\frac{1}{7}$ (iv) $\frac{1}{2}$
2. The function _____ is called the probability function of random variable X.
   (i) $F(x)$ (ii) $p(x)$ (iii) $f(x)$ (iv) $f'(x)$
3. The hypothesis is true but our best accepts is _____.
   (i) type I error (ii) correct decision (iii) type II error (iv) none of these
4. The variance of the χ^2 distribution is _____ the degrees of freedom
   (i) equal (ii) once (iii) twice (iv) thrice
5. _____ is known as the regression coefficient of X and Y
   (i) $\frac{\sigma_x}{\sigma_y}$ (ii) $\frac{\sigma_y}{\sigma_x}$ (iii) $r\left(\frac{\sigma_y}{\sigma_x}\right)$ (iv) $r\left(\frac{\sigma_x}{\sigma_y}\right)$

SECTION – B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks **(5 x 3 = 15)**

6. a) A bin contains 5 defective (that immediately fall when put in use), 10 partially defective (that fail after a couple of hours of use) and 25 acceptable transistors. A transistor is chosen at random from the bin and put into use. If it does not immediately fail, what is the probability it is acceptable?

   (OR)

   b) State and prove that the multiplication theorem on probability.

7. a) Suppose that X is a continuous random variable whose probability density function is given by

$$f(x) = \begin{cases} C(4x - 2x^2), & 0 < x < 2 \\ 0 , & \text{otherwise} \end{cases}$$

   i) What is the value of C?
   ii) Find $P\{X > 1\}$

   (OR)

   b) Suppose X has the following probability mass function

$$p(0) = 0.2, \quad p(1) = 0.5, \quad p(2) = 0.3$$

   Calculate $E[X^2]$.

8. a) In a random sample of 1000 person from town A, 400 are found to be consumers of wheat. In a sample of 800 towns B, 400 are found to be consumers of wheat. Do these data reveal a significant difference between town A and B, so far as the proportion of wheat consumers is concerned?

   (OR)

   b) A sample of 900 items has mean 3.4 and standard deviation 2.61. Can the sample be regarded as drawn from a population with mean 3.25 at 5% level of significance?

9. a) Explain the procedure for testing difference between means of two samples (Independent samples).

   (OR)

   b) From the data given below about treatment of 250 patients suffering from a disease. State whether the new treatment is superior to the conventional treatment.

Treatment	No. of Patients		
	Favourable	Not Favourable	Total
New	140	30	170
Conventional	60	20	80
Total	200	50	250

(Given for degrees of freedom = 1, χ^2 at 5 % = 3.84)

Cont...

10. a) Prove that regression coefficient are independent of change of origin but not scale.

(OR)

b) Find the most likely production corresponding to a rainfall 40' from the following data.

	Rainfall	Production
Average	30'	500kg
Standard Deviation	5'	100kg
Coefficient of Correlation(r)	0.8	

SECTION – C (30 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (5 x 6 = 30)

11. a) State and prove Baye's theorem.

(OR)

b) There are three urns containing 2 white and 3 black balls; 3 white and 2 black balls and 4 white and 1 black balls respectively. There is equal probability of each urn being chosen. One ball is drawn from an urn chosen at random.
   i) What is the probability that a white ball is drawn?
   ii) Find the probability that the white ball drawn is from the second urn.

12. a) The joint density function of X and Y is given by

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

Compute (a) $P\{X > 1, Y < 1\}$; (b) $P\{X < Y\}$; and (c) $P\{X < a\}$.

(OR)

b) If X is a random variable with mean $\mu = 3$ and variance $\sigma^2 = 16$, find
   i) $P(X < 1)$, ii) $P(X > -1)$ iii) $P(2 < X < 7)$

13. a). Two random sample of sizes 400 and 500 have mean 10.9 and 11.5 respectively. Can the sample be regarded as drawn from same population with variance 25?

(OR)

b) There are 1000 students in a college. Out of 20000 in the whole university, in a study 200 were found smokers in the college and 1000 in the whole university is there is significant difference between the proportion of smokers in the college and university.

14. a) The samples are drawn from two normal populations. From the following data test whether the two samples have the same variance at 5% level.

Sample1:	60	65	71	74	76	82	85	87		
Sample2:	61	66	67	85	78	63	85	86	88	91

(OR)

b) Explain clearly the techniques of analysis of variance for a one way classification data.

15. a) Explain the principle of least squares used for estimation for linear regression.

(OR)

b) From the following data obtain two regression equations and calculate the correlation coefficient.

X	1	2	3	4	5	6	7	8	9
Y	9	8	10	12	11	13	14	16	15

Estimate the value of Y which should correspond on an average to X= 6.2

Z-Z-Z END