

B4.1-R4: COMPUTER BASED STATISTICAL & NUMERICAL METHODS

NOTE:

1. Answer question 1 and any FOUR from questions 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.
3. Only Non-Programmable and Non-Storage type Scientific Calculator allowed.

Time: 3 Hours

Total Marks: 100

1.

- a) Prove that $\nabla\Delta = \Delta\nabla = \nabla \cdot \nabla = \delta^2$.
- b) Suppose 3.14 is used as an approximation to π . Find the bounds on the absolute and relative errors.
- c) Solve by Gauss elimination method

$$\begin{aligned} X+2y+z &= 3 \\ 2x+3y+3z &= 10 \\ 3x-5y+2z &= 13 \end{aligned}$$
- d) What is the chance that a leap year selected at random will contain 53 Sundays?
- e) The Karl Pearson's coefficient of skewness of a distribution is 0.32. Its standard deviation is 6.5 and the mean is 29.6. Find the mode.
- f) Given a normal distribution with mean = 50 and standard deviation = 8, find the probability that X assumes a value between 34 and 62.
- g) Define Type I error and Type II error. How one makes a decision of statistical hypothesis using p-value?

(7x4)

2.

- a) Use the series $\log_e [(1+x)/(1-x)] = 2[x + x^3/3 + x^5/5 + \dots]$ to compute the value of $\log_2 (1.2)$ correct to seven decimal places. Find the number of terms retained.
- b) Use Newton-Raphson method to find out the real root of transcendental equation, $\cos x = x^2$, in three significant figures.

(9+9)

3.

- a) Find the form of the function $Y = f(x)$, given that

X	0	1	4	5
Y	4	3	24	39

- b) Solve the system of equations

$$\begin{aligned} 5x - 2y + z &= 4 \\ 7x + y - 5z &= 8 \\ 3x + 7y + 4z &= 10 \end{aligned}$$
 by using LU – decomposition method.

(9+9)

4.

- a) Find the first derivative of $y = f(x)$ at $x = 0.4$ from the following table:

X	0.1	0.2	0.3	0.4
Y	1.10517	1.22140	1.34986	1.49182

- b) The velocities of a car (running on a straight road) at intervals of 2 minutes are given below:

Times in minutes	0	2	4	6	8	10	12
Velocity(km/hr)	0	22	30	27	18	7	0

Find the distance covered by the car.

(9+9)

5.

a) Evaluate $\int_1^2 \frac{1}{x} dx$ by using Trapezoidal rule with 4 strips and determine the error by direct integration.

b) The results of conducting an examination in two papers A and B for 20 candidates were recorded as under:

8 passed in paper A; 7 passed in paper B; 8 failed in both papers A and B

If out of these candidates one is selected at random, find the probability that the candidate:

- i) passed in both papers A and B
- ii) failed only in A;
- iii) failed in A and B

(9+9)

6.

a) From the following data, obtain the two regression equations:

Sales	:	91	97	108	121	67	124	51	73	111	57
Purchases	:	71	75	69	97	70	91	39	61	80	47

Hence find the correlation coefficient between sales and purchases.

b) Let X_1, X_2, \dots, X_n be a random sample from the exponential distribution with p.d.f.

$$f(x; \theta) = \frac{1}{\theta} e^{-x/\theta}, 0 < x < \infty, 0 < \theta < \infty$$

find the maximum likelihood estimator for θ .

(9+9)

7.

a) 240 computers, each with four components (viz., processor, monitor, keyboard and motherboard), which were randomly selected for testing revealed the following distribution:

No. of defective Components	:	4	3	2	1	0
No. of Computers	:	10	55	105	58	12

Is the result consistent with the hypothesis that defectives and non-defectives are equally probable?

b) A computer manufacturing company claims that its brand-A computers outsells its brand-B by 10%. It is found that 40 out of random sample of 200 users prefer brand-A and 18 out of another sample of 100 users prefer brand-B. Test at 5% level of significance whether the 10% difference is a valid claim.

c) For a normal distribution of 100 items the lower quartile Q_1 is 73 and σ is 15. Find

- i) median
- ii) limits for central 50% of distribution
- iii) mean deviation.

(9+3+6)