JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech.-IV Semester (BI)

COURSE CODE (CREDITS): 18B11MA411(3) MAX. MARKS: 35

COURSE NAME: **BIOSTATISTICS**

COURSE INSTRUCTOR: **SST** MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

(c) Use of a scientific calculator is allowed.

Q. No.	Question	CO	Marks
Q1	In a study of saliva cotinine, seven subjects, all of whom had abstained from smoking for a week, were asked to smoke a single cigarette. The cotinine levels at 12 and 24 hours after smoking are provided in the following table: Subject / Cotinine Level (mmol/L) / After 12 hours / After 24 hours 1 — 73 — 24 2 — 58 — 27 3 — 67 — 49 4 — 93 — 59 5 — 33 — 0 6 — 60 — 11 7 — 106 — 33 Calculate Pearson's correlation coefficient between the 12-hour and 24-hour cotinine levels and interpret the result.	1	5
Q2	The probability density function of a random variable X is as follows: $$f_X(x) = \begin{cases} k\sqrt{x}, & 0 < x < 1 \\ 0, & elsewhere \end{cases}$$ Evaluate the following: a) Evaluate k. b) $E(1 - 2X)$, c) Variance of X.	2	1+2+2
Q3	Suppose that 100 high-performance tires made by a certain manufacturer lasted on average 21,819 miles with a standard deviation of 1,295 miles. Test the null hypothesis $\mu = 22,000$ miles against the alternative hypothesis $\mu < 22,000$ miles at the 0.05 level of significance.	3	5
Q4	Use the data in the following table to test at the 0.01 level of significance whether a person's ability in mathematics is independent of his or her interest in statistics.	3	5

Ability in Mathematics

		Low	Average	High
Ability in	Low	63	42	15
Statistics	Average	58	61	31
	High	14	47	29

Q5	a) To find out whether a new serum will arrest leukemia, nine patients, who have all reached an advanced stage of the disease, are selected. Five patients receive the treatment and four do not. The survival times, in years, from the time the experiment commenced are: Treatment 2.1 5.3 1.4 4.6 0.9 No treatment 1.9 0.5 2.8 3.1 Use the Wilcoxon rank-sum test, at the 0.05 level of significance, to determine if the serum is effective. b) Explain a continuous random sequence with a suitable example.	4, 5	4+1
Q6	The following data represent the operating times in hours for three types of tablets before a recharge is required: Tablet A Tablet B Tablet C 4.9 6.1 4.3 4.6 5.2 5.5 5.4 6.2 5.8 5.5 6.4 6.8 5.6 6.5 6.3 5.2 4.8 6.6 Use the Kruskal-Wallis test at the 0.05 level of significance, to test the hypothesis that the operating times for all three tablets are equal.	4	5
Q7	The state transition diagram for a Markov chain $\{X_n, n \geq 0\}$ with states 0,1, and 2 is as follows:	5	1+4

a) Construct a transition probability matrix for this Markov chain.
b) Obtain steady-state probabilities.

Parts of Useful Statistical Tables

Table A.5 (continued) Critical Values of the Chi-Squared Distribution

v	0.30	0.25	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.001
1	1.074	1.323	1.642	2.706	3.841	5.024	5.412	6.635	7.879	10.827
2	2.408	2.773	3.219	4.605	5.991	7.378	7.824	9.210	10.597	13.815
3	3.665	4.108	4.642	6.251	7.815	9.348	9.837	11.345	12.838	16.266
4	4.878	5.385	5.989	7.779	9.488	11.143	11.668	13.277	14.860	18.466
5	6.064	6.626	7.289	9.236	11.070	12.832	13.388	15.086	16.750	20.515

Table A.17 (continued) Critical Values for the Wilcoxon Rank-Sum Test

One-Tailed Test at $\alpha = 0.025$ or Two-Tailed Test at $\alpha = 0.05$

n_1	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																	
2					0	0	0	0	1	1	1	1	1	2	2	2	2
3		0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
4	0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	13
5		2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
6			5	6	8	10	11	13	14	16	17	19	21	22	24	25	27
7				8	10	12	14	16	18	20	22	24	26	28	30	32	34
8					13	15	17	19	22	24	26	29	31	34	36	38	41
9						17	20	23	26	28	31	34	37	39	42	45	48
10							23	26	29	33	36	39	42	45	48	52	55