

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

B.Tech. -IV Semester (CSE/IT)

COURSE CODE(CREDITS): 18B11CI413(2)

MAX. MARKS: 35

COURSE NAME: Modeling and Simulation Techniques

MAX. TIME: 2 Hours

COURSE INSTRUCTORS: Rakesh Kanji*, Vivek Sehgal, Shubham Goel, Shweta Pandey

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

1. (a) What is the importance of probability distribution functions in modeling and simulation? Give the brief comparison between Binomial, Exponential, Normal, and Poisson Distributions

(b) A water bottle manufactures claims that life of bottles manufactured by them follows normally distribution, with a mean average life of 800 days and a standard deviation of 40 days. Find the probability that a sample of 16 bottles selected on random basis will have an average life of less than 775 days.

Useful values: $P(-2 < Z < 0) = 0.4772$, $P(Z < -2) = 0.0227$, $P(Z < 2) = 0.9772$,

$P(-1.65 < Z < 0) = 0.4505$, $P(Z > 2.5) = 0.006209$, $P(0 < Z < 1.75) = 0.46$, where Z is standard normal variate

[Marks: 6, CO-2]

2. How do you interpret a chi-square test? Use the chi-square test with $\alpha=0.05$ and number of intervals $n=10$ to test whether the data shown below are uniformly distributed.

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42
0.99	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49
0.37	0.51	0.54	0.01	0.81	0.28	0.69	0.34	0.75	0.49
0.72	0.43	0.56	0.97	0.30	0.94	0.96	0.58	0.73	0.05
0.06	0.39	0.84	0.24	0.40	0.64	0.40	0.19	0.79	0.62
0.18	0.26	0.97	0.88	0.64	0.47	0.60	0.11	0.29	0.78

Critical Values of the Chi-square distribution with d degrees of freedom

d	0.05	0.01	0.001	d	0.05	0.01	0.001
1	3.841	6.635	10.828	11	19.675	24.725	31.264
2	5.991	9.210	13.816	12	21.026	26.217	32.910
3	7.815	11.345	16.266	13	22.362	27.688	34.528
4	9.488	13.277	18.467	14	23.685	29.141	36.123
5	11.070	15.086	20.515	15	24.996	30.578	37.697
6	12.592	16.812	22.458	16	26.296	32.000	39.252
7	14.067	18.475	24.322	17	27.587	33.409	40.790
8	15.507	20.090	26.125	18	28.869	34.805	42.312
9	16.919	21.666	27.877	19	30.144	36.191	43.820

3. What is Monte Carlo Simulation? The company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 to 204 mopeds, whose probability distribution is as follows. [Marks: 6, CO-3]

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed three stored that can accommodate only 200 mopeds. Using the following 15 random numbers: 82,89,78,24,53,61,18,45,4,28,50,77,27,54,10.

Simulate the process to find out what will be the average number of

- (i) mopeds waiting in the factory
- (ii) Empty space on the lorry?

[Marks: 6, CO-4]

4. With the availability of data, Explain the parameters which may be estimated from the data? List all the possible estimators for distributions often used in simulation

[Marks: 6 CO-4]

5. (a) For a simulation process, explain the formation of problem and plan of the study with flow diagram.
 (b) Explain the basic steps of modelling and simulation with block diagram.

[Marks: 6, CO-5]

6. (a) Discuss some general prospective on validation of simulation models.
 (b) What are six classes of techniques for increasing the validity and credibility of a simulation model.

[Marks: 5, CO-6]