

(3 Hours)

[Total Marks : 80

N.B. : (1) Question No. 1 is compulsory.

(2) Attempt any **four** out of remaining **six** questions.

(3) Make assumptions if required and justify it.

1. (a) Explain in detail simulation application in anyone of the following system: **10**
- Patient flow analysis in a hospital.
 - Book counter analysis in a library.
 - Goods flow analysis in a grocery shop.
- (b) Use the mixed congruential method to generate a sequence of five two digit random numbers with $X_0 = 27$, $a=17$, $c=43$, and $m=100$. Also use the Kolmogorov-Smirnov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval $[0,1]$ can be rejected. **10**
2. (a) The breaking strengths of mild steel bar is normally distributed. A sample of 18 observations is collected. Determine the maximum likelihood estimator. **8**

345.15	481.32	614.14	732.75	545.78	464.21	809.94
792.07	662.35	517.55	669.88	441.59	556.79	787.63
693.25	522.72	381.28	489.46			

- (b) Explain the steps in simulation study. **7**
3. (a) The number of customer arriving at coffee shop between 9:00am to 9:00pm is poisson distributed with mean 4. Generate Poisson variate using acceptance rejection technique. Use the following five random numbers 0.5389, 0.0532, 0.3492, 0.2373, 0.0123 in sequence. **8**
- (b) Derive the Conservation Equation in the context of measures of performance of Queuing models. **7**
4. (a) An NGO collected the records of monthly number of job related accidental injuries at an underground coal mine for study. The records for the past 100 months are as follows: **8**
- | | | | | | | | |
|-------------------------------|----|----|----|---|---|---|---|
| Accidental injuries per month | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Frequency | 35 | 40 | 13 | 6 | 4 | 1 | 1 |

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Use the Chisquare test to test hypothesis that the underlying distribution is poisson and $\chi_{0.05,2}^2 = 5.99$

- (b) Explain the types of simulation with respect to output analysis. 7
5. (a) Consider the sequence of 40 numbers. Test whether 5th, 10th, 15th number in the sequence are autocorrelated where $\alpha = 0.05$. ($Z_{0.25} = 1.96$) 3
- 0.97 0.40 0.84 0.02 0.82 0.29 0.69 0.51 0.63 0.15
 0.17 0.71 0.65 0.26 0.51 0.67 0.38 0.44 0.75 0.59
 0.09 0.49 0.84 0.81 0.60 0.43 0.53 0.72 0.33 0.66
 0.96 0.27 0.41 0.54 0.18 0.26 0.87 0.11 0.20 0.78
- (b) What are the measures of performance and their estimation for output data. 7
6. (a) Suppose that the life of a computer IC is exponentially distributed with mean 4. Generate two life times from this distribution where $R_1 = 0.762$ and $R_2 = 0.389$. 8
- (b) What are the characteristics of a queue. Mention the measures of performance of queuing system with proper notations. 7
7. (a) Write short notes on 8
- (i) Verification of Simulation Models.
 (ii) Properties of Random Numbers.
- (b) Derive the inverse transformation method for Weibull distribution. 7