MODIBBO ADAMA UNIVERSITY, YOLA

FACULTY OF PHYSICAL SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

SECOND SEMESTER EXAMINATION 2022/2023 ACADEMIC SESSION

CSC 510: COMPUTER MODELING AND SIMULATION

INSTRUCTION: ***Question ONE is Compulsory and answer ANY OTHER TWO (2) in all***

Time allowed: ***2:00hrs*** **Unit: 2**

QUESTION #1

(a) What is System and state the components of system with example. **(3+4+2mks)**

(b) With the help of flow diagram, Explain the single channel queuing system. **(2+4mks)**

(c) International Brewery, Ilesa has three different mixers that fail in service, which cost them low turnout of production. The distribution of the life of each mixer is identical, as shown in Table 1. When a Mixer fails, the production stops, an engineer was called and a new mixer is installed. The delay time of the engineer's arriving at the Brewery is also a random variable having the distribution given in Table 2. Downtime for the production is estimated at ₦4,500 per minute. The direct on-site cost of the engineer is ₦1,500 per hour. It takes 20mins to change one mixer, 30mins to change two mixers and 40mins to change three mixers. The mixer cost is ₦130,000. A proposal has been made to replace all three mixers whenever a mixer fails. Management needs an evaluation of the proposal. To simulate the total cost per 10000 mixer/hours will be used as the measure of performance. Calculate the Cost of Mixers; Cost of delay time; Cost of downtime during repair; Cost of working hour Engineer; Total cost system; Total life of all Mixers; Total cost per 10000 Mixer/hrs. Delay Random Digits: 4, 3, 7, 8, 3, 5, 7, 1

Table 1: Distribution of mixer life

Mixer life	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Probability	0.02	0.06	0.12	0.09	0.05	0.05	0.10	0.13	0.25	0.13

Table 2: Delay distribution table

Delay Time	15	25	35	45
Probability	0.40	0.30	0.20	0.10

Table 3: Mixer Life Time Random Digit

Mixer1	44	30	10	63	67	8	49	84
Mixer2	19	51	70	43	81	44	86	93
Mixer3	65	56	11	86	76	65	61	96

(5+5+5mks)

QUESTION #2

(a) Enumerate and elucidate the properties of random numbers? **(2+4mks)**

(b) Explain the algorithm of Chi-Square Test with little example **(6mks)**

(c) Explain the chi-square test with α = 0.05 to test whether the data shown below are uniformly distributed. Contains the essential computations. The test uses n = 10 intervals of equal length, namely (0, 0.1], (0.1, 0.2], ., ., ., (0.9, 1.0]. Calculate the value of x^2; then compare with the critical value. If x^2 is much smaller than the tabulated value of x_α^2 the null hypothesis of a uniform distribution is not rejected. **(8mks)**

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	0.30	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

QUESTION #3

(a) What do you mean by system modeling? State the advantages and disadvantages of simulation. **(3+4mks)**

(b) Explain the various steps of Simulation Study? **(3mks)**

(c) Suppose the maximum inventory level is M 11 units and the review period is 5 days estimate by simulation the average ending units in inventory and number of days when a shortage condition occurs. Initial simulation is started with level of 3 units and an order of 8 units scheduled to arrive in two days time. Simulate for three cycles (15 days). The probability for daily demand and lead time is given below. Calculate average ending inventory and number of day shortage units.

Demand	0	1	2	3	4
Probability	0.1	0.25	0.35	0.2	0.1

Load time	1	2	3
Probability	0.5	0.3	0.2

Random Digit for demand: 24, 35, 65, 25, 8, 85, 77, 68, 28, 5, 92, 55, 49, 69, 70

Random Digit for Lead: 5, 0, 3 **(5+5mks)**

QUESTION #4

(a) Monte Carlo simulation is a mathematical technique that simulates the range of possible outcomes for an uncertain event. Discuss with advantages and Disadvantages? **(3+3mks)**

(b) Briefly state the algorithm of Kolmogorov-Smirnov Test with example **(6mks)**

(c) Explain the pseudo random numbers and its applications. The following sequence numbers have been generated 0.54, 0.73, 0.98, 0.11, 0.29, 0.23, 0.65, 0.84, and 0.37. Use the Kolmogorov-Smirnov test with α=0.05 to determine, if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. (Note that the critical value of D for α = 0.05 and N=6 is 0.432 **(8mks)**

QUESTION #5

(a) What is Simulation & Modeling? Explain when simulation is appropriate and not appropriate tool?**(5mks)**

(b) What are different random number generation methods? Explain one with examples. **(3+2mks)**

(c) Test either the following random number are auto-correlated. Using Autocorrelation Test at = 5%, Test number for position 2nd, 7th, 12th if are auto-correlated **(10mks)**

0.19	0.16	0.82	0.63	0.04	0.16	0.30	0.22	0.88	0.48
0.29	0.56	0.44	0.05	0.81	0.38	0.59	0.37	0.71	0.43
0.92	0.45	0.57	0.99	0.20	0.14	0.64	0.50	0.73	0.15
0.02	0.49	0.86	0.24	0.90	0.74	0.41	0.09	0.08	0.42
0.11	0.23	0.77	0.08	0.69	0.46	0.39	0.18	0.21	0.98

Good Luck