Department of Statistics and Operations Research

College of Science

King Saud University

OR 441 First Mid-term Examination

Semester 1, 1442 H

Name of Student: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_

 Student’s Number: \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_

Section number:\_\_\_\_\_\_\_\_\_\_\_\_

 Answer table for Question 1

8 For each question, put the code of the correct answer in the above table under the question number.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A | D | C | D | A | A | C | D | C |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| D | C | B | A | C | A | B | D | B |

8 Mobile Telephones are not allowed in the classrooms.

8 Time allowed is 1.5 hour.

8 Attempt all questions.

8 The answer should be clear-cut

8 An ambiguous answer will be considered wrong.

8 Do not answer with pencil or red pen.

**Question 1**

1. Attribute is property of an

(a) Entity (b) Model (c) Event (d) None of these

1. If we are going to simulate an inventory problem, we must
2. run the simulation for many days
3. run the simulation many times, i.e., using multiple sets of random numbers
4. run the simulation once, for a relative short period of time
5. run the simulation for many days many times, i.e., using multiple sets of random numbers.
6. In a banking system, which one of the following can be considered as an event?

(a) Customers (b) Making deposits

 (c) Departure of a customer (d) Number of customers awaiting

1. In an inventory system, levels of inventory can be considered as which type of system component?

(a) Entities (b) Attributes (c) Activity (d) State variables

1. Discrete event simulation models mean simulation model is

(a) Discrete, dynamic, and stochastic (b) Discrete, static and deterministic

(c) Discrete, static and stochastic (d) Discrete, dynamic and deterministic

1. In a cafeteria system which of the following can be considered as an entities

(a) Diners (b) Size of appetite

(c) Selecting food (d) Number of diners in waiting line

1. Server utilization factor is evaluated as

(a) (Total time available for the server) / (Total engage time of server)

(b) (Total time available for the server) - (Total engage time of server)

(c) (Total engage time of server) / (Total time available for the server)

(d) (Total engage time of server) + (Total time available for the server)

1. In communication systems, messages can be considered as which type of system component?

(a) Attributes (b) Activity (c) State variables (d) Entities

1. In a laundromat system which of the following can be considered as an event

(a) Washing machine (b) Breakdown rate

(c) Occurrence of breakdowns (d) Number of machines in repair

1. In a fast-food restaurant system which of the following can be considered as a state variable

(a) Customers (b) Size of order desired

(c) placing the order (d) Number of customers waiting

1. In a hospital system which of the following can be considered as an activity

(a) Patients (b) Attention level required

(c) providing service required (d) arrival of patients

1. In a grocery store system which of the following can be considered as an attribute

 (a) Shoppers (b) Length of grocery list

(c) Checking out (d) Number of shoppers

1. The life of a device used to inspect cracks in aircraft wings is given by *X*, a continuous random variable assuming all values in the range *x* > 0. The pdf of the device’s lifetime, in years, is as follows:

*f(x)=0.5 exp(-x/2), x > 0*

The probability that the life of the device is between 2 and 3 years is

(a) 0.145 (b) 0.5 (c) 0.92 (d) 0.01

1. A production process manufactures computer chips on the average at 2% nonconforming. Every day, a random sample of size 50 is taken from the process. If the sample contains more than two nonconforming chips, the process will be stopped. Compute the probability that the process is stopped by the sampling scheme.

(a) 0.145 (b) 0.5 (c) 0.92 (d) 0.01

1. A computer repairperson is “beeped” each time there is a call for service. The number

of beeps per hour follows Poisson distribution with mean of 2 per hour. The probability of

three beeps in the next hour is

(a) 0.18 (b) 0.148 (c) 0.385 (d) 0.823

1. Which of the following probability distribution is most commonly used for number of arrivals in a given time in a single server queuing model

(a) Negative exponential distribution (b) Poisson distribution

(c) Normal distribution (a) Beta distribution

1. Which one is the instantaneous occurrence that might change the state of system

(a) Entity (b) Attribute (c) Model (d) Event

1. Forty percent of the assembled ink-jet printers are rejected at the inspection station. Find the probability that the first acceptable ink-jet printer is the third one inspected

(a) 0.78 (b) 0.096 (c) 0.203 (d) 0.567

**Question 2**

 A store has one counter. The probability of inter-arrival time and service time of customers are given in the following table.



Random numbers used for prediction of inter-arrival time and service time are given in the table below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **customer** | **1** | **2** | **3** | **4** | **5** |
| Random numbers for arrival | 0 | 0.612 | 0.552 | 0.012 | 0.332 |
| Random numbers for service | 0.287 | 0.012 | 0.614 | 0.853 | 0.671 |

 It is assumed that first customer comes at 0 time. Complete the following simulation table that is carried out to find the performance measures of a queueing system for 5 customers

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **customer** | **R.n. arrival** | **Inter arrival time** | **R. n. for service** | **Cum. Arrival time** | **Service time** | **Time service start** | **Wait time in queue** | **Time service ends** | **Time custom in system** |
| 1 |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |

Find the following performance measures

1. Average waiting time
2. Probability of idle server
3. Average service time
4. Expected service time

**Question 3**

Consider the following sequence of numbers, read from left to right:

0.12 0.01 0.23 0.28 0.89 0.31 0.64 0.28 0.83 0.93

0.99 0.15 0.33 0.35 0.91 0.41 0.60 0.27 0.75 0.88

0.68 0.49 0.05 0.43 0.95 0.58 0.19 0.36 0.69 0.87

 Test for whether the 3rd, 8th, 13th, and so on, numbers in the sequence are autocorrelated using level of significance α= 0*.*05. Note that *Z0.05 = 1.645*, *Z0.025 = 1.96*