



# United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam Trimester: Fall 2019

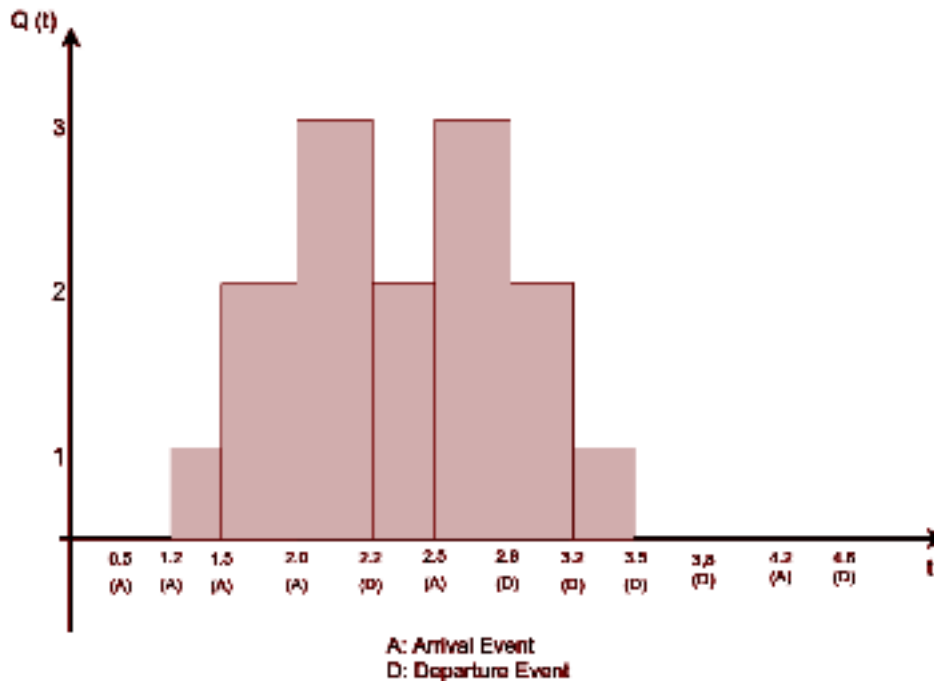
Code: CSI 423 Course Title: Simulation & Modelling

Marks: 30 Time: 1 hour 45 minutes

Answer **ALL** of the following questions:

## QUESTION 1

[2+4+2]



Suppose a single server queue model follows the above  $Q(t)$  vs  $t$  graph. Observe the graph and answer the following questions.

Simulation starts at time,  $t = 0$  and simulation ends at time,  $t = 4.6$ . Queue policy is **FIFO**.

- Calculate the expected number of customers in the queue **using the given graph**.
- Write down the serial of the customers entering into the server and fill up the following table for each customer **using the given graph**. The first two services have been done for you. Complete the table for the next customers:

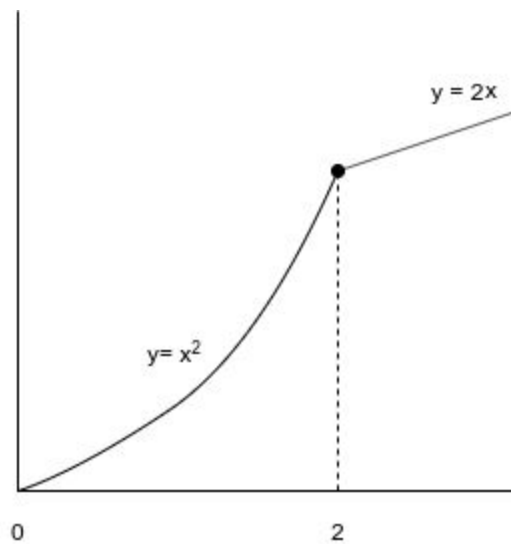
Customer no	Arrival Time	Service Starting time	Delay= Service Starting Time- Arrival Time	Service Ending time	Service Time = Service Ending time - Service starting time
1	0.5	0.5	0	2.2	1.7
2	1.2	2.2	1	2.8	0.6

3					
4					
5					
6					

- c) Calculate average delay from 1(b). Draw  $B(t)$  vs  $t$  graph for the above scenario.

## QUESTION 2

- a) Describe the idea to estimate the value of  $PI(\pi)$  using Monte-Carlo method. [3]  
 Using the random table given at the end of the question, estimate the value using 6 data points. **Rule of reading Random Table:** each data point's x- coordinate will be taken from column-1 and y- coordinate must be taken from column-2.
- b) Discuss several applications of Monte Carlo Simulation Method. [2]
- c) See the following graph: [3]



The above graph consists of two functions. Now Discuss how can you find the area of the given graph using Monte Carlo method. (Just write down the steps. You do not need to show any calculation)

### **QUESTION 3**

- a) Show the flow of control among different components of Discrete event simulation model using proper diagram. [3]
- b) Give one example for each of the following simulation or system study types: [3]
- i) Continuous simulation model
  - ii) Static simulation model
  - iii) Analytic Solution
- c) What is the difference between next-event time advance and fixed increment time advance mechanism. [1]

### **QUESTION 4**

- a) Suppose  $x$  is a continuous random variable which has probability distribution  $f(x) = cx^2$  if  $-1 \leq x \leq 1$  and 0 otherwise. [1+2]
- I. Find the value of  $c$ .
  - II. Find  $E(4X+3)$  and  $\text{Var}(X)$ .
- b) A pair of fair dice is rolled once. The sum of two numbers on the dice represents the outcome for a random variable,  $X$ . What is the probability that  $X$  is odd? [3]
- Suppose if  $X$  is odd, you have to roll again until you get even sum. What is the probability that you have to roll the dice not more than 4 times ?
- c) How does the shape of the curve of normal distribution change with the change of variances? Show with appropriate figures. [1]

**Random Table :**

<b>52</b>	<b>50</b>	<b>60</b>	<b>52</b>	<b>05</b>
<b>37</b>	<b>27</b>	<b>80</b>	<b>69</b>	<b>34</b>
<b>82</b>	<b>45</b>	<b>53</b>	<b>33</b>	<b>55</b>
<b>69</b>	<b>81</b>	<b>69</b>	<b>32</b>	<b>09</b>
<b>98</b>	<b>66</b>	<b>37</b>	<b>30</b>	<b>77</b>
<b>96</b>	<b>74</b>	<b>06</b>	<b>48</b>	<b>08</b>
<b>33</b>	<b>30</b>	<b>63</b>	<b>88</b>	<b>45</b>
<b>50</b>	<b>59</b>	<b>57</b>	<b>14</b>	<b>84</b>
<b>88</b>	<b>67</b>	<b>02</b>	<b>02</b>	<b>84</b>
<b>90</b>	<b>60</b>	<b>94</b>	<b>83</b>	<b>77</b>