(2) A self-service store employs one cashier at its counter. Nine customers arrive, on an average, every 5 minutes while the cashier can serve 10 customers in 5 minutes. By assuming Poisson distribution for arrival rate and exponential distribution for service rate, find

(i) the probability that a customer arriving at the store will have to wait.

(ii) the average length of the queue that forms.

(iii) the average time a customer spends in the system.

(iv) the probability that there will be three or more customers waiting for the service.

(v) the fraction of the time that there are no customers.

Formulas (in the usual notation)

(M/M/1):(∞/FIFO) & (M/M/1):(∞/SIRO) Queuing Systems

$$P_n = \left(\frac{\lambda}{\mu}\right)^n \left(1 - \frac{\lambda}{\mu}\right)$$

$$P(\text{queue size} \geq \text{n}) = \rho^n$$

$$E(n) = \frac{\lambda}{\mu - \lambda}$$

$$E(m) \frac{\lambda^2}{\mu(\mu - \lambda)}$$

$$V(n) = \frac{\lambda\mu}{(\mu - \lambda)^2}$$

$$E(w) = \frac{\lambda}{\mu(\mu - \lambda)}$$

$$E(v) = \frac{1}{\mu - \lambda}$$

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THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. /B.Ed. DEGREE PROGRAMME
APPLIED MATHEMATICS-LEVEL 05
ADU5304 – OPERATIONAL RESEARCH
OPEN BOOK TEST 2017/2018

Duration: One Hour

Date: 12.01.2019	**Time: 04.00 p.m- 05.00 p.m**

Answer all questions

(1) Part A

There are two players in a game, say player *A* and player *B*. Player *A* has Rs.2 coin and Rs.5 coin, and player *B* has Rs.1 coin and Rs.10 coin. Each player selects a coin from the other player without knowing what coin the other player has selected. If the total rupees of the coins selected is odd, player *A* gets a payoff worth of two coins that were selected, but if the total is even, player *B* gets a payoff worth of the two coins.

(i) Construct the payoff matrix with respect to the player *A*.

(ii) Is there a saddle point? Justify your answer.

(iii) Determine the optimal strategies for player *A* and player *B*.

(iv) Find the value of the game.

Part B

Determine the ranges of values of λ and μ that will make the position (2, 2) a saddle point for the game having the payoff matrix given below:

		Player *B*		
		B_1	B_2	B_3
Player *A*	A_1	1	3	5
	A_2	8	4	λ
	A_3	2	μ	9