Registration No :

Total Number of Pages : 02

3rd Semester Regular Examination 2019-20
QUANTITATIVE METHODS-II
BRANCH : IMBA
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB540

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1   **Only Short Answer Type Questions (Answer All-10)**   (2 x 10)

a) What do you mean by pure strategy?
b) What do you mean by two person Zero Sum Game?
c) If λ =10 customers per hour and μ= 15 customers per hour, Then probability that the service facility is idle.
d) Define traffic Intensity?
e) Write Kendall's notation on Queuing theory.
f) What is simulation?
g) Define payoff matrix.
h) Write two applications of Markov Analysis.
i) Define bulking.
j) What do you mean by Queue discipline?

Part- II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)

a) Using dominance rule find the value of game from the following information:

	Player-B		
Player-A	B_1	B_2	B_3
A_1	3	9	4
A_2	8	4	9
A_3	7	3	8

b) Write characteristics and applications of Markov analysis.
c) A market Survey is made on two brands of breakfast foods A and B .Every time a customer purchases, he may buy the same brand or switch to another brand. The transition matrix is given below:

		To	
From		A	B
	A	0.8	0.2
	B	0.6	0.4

At present it is estimated that 60% of the people buy brand A and 40% buy brand B.Determine the market share of brand A and brand B in the steady.

d) What is game theory? State the assumptions underlying it.Discuss its importance to business decisions.

e) What is Markov Process? In what areas of management can they be applied successfully?

f) How are steady state probabilities are calculated? Do you agree that they are independent of the initial conditions? Explain.

g) On an average, 5 customers reach a barber's shop every hour. Determine the probability that exactly 3 customers will reach in a 30 minutes period, assuming that arrivals follows Poisson distribution.

h) Explain the role of queuing theory in decision making and discuss its application.

i) What are the procedures involved for formulate matrix of transition probabilities.

j) What are the steps involved in simulation process ? Explain.

k) Explain advantages and disadvantages of simulation.

l) A bakery keeps stock of a popular brand of cake. Previous experience shows the daily demand pattern for the items with associated probabilities as follows:

Daily demand(nos) :	0	10	20	30	40	50
Probability :	0.01	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random numbers to estimate the demand for the next 10 days. The random numbers are 25,39,65,76,12,05,73,89,19,49.Also estimate the daily average demand for the cakes on the basis of the stimulated data.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Find the value of game using graphical method: **(16)**

		Player-B			
Player-A		B_1	B_2	B_3	B_4
	A_1	2	2	3	-2
	A_2	4	3	2	6

Q4 (a) In a railway Marshalling yard, Goods rain arrive at a rate of 30 trains per day. Assuming that inter arrival time follows an exponential distribution and the service time with an average of 36 ninutes. Calculate (i)Expected Queue size (II) probability that the queue size exceeds 10. **(8)**

(b) Explain the structure of a queue System. **(8)**

Q5 A demist schedules all his patients for 30 minutes appointments. Some of the patients take more 30 minutes some less, depending upon the type of dental work to be done. The following summery shows the various categories of work, their probabilities and time actually needed to complete the work. **(16)**

Category of services	Filing	Crown	Cleaning	Extraction	Check up
Time Required(min)	45	60	15	45	15
Probability	0.40	0.15	0.15	0.10	0.20

Stimulate the dentist 's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor..Assume that all

starting at 8.00 A.M. Using the following random numbers for handling the above problem : 40,82,11,34,25,66,17,79.

Q6 To investigate brand switching between different brands of detergent powder ,a research company surveyed shoppers in a area to discover their behaviour. The survey on a number of shoppers in relation to three leading brands Superwash,Previousbuy and shine has revealed the following information:

(16)

Current Buy	Previous Buy	Number
Super wash	Super wash	200
Clean	Clean	150
Shine	Shine	100
Clean	Super wash	50
Shine	Super wash	25
Super wash	Clean	80
Shine	Clean	45
Super wash	Shine	130
Clean	Shine	20

(a) Using the information, Develop Transition Probability matrix
(b) Calculate the market share for each brand after two purchase
(c) Calculate the market share for each brand in the long run.

3rd Semester Regular / Back Examination 2018-19
QUANTITATIVE METHODS-II
BRANCH : IMBA
Time : 3 Hours
Max Marks : 100
Q.CODE : E072
Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any Two from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** (2x10)

a) What is meant by a "payoff matrix"? What are the three things that are shown in the payoff matrix?

b) If λ, μ are the rates of arrival and departure in a M/M/I queue respectively, give the formula for the probability that there are n customers in the queue at any time in steady state.

c) If the arrival and departure rates in a public telephone booth with a single phone are 1/12 and 1/14 respectively, find the probability that the phone is busy.

d) Consider the Markov chain with three states, S={1,2,3}, that has the following transition matrix

$$\begin{pmatrix} 1/2 & 1/4 & 1/4 \\ 1/2 & 0 & 2/3 \\ 1/2 & 1/2 & 0 \end{pmatrix}$$

Draw the state transition diagram for this chain.

e) An urn contains 1 red ball and 10 blue balls. Other than their color, the balls are indistinguishable, so if one is to draw a ball from the urn without peeking - all the balls will be equally likely to be selected. If we draw 5 balls from the urn at once and without peeking, what is the probability that this collection of 5 balls contains the red ball?

f) Consider an experiment which consists of 2 independent coin-tosses. Let the random variable X denote the number of heads appearing. Write down the probability mass function of X.

g) Define "simulation model" and "analytical model" and clarify the key differences between the two terms.

h) Using the Little's formula, obtain the average waiting time in the system for M|M|1|N model.

i) List out two advantages and two disadvantages of simulation.

j) Write the procedure for determining Steady-State (Equilibrium) Conditions in Markov chains.

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any EIGHT out of TWELVE)** (6x8)

a) Solve the game with the pay-off matrix for player A as given in table.
Game Problem

		Player B		
		B₁	B₂	B₃
	A₁	-4	0	4
Player A	A₂	1	4	2
	A₃	-1	5	-3

b) consider the following pay-off matrix concerning zero sum two person game.

		Player B				
		I	II	III	IV	V
	I	-2	0	0	5	3
Player A	II	4	2	1	3	2
	III	-4	-3	0	-2	6
	IV	5	3	-4	2	-6

What is the optimal plan for both the players?

c) Define the terms pure strategy and mixed strategy games? Illustrate with example how they differ from each other.

d) Illustrate queuing model with one real time example.

e) State and prove The Minimax Theorem.

f) Consider a continuous Markov chain with two states $S=\{0,1\}$. Assume the holding time parameters are given by $\lambda_0=\lambda_1=\lambda>0$. That is, the time that the chain spends in each state before going to the other state has an Exponential(λ) distribution.

    i.   Draw the state diagram of the embedded (jump) chain.

    ii.   Find the transition matrix $P(t)$.

g) Define Markov Chains? Illustrate the use of it with an example

h) What is Monte Carlo simulation? How does it relate to the Monte Carlo Method? What are the steps to perform a simple Monte Carlo analysis.

i) What does the steady state represent to a Markov Chain? Explain using an example.

j) A television repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

k) What are various advantages and disadvantages of simulation model?

l) Define the following terms and elucidate with an example

    i   Stochastic Simulation

    ii.   Transition-State and Steady –State;

    iii.   Games having no saddle point

    iv.   Two-person zero-sum game

Part-III

Long Answer Type Questions (Answer Any TWO out of FOUR)   **(16)**

Q3   Mr. Srinivasan, owner of Citizens restaurant is thinking of introducing separate coffee shop facility in his restaurant. The manager plans for one service counter for the coffee shop customers. A market study has projected the inter-arrival times at the restaurant as given in the table. The counter can service the customers at the following rate :

Mr. Srinivasan will implement the plan if the average waiting time of customers in the system is less than 5 minutes. Before implementing the plan, Mr. Srinivasan would like to know the following :

Inter–arrival times		Service times	
Time between two consecutive arrivals (minutes)	Probability	Service time (minutes)	Probability
2	0.15	2	0.10
3	0.25	3	0.25
4	0.20	4	0.30
5	0.25	5	0.2
6	0.15	6	0.15

i.   Mean waiting time of customers, before service.
ii.   Average service time.
iii.   Average idle time of service.
iv.   The time spent by the customer in the system.
v.   Simulate the operation of the facility for customer arriving sample of 20 cars when the restaurant starts at 7.00 pm every day and find whether Mr. Srinivasan will go for the plan.

Q4   Consider the following continuously operating job shop. Interarrival times of jobs are distributed as follows :   **(16)**

Time between Arrivals (Hours)	Probability
0	0.23
1	0.37
2	0.28
3	0.12

Processing times for jobs are normally distributed with mean 50 minutes and standard deviation 8 minutes. Construct a simulation table, and perform a simulation for 10 new customers. Assume that when the simulation begins there is one job being processed (scheduled to be completed in 25 minutes) and there is one job with a 50-minute processing time in the queue.

i.   What was the average time in the queue for the 10 new jobs?
ii.   What was the average processing time of the 10 new jobs?
iii.   What was the maximum time in the system for the 10 new jobs?

Q5   Two players: The employee (Raquel) and the employer (Vera). Raquel has to choose whether to pursue training that costs Rs.1, 000 to herself or not. Vera has to decide whether to pay a fixed wage of Rs.10, 000 to Raquel or share the revenues of the enterprise 50:50 with Raquel. The output is positively affected by both training and revenue sharing. Indeed, with no training and a fixed wage total output is Rs.20, 000, while if either training or profit sharing is implemented the output rises to Rs.22, 000. If both training and revenue sharing are implemented the output is Rs.25, 000.   **(16)**

i.   Construct the pay-off matrix
ii.   Is there any equilibrium in dominant strategies?
iii.   Can you find the solution of the game with Iterated Elimination of Dominated Strategies?
iv.   Is there any Nash equilibrium?

Q6   What is a confidence interval? How is a confidence interval computed? Under what conditions is a confidence interval valid? What is the method of independent replications? How can the width of a confidence interval be reduced?   **(16)**

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Total Number of Pages: 03

IMBA
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3ʳᵈ Semester Regular Examination 2017-18
QUANTITATIVE METHODS-II
BRANCH : IMBA
Time: 3 Hours
Max Marks: 100
Q.CODE: B1135

**Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.**

Q1   **Answer the following questions:**   (2x10)

a)   Markov analysis deals with the probabilities of future occurrence by analyzing the _____ probability and _____ simulation method is used to solve problems having conditions of uncertainty and when mathematical formulation is not possible.

b)   The strategy that is taken by a player ignoring the strategy taken by the opponent is called _____ strategy and the probability of moving from one state to another or remain in the same state in a single time period is called _____ probability.

c)   Service time in queuing model occurs by _____ probability distribution and arrival time occurs by _____ probability distribution.

d)   If the value of the game is not zero, then the game is called _____ game and the pay-off in saddle point is called _____ of the game.

e)   Ambulance and firefighting equipment and dispatching are applications of _____ method and determination of future manpower requirements of an organization is made by _____.

f)   Financial models are made by _____ technique and prediction of future utilization of machines considering the breakdown and maintenance schedules is made by _____ process.

g)   Game theory is a mathematical theory under _____ situation and the player whose condition is not better during the game is called _____.

h)   If $\lambda = 25$ customers per hour and $\mu = 120$ seconds per a customer, then traffic intensity is _____ and expected waiting time in queue is _____.

i)   Mechanics in a maintenance shop for repairs are _____ customers and parking spaces in a parking lot is an example of _____ service mechanism.

j)   Weather model is an application of _____ and the place where service is provided is called _____.

Q2   **Answer the following questions:**   (2×10)

a)   Find value of the game from the following pay-off matrix.

Player B
Player A | 5 | 6 | 9 |

b)   If $\lambda = 10$ customers per hour and $\mu = 15$ customers per hour, then find probability that the service facility is idle.

c)   If $\lambda = 20$ customers per hour and $\mu = 25$ customers per hour, then find expected number of customers in the system.

d) If $\lambda = 4$ minutes per a customer and $\mu = 3$ minutes per a customer, then find expected waiting time in the system.

e) Explain 'customers behavior' under queuing model.

f) Explain Monte-Carlo simulation method.

g) Explain saddle point in game theory.

h) Explain mixed strategy in game model.

i) Find a two-day transition matrix from a one-day transition matrix given below.

$$
\text{Today} \quad
\begin{array}{c}
\text{Tomorrow} \\
\begin{bmatrix}
0.6 & 0.4 \\
0.4 & 0.6
\end{bmatrix}
\end{array}
$$

j) Draw transition probability tree diagrams from the following transition probability matrix.

$$
\text{Current State} \quad
\begin{array}{c}
\text{Next State} \\
\begin{array}{c c c}
 & A & B \\
A & 0.8 & 0.2 \\
B & 0.6 & 0.4
\end{array}
\end{array}
$$

Q3 In a bank cheques are cashed at a single 'teller' counter. Customers arrive at the (15) counter in a poisson manner at an average rate of 30 customers per hour. The teller takes on an average a minute and a half to cash cheque. The service time has been shown to be exponentially distributed.
i) Calculate the probability that the teller is idle.
ii) Calculate the expected number of customers in queue.
iii) Calculate the expected waiting time in queue.

Q4 Abackery keeps stock of a popular brand of cake. Previous experience shows the (15) daily demand for the item with associated probabilities as given below

Daily demand (Nos.)	0	10	20	30	40	50
Prob.	.01	.20	.15	.50	.12	.02

Use the following sequence of random numbers to simulate the demand for next 10 days.
Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49

Q5 Three manufactures X, Y & Z are competing with each other. The following matrix (15) gives the transition probabilities that customers will move from one manufacturer to the other in any month. Interpret the matrix in terms of
a) Retention and loss.
b) Retention and gain.

$$
\begin{array}{c c c c}
 & x & y & z \\
x & 0.7 & 0.1 & 0.2 \\
y & 0.1 & 0.8 & 0.1 \\
z & 0.2 & 0.1 & 0.7
\end{array}
$$

Q6 Find optimal strategies for both players and value of the game by using dominance   (15)
rule from the following matrix.

		Player B		
		B1	B2	B3
	A1	1	2	3
Player A	A2	4	5	6
	A3	3	2	9

Q7 The price of an equity share of a company may increase, decrease or remain   (15)
constant on any given day. It is assumed that the change in price on any day affects
the change on the following day as described by the following transition matrix :

Tomorrow

		Increase	Decrease	Constant
	Increase	0.5	0.2	0.3
Today	Decrease	0.7	0.1	0.2
	Constant	0.4	0.5	0.1

a) If the price of the share increased today, what are chances that will increase,
decrease or remain unchanged day after tomorrow.
b) If the price of the share decreased today, what are chances that it will increase,
decrease or remain unchanged day after tomorrow.

Q8 **Write short answer on :**   (15)
a) Maximin – Maximax principle in game model.
b) Input process and sercive time distribution in queing model.