CT-405 Modeling and Simulation **Midterm** **Date: 17-12-2021**

Time Allowed: 90 Mins **Marks: 20**

Q#1. [C3]

a. A machine shop repairs small electric motors, which arrive according to a Poisson process at the rate 11 per week where a week comprises of 5 days with eight hour work day. An analysis of past data indicates that engines can be repaired, on the average, in 2.5 hours. **Compute** how many working hours should a customer expect to leave a motor at the repair shop (not knowing the status of the system)? How much is the utilization ratio of the machine? How many motors are in the queue to be repaired per hour? [04]

b. **Show** steps of simulation through diagram. [02]

Q#2. [C2]

a. **Explain** Poison Process, reneging, system boundary and exponential Distribution. [05]

b. **Differentiate** systems according to nature and type of components. [03]

Q#3. [C4]

Consider the hospital mgmt. system with one window is simulated. The system consists of those customers in waiting line plus the one checking out. A stopping time of 27 minutes is set for the model. The simulation analyst desires to **analyze** mean response time, mean proportion of customers who spend 4 or more minutes in the system and number of departures up to the current simulation time. Design a table using event scheduling algorithm for the given IAT and ST [06]

IAT	3	4	5	2	6	7
ST	2	7	6	3	7	5

SEAT NO. 87

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

FINAL YEAR(SOFTWARE ENGINEERING)
FALL SEMESTER EXAMINATIONS 2021
BATCH 2018

Time: 3 Hours

Dated:15-02-2022
Max.Marks:60

Modeling & Simulation - SE-405

Instructions: Attempt All Questions

Q#1. [CLO-3]

a. Six dump trucks are used to haul coal from the entrance of a small mine to the railroad. Each truck is loaded by one of two loaders. After a loading, the truck immediately moves, this system is simulated. The system consists of those trucks in waiting line plus the one that is leaving. A stopping time of 25 minutes is set for the model. The simulation analyst desires to estimate mean response time, mean proportion of trucks that spend 5 or more minutes in the system and number of departures up to the current simulation time. **Outline** a table using event scheduling algorithm for the given IAT and ST. [06]

IAT	3	3	5	2	5	4
ST	2	6	6	8	5	4

b. **Explain** characteristics of queuing system in detail. [04]

Q#2. [CLO-1]

a. The owner of a bank ABC has collected data on the number of times that service has been provided on each day over the past 500 days. The results are as follows: [06]

Services per day	0	1	2	3	4	5	6	7
Number of days	135	127	108	48	35	30	13	4

Observe *does the distribution of service interruptions follow a Poisson distribution.(Use the 0.05 level of significance and critical value = 5.99)*

b. ***Describe*** *the properties of petri net.* [04]

Q#3. [CLO-2]

a. *In present days A+, Skyline and Destiny Builders provides training to their employees. Assume that 80% of employees of A+ get training from A+, and rest from Destiny, 40% of Skyline's employee get training from Skyline and rest split evenly between A+ and Destiny, of the employees of Destiny 70% get training from Destiny, 20% from A+, 10% from Skyline.* **Predict** *the probability that in 2nd loop employee from Destiny will take training from A+. Also create transition table and transition diagram.* [04]

b. Alaska cabinet-making shop, in Memphis, has one technician that drills holes for the installation of hinges. The technician needs setting up for each order of cabinets. The orders appear to follow the Poisson distribution, averaging 4 per 12-hour day. There is a single technician for setting these machines. His service times are exponential, averaging 2 hours each. **Calculate** the [06]

following:

i. The utilization factor for this system?
ii. The average number of these machines in system?
iii. Impact on machines in service would there be if 3 technicians are available?

Q#4. [CLO-2]

a. **Create** a petri net from the following metrics, also **draw** a reachability graph, find out is the petri net bounded and live? [06]

E^+ =					
	1	1	0	0	0
	0	1	0	1	0
	0	0	1	0	0
	0	0	0	0	1

E^- =					
	0	0	2	0	1
	1	0	0	0	0
	0	1	0	0	0
	0	0	0	1	0

M^o =	
	0
	1
	0
	1

b. Define random and pseudo random variates, give short **Explanation** of techniques to generate random variates. [04]

Q#5. [CLO-3]

a. Explain common markov models; also **identify** the classification of states of markov chain for following diagram. [05]

	A	B	C	D	E	F	G
A	0.5	0.5	0	0	0	0	0
B	1	0	0	0	0	0	0
C	0.25	0	0	0.5	0.25	0	0
D	0	0.25	0.5	0	0.25	0	0
E	0	0	0	0	0	1	0
F	0	0	0	0	0	0	1
G	0	0	0	0	0.5	0.5	0

b. List the steps of input modeling, **Give** pitfalls of data collection how these pitfalls can be handled. [05]

Q#6. [CLO-1]

a. **Discuss** components of discrete event simulation model. [04]
b. **Differentiate** steady state and transient models, static and dynamic models [03]
c. **Explain** Poisson, Empirical and binomial distribution [03]

BATCH 2016-2017

Time: 3 Hours

Dated:03-02-20

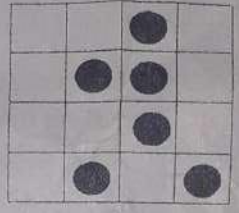
Max.Marks:60

Modeling & Simulation - SE-405

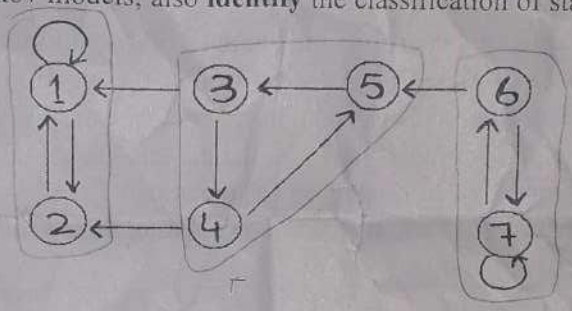
Instructions: Attempt All Questions

Q#1:

a. For the giving 4*4 grid, apply rule of life to **figure out** the transitions of next four generat State rule 110 of elementary CA with example and classify elementary CA accordi Wolfram.



b. Explain common markov models; also **identify** the classification of states of markov chai following diagram.



Q#2:

a. The manager of a commercial mortgage department of a large bank has collected data the past two years concerning the number of commercial mortgages approved per week results from these two years (107 weeks) indicated the following:

Number of commercial mortgages approved	0	1	2	3	4	5	6	7
Frequency	14	24	33	18	8	7	2	1

Apply Chi-square test to find whether the distribution of commercial mortgages approv week follow a Poisson distribution? (Use the 0.01 level of significance, critical value is

b. **Classify** types of system according to output analysis, discuss absolute meas performance and its estimations also high light the concept of biased estimators.

Q#3:

a. According to Kemeny, Snell, and Thompson, the Land of Oz is blessed by many thin not by good weather. They never have two nice days in a row. If they have a nice day, t just as likely to have snow or rain the next day with equal probabilities. If they have sno have an equal chance of having the rainy and nice day and 50% chance of snowy day.

the next three days' weather

types of system according to uncertainties involved and according to degree of interconnection of events. Also differentiate stead state and transient models.

c. Define random variate, **elaborate** different techniques to generate random variates

Q#4:

a. **Create** a petri net from the following metrics, also **draw** a reachability graph, find out is the petri net bounded and live?

$E^+ =$				
P_1	1	1	0	0
P_2	0	0	1	0
P_3	0	0	0	1
P_4	0	0	1	0
P_5	0	0	0	1

$E^- =$				
	0	0	1	0
	1	0	0	1
	0	1	0	0
	0	0	0	1
	0	0	1	0

$Mo =$	
	1
	0
	0
	1
	1

b. **Provide** definitions of the following :

i. Geometric distribution
ii. Poisson process
iii. Calling population
iv. Next event time advance mechanism
v. List processing

Q#5:

a. Six dump trucks are used to haul coal from the entrance of a small mine to the railroad. Each truck is loaded by one of two loaders. After a loading, the truck immediately moves, this system is simulated. The system consists of those trucks in waiting line plus the one that is leaving. A stopping time of 24 minutes is set for the model. The simulation analyst desires to estimate mean response time, mean proportion of trucks that spend 5 or more minutes in the system and number of departures up to the current simulation time. **Outline** a table using event scheduling algorithm for the given IAT and ST.

IAT	3	2	6	2	4	5
ST	2	5	5	8	4	5

b. Define markov chains also **Identify** the common markov models.

c. **Explore** Petri net its uses and its initiative structures.

Q#6:

a. A machine shop repairs small electric motors, which arrive according to a Poisson process at the rate 12 per week (5-day, 40-hour workweek). An analysis of past data indicates that engines can be repaired with service time of 2 hours. **Compute** a) service factor for this system? b) Average number of these motors in service? c) What impact on machines in service would there be if a 3 technicians are available?

b. List the steps of input modeling, **Give** pitfalls of data collection how these pitfalls can be handled.

c. **Describe** different techniques validation of a simulation model.

—— X ——

Q#4

a. **Discuss** types of validity and **explain** the techniques to validate a simulation model [04]

b. **Elaborate** Petri net and its initiative structures. [03]

c. Assume that a man's profession can be classified as professional, skilled laborer, and unskilled laborer, assume that of the sons of professional men, 70% are professional, rest split evenly in other two categories. In case of skilled labors 60% are skilled laborers, 30% are professional and 10% are unskilled laborer. Finally in case of unskilled laborers 50% of sons are unskilled laborers, 25% are in other two categories. Set up transition matrix, **find** probability that randomly chosen grandson of unskilled laborer is a professional man. [03]

Q#5

a. **Give** list of the steps of input modeling [02]

b. **Clarify** any four characteristics of queueing systems [03]

c. Create a petri net from the following metrics, also draw a reachability graph, **Examine** is the petri net bounded and live? [05]

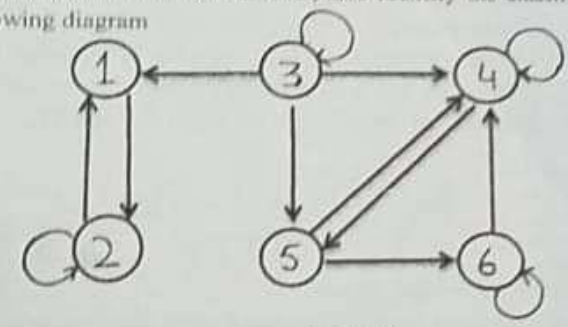
	T_1	T_2	T_3	T_4	T_5
P_1	1	1	0	0	0
P_2	0	1	0	1	0
P_3	0	0	1	0	0
P_4	0	0	0	0	1

	T_1	T_2	T_3	T_4	T_5
P_1	0	0	2	0	1
P_2	1	0	0	0	0
P_3	0	1	0	0	0
P_4	0	0	0	1	0

Mo	
	2
	0
	0
	0

Q#6

a. Explain common markov models, also **identify** the classification of states of markov chain for following diagram [05]



b. **List and define** the components of DESM [03]

c. **Explain** stochastic processes and its classification [02]

Q8 pro. Expl.

BESE-006

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FINAL YEAR FALL SEMESTER (SOFTWARE ENGINEERING)
EXAMINATIONS 2018
BATCH 2015-2016

Time: 3 Hours **Dated:07-02-2019** **Max.Marks:60**

Modeling & Simulation - SE-401

Instructions: Attempt all questions.

Q#1.

a. **Classify** the system w.r.t. interaction. [02]

b. **Differentiate** absolute performance and relative performance. [03]

c. Bill Youngdahl has been collecting data at the TU student grill. He has found that, between 5:00 P.M. and 7:00 P.M., students arrive at the grill at a rate of 25 per hour (Poisson distributed) and service time takes an average of 2 minutes (exponential distribution). There is only 1 server, who can work on only 1 order at a time. [06]

i. What is the average time a student is in the grill area?

ii. Suppose that a second server can be added and 2 servers act independently with each taking an average of 2 minutes. **Examine** the effect on the average time of a student in a system?

Q#2.

a. **Explain** techniques to generate random variates. [04]

b. Consider the ticket booth system with one ticketing counter is simulated. The system consists of those customers in waiting line plus the one checking out. A stopping time of 25 minutes is set for the model. The simulation analyst desires to estimate mean response time, mean proportion of customers who spend 5 or more minutes in the system and number of departures up to the current simulation time. **Outline** a table using event scheduling algorithm for the given IAT and ST. [05]

IAT	4	5	2	8	3	7
ST	5	3	4	6	2	7

#3.

a. **Explain** the steps of simulation study also depict through diagram. [03]

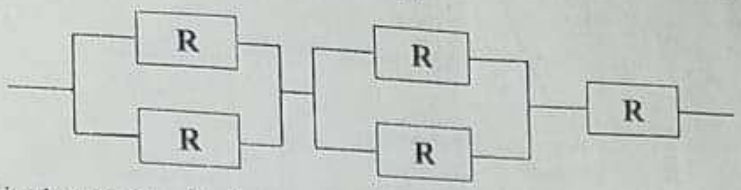
b. Records pertaining to monthly number of job related injuries at chemical plant were being studied by an NGO, the values for the past 120 months were as follows: [07]

Injuries/month	0	1	2	3	4	5	6
frequency	40	46	16	9	4	3	2

Figure out that underlying distribution is Poisson using chi-square goodness of fit test (Use the 0.05 level of significance and critical value = 5.99)

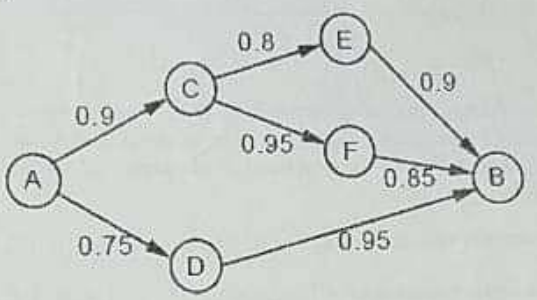
QUESTION NO. 5

(a) What is Reliability ?
Express the reliability of a series system in the form of a mathematical model.
By taking an appropriate example show that the reliability of a series system degrades As the complexity of the system is increased.



Write the expression for the overall Reliability of the system given in the above Reliability Block Diagram.

(b) A computer network connects two nodes A and B through intermediate nodes C, D, E, F, as shown. For every pair of directly connected nodes, say i and k, there is a given probability p_{ik} that the link from i to k is up. We assume that link failures are independent of each other.
What is the probability that there is a path connecting A and B in which all links are up?



QUESTION NO. 6

(a) Consider a single server, infinite queue length and infinite population queueing model where arrival and service of entities both follow the Markovian property.
Model the system at steady state and derive expression for expected number of entities is the system.

(b) Consider an M/M/1: ∞/∞ queuing system which has a Poisson arrival rate of 8/hr. and an exponential service rate of 9/hr. Find the following:

i- Probability that there is no entity in the system
ii- Probability that there is no queue
iii- Probability that there are at least two entities in the system
iv- Expected number of entities in the queue and in the system

— X —

SE-140044

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

FINAL YEAR FALL SEMESTER (SOFTWARE ENGINEERING)
EXAMINATIONS 2017-2018
BATCH 2014-2015

Time: 3 Hours

Dated:09-03-2018
Max.Marks:60

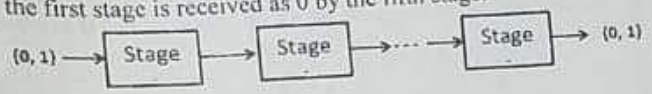
Modeling & Simulation - SE-401

Instructions:

i. Attempt any five questions.
ii. All questions carry equal marks.
iii. Attempt questions and their parts in the given order.

QUESTION NO. 1

(a) What is a Stochastic process ? Describe Marchov process and Marchov chain.
(b) A binary communication channel transmits 0 and 1 through multiple stages. The probability, that the output of a given stage is the same as its input, is 0.75. Model the process as a Markov chain and hence calculate the probability that a 0 entering the first stage is received as 0 by the fifth stage.



QUESTION NO. 2

(a) Explain Monte Carlo simulation with the help of an example.
(b) Generate a manual event list for customers arriving at a single-queue, single-server system. Calculate system time, average number in queue, and resource utilization based on the system for 18 min.

Inter-arrival times in minutes for 10 arrivals: 2, 1, 3, 1, 3, 2, 4, 2, 1, 1

Service times in minutes for 10 arrivals: 2, 3, 1, 3, 2, 2, 1, 3, 2, 2

QUESTION NO. 3

(a) What are Petri nets ? How these are used in system modeling.
(b) Model the following constructs by Petri nets;
i- Sequential actions ii- Concurrency iii- Dependency
iv- Cycles v- Conflict vi- Synchronization

QUESTION NO. 4

(a) Discuss Availability Analysis. What is Instantaneous Availability ?
(b) Draw and discuss the following curves:
i- Load vs Throughput
ii- Load vs Response Time

Alice wants to send message "3" CALCULATE the Public, Priva... original message i.e. "3". [CLO-2]

Following Table shows a sample of ... IP address that range from 192.168.1.0 ... [CLO-2]

Rule #	Source Address	Sour...
1	Any	Any
2	192.168.1.1	Any
3	Any	Any
4	Any	Any

Table for ...

4															
5															
6															
7															
8															
9															
A															
B															
C															
D															
E															
F															

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