USN - 1KS18CS097
SIGN - Sourabh

Name: Sourabh Santosh Kamble
USN: 1KS18CS097
Semester: VI
Section: CSE 'B'
Subject: System Modelling and Simulations
Subject Code: 18CS645
Signature: Sourabh

INTERNAL ASSESMENT - 1

PART - A

1. a. A system is a group of objects that are joined together in some regular interaction to achieve or accomplish a purpose.

Eg: A bank is a system where employees, & tools are the components of that system.

The types or categorization of systems is as follows.

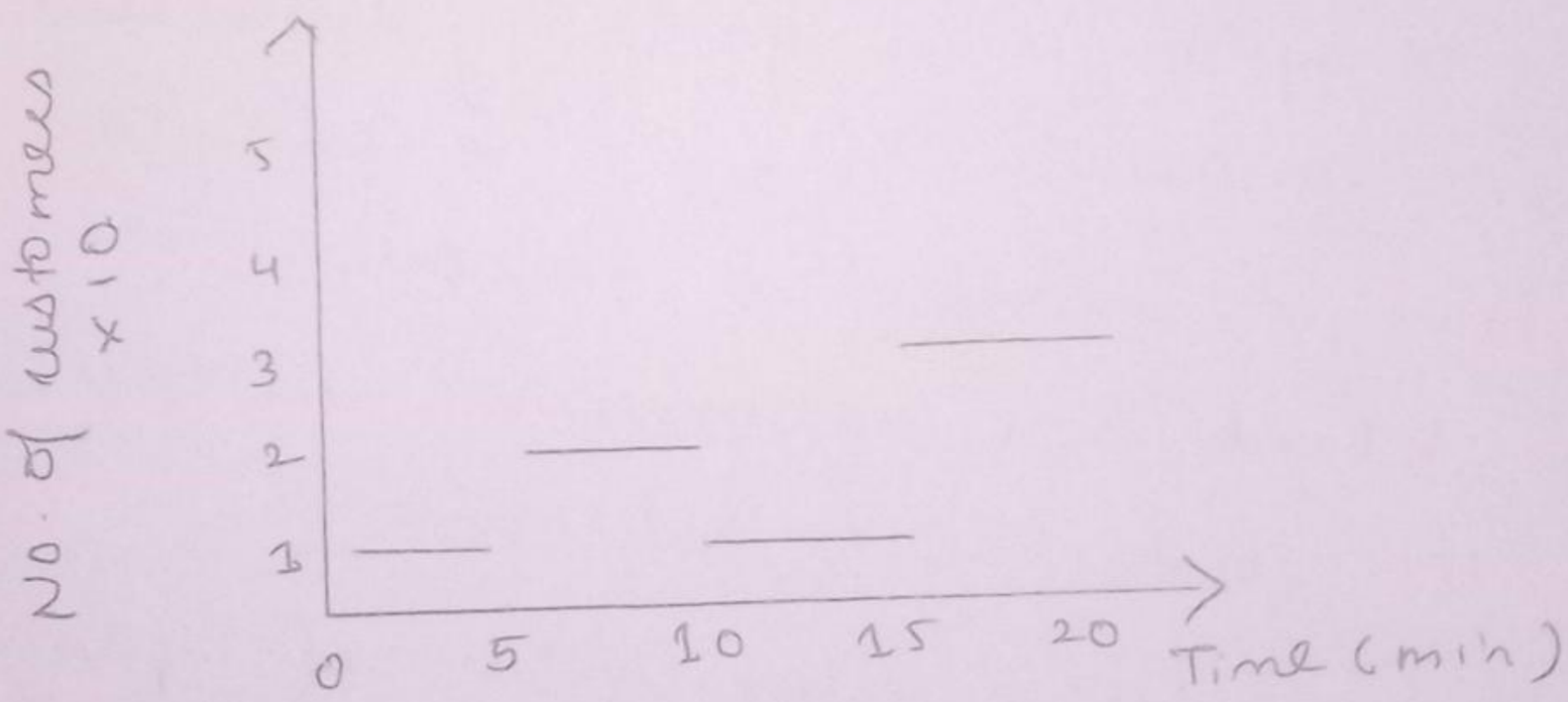
i) Discrete system.
ii) Continues system.

DISCRETE SYSTEM:

A system in which the state variables change only at a discrete point or set of points in time is called discrete system.

In discrete systems the state changes at some point and remains constant the other times.

Eg: Number of customers in the queue in a bank. - The customers arrive and wait in the queue until the person ahead of them has been served. So when the person's service is completed the next moment queue size can either increase or decrease.



The above graph shows that from 0 to 5 minutes only 10 customers wait in queue. from 5-10 minutes only 20 customer, 10-15 minutes it falls back to 10 customer, but from 15-20 minutes 30 customers are in the queue.

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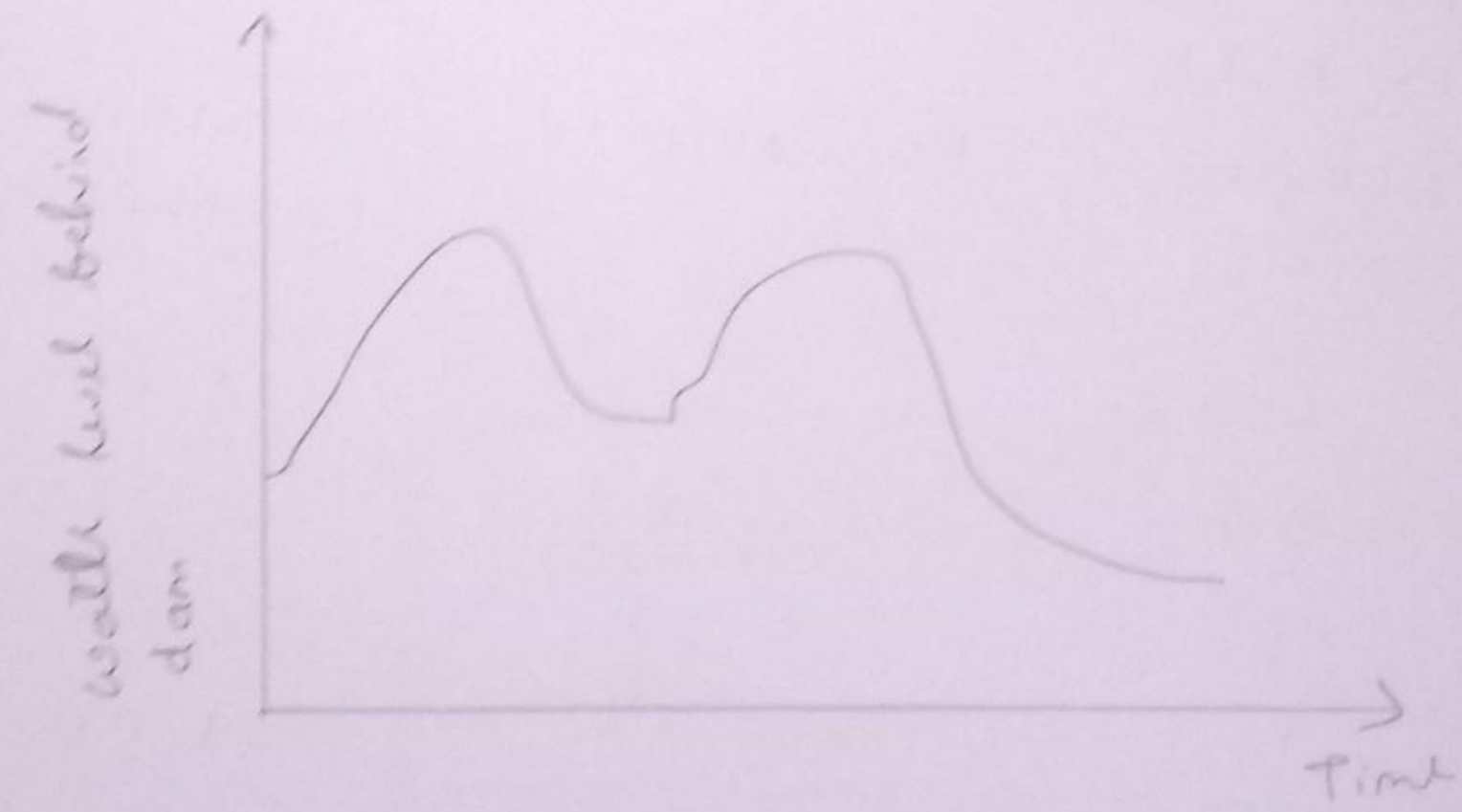
CONTINUES SYSTEM :

A system in which the state variables change continously over time is called continues system.

In continues system the state variables change for every unit of time and does not remain constant at all.

Eg: The water behind the dam - The water level rises or falls continuously due to natural phenomenal weather conditions and other factors.



1.b. RANDOM DIGIT GENERATION (RDA) FOR INTER-ARRIVAL TIME (IAT)

INTER-ARRIVAL TIME	PROBABILITY	CUMULATIVE PROBABILITY	RANDOM DIGIT ASSIGNMENT
1	0.25	0.25	01 - 25
2	0.40	0.65	26 - 65
3	0.20	0.85	66 - 85
4	0.15	1.00	86 - 00

RDA GENERATION FOR SERVICE TIME

i) ABLE

SERVICE TIME	PROBABILITY	CUMULATIVE PROBABILITY	RDA
2	0.30	0.30	01 - 30
3	0.28	0.58	31 - 58
4	0.25	0.83	59 - 83
5	0.17	1.00	83 - 00

ii) BAKER

SERVICE TIME	PROBABILITY	CUMULATIVE PROBABILITY	RDA
3	0.35	0.35	01 - 35
4	0.25	0.60	36 - 60
5	0.20	0.80	61 - 80
6	0.20	1.00	81 - 00

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ARRIVAL TIME GENERATION:

CUSTOMER NO.	RDA	IAT	ARRIVAL TIME
1	-	-	0
2	26	2	2
3	98	4	6
4	90	4	10
5	26	2	12
6	42	2	14

SERVICE TIME GENERATION:

CUSTOMER NO.	RDA	SERVICE TIME
1	95	5 (A)
2	21	3 (B)
3	51	3 (A)
4	92	5 (A)
5	89	6 (B)
6	3	2 (A)

A -> ABK
B -> Baker

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SIMULATION

~~Calculus~~

A	B	C	D	E	F	G	H	I	J	K
1	-									
2	2									
3	6									
4	10									
5	12									
6	4									

SIMULATION:

A	B	C	D	E	F	G	H	I	J	K	L
1	-	0									
2	2	2									
3	4	6									
4	4	10									
5	2	12									
6	2	14									

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SIMULATION:

A	B	C	D	E	F	G	H	I	J	K	L	M	N
					A	95	5	0	0	5			
1	-	0	0	0							5		
					B	21	3	2	0				
2	2	2	5	0						9			
					A	51	3	6	0				
3	4	6	5	5						15			
					A	92	5	10	0				
4	4	10	9	5							18		
					B	89	6	15	3				21
5	2	12	15	5									
6	2	14	15										

SIMULATION:

A	B	C	D	E	F	G	H	I	J	K	L	M	N
					A	95	5	0	0	5		0	5
1	-	0	0	0							5	0	3
					B	21	3	2	0			0	3
2	2	2	5	0						9			
					A	51	3	6	0			0	5
3	4	6	5	5						15			
					A	92	5	10	0			0	6
4	4	10	9	5							18		
					B	89	6	12	0			0	3
5	2	12	15	5						17			
					A	3	2	15	1				
6	2	14	15	18									

where

A → Call / Customer Number

B → Inter Arrival time (IAT)

C → Arrival time

D → Able Time Able is Available

E → Time Baker is Available

F → Who gets job A ⇒ Able, B ⇒ Baker.

G → RDA for Service Time

H → Service Time

I → Time Server starts for customer

J → Time waited in Queue (customer)

K → Time service End by Able.

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L → Time service end by Baker
M → Idle Time of server
N → Time spent in system.

1.C. SIMULATION APPROPRIATE:

The simulation is appropriate under following conditions

i) If a major product has to be constructed or designed, SO simulation can provide idea before implementation.

ii) Visualization of plans can be done using animated simulation in such a way the cons and pro's can be analyzed.

iii) If the simulation is used for training individuals with certain skills such as surgeries in hospitals, to driving simulations, etc.

iv) To find important input parameters by changing simulations.

v) Simulation enables study of internal interaction of subsystem with complete system, to avoid complication.

vi) Informational, organization changes have to be made, then simulation comes in handy.

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PART - B

3.a. **CUMULATIVE DISTRIBUTION FUNCTION:**

Cumulative distribution function F(x) is denoted as,

$$F(x) = P(X <= x) \quad \text{where}$$

if x is discrete then

$$F(x) = \sum_{\forall x_i \leq x} p(x_i)$$

if x is continous then

$$F(x) = \int_{t=-\infty}^{x} f(t)\,dt$$

PROPERTIES:

i) F is non-decreasing function, if $a < b$

then $F(a) \leq F(b)$

ii) $\lim_{x \to \infty} F(x) = 1$

iii) $\lim_{x \to \infty} F(x) = 0$

The finalized equation for probability in terms of cumulative distribution function as follows,

$$P(a < X < b) = F(b) - F(a), \quad \forall\ a < b$$

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Example :

Let us consider,

$$F(x) = \frac{1}{2}\int_0^x e^{-t/2}dt = 1 - e^{-x/2}$$

$$F(x) = 1 - e^{-x/2}$$

The probability that device is will last for 2years is

$$P(0 \le X \le 2) = F(2) - F(0) = 0.6321$$

The probability that device will last for 2 to 3 years is

$$P(2 \le X \le 3) = F(3) - F(2) = 0.1447.$$

3.5.

	SYSTEM STATE		LISTS		STATISTICS		
CLOCK	LQ(t)	LS(t)	CHECKOUT LINE	FUTURE EVENT LIST	S	NO	F
0.	0	1	(C1,0)	(A,1,C2), (D,4,C1), (E,60)	0	0	0
1	1	1	(C1,0)(C2,1)	(A,2,C3), (D,4,C1), (E,60)	0	0	0
2	2	1	(C1,0) (C2,1) (C3,2)	(D,4,C1), (A,8,C4), (E,60)	0	0	0
4	1	1	(C2,1) (C3,2)	(D,6,C2), (A,8,C4), (E,60)	0	0	0

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6	0	1	(C3,2)	(A,8,C4), (D,11,C3), (E,60)	4	1	0
8	1	1	(C3,2) (C4,8)	(D,11,C3), (A,11,C5), (E,60)	9	2	1
11	1	1	(C4,8) (C5,11)	(D,15,C4), (A,15,C6), (E,60).	9	2	1
15	0	1	(C5,11)	(D,16,C4), (A,18,C6), (E,60)			

No. of pages: 11

Questions attempted:

1.a, 1.b, 1.c

3.a, 3.b