	/	2	P	
1	1	j	L	,

)	ii Compu	ite Arrival time	e trom	IAT
	·C·No	Random Digit	T	Arrival Time
- Charles		-	-	0
The State of the S	2	913	8	8
	, 3	727	. G	14
-	4	015	1	15
	5	948	8	23
	G	309	3	೩ 6
	7	9 ଶ ଶ	8	34
	8	753	7	41
	9	235	2	43
	10	308	3	43

iii Determine Service Time Distribution Table

S.No	P(1/6)	Cumulative probability	Random Digit Assess
1	0.16	0.16	01-16
ચ	0-16	0.32	17-32
3	0.16	0.48	33-48
4	0.16	0.64	49-64
5	0.16	0.80	65-80
G	0.16	0.96	81-96

iv) Compute Service Time

1		CALL TO SEE SEE
S·No	Random	Service Time
1	84	6
2	10	1
3	74	5
4	53	4
5	* 17	ર
6	79	5
7	91	G
ઠ	67	5
9	89	6
10	38	3

Ne min	55 10.210	2+5+1+3+)	seavea =	Total run time of	11	seaved of	idle serv
		i o a min	wait = 3 =	cristomers to	No. of cu	11 -	2000 bability
BID	10 11	0	customers	no of custo	Total	waiting Time	waitin
	$\bar{\omega}$	4 +	witing in qu	time customer	Total		Average
െ	0	9	55	<i>ড</i>	ω	46	ō
ເນ	٥	٩	S &	. 4 6	ត	4	هـ
0	_	(J)	46	<u>4</u> .	(r)	4)	80
0	w	6	\$	₩	റ	w 4	ب
0	-	(r)	ώ	20	(J)	ಶ್ರೀ	െ
o	0	Ro	R (5	20	es	еэ (v)	ហ
4 (17-15)	o	တ	وع (ب)	19	4	Ũi	4
0 (14-14	男(14-9)	5(19-14)	59	74	(J)	<u>~</u>	ώ
0 (8-8)	2(8-6)	(8-6) 1	_0	Ø		∞	وع
Queue	0	6 (6-0)	6 1	0	ഉ	0	12
wait in	Seaven	Time spent		a	Time	Time	
	7416	, ,	Time Service	To BOR Service	Service	Arrival	o Źo
TSD AT	TSA(n) - TSE(n)	TSE - AT	ካ <mark>@</mark> ፕՏ	for 10 customers	Table f	Simulation	V) Sin

Total run time of simulation

(TSE (ast value)

57: 1 2 3 4 5 6 6.05

Develop a simulation Table for 10 customers

p: 0.10 0.40 0.25 0.30 0.10 customers

Take a random digit for arrival:

13 37 15 48 9 32 35 2

at small grocery store has enly one check out counter at random from 1-6 min apart. Each possible value of IAT has the same probability of occurance.

The service time vary from 1 to 6 mins with probability shown below.

$$\frac{10}{100} = \frac{10}{25} = \frac{1$$

Average time system = Total time customers spends in strain of customers in strain in strains in st

$$u_1^*\overline{w} \in \cdot + = \frac{\varepsilon}{13} = \frac{\varepsilon}{9+\varepsilon+1} = \frac{\varepsilon}{13}$$

Average waiting = Total time customer wait in queuc wait in queuc and tin queuc

$$\frac{100 \text{ H} \cdot 9}{6} = \frac{94}{6} = \frac{94}{1-01} = \frac{94}{1-0$$

Average Time Sum of all time blw arrival

$$\frac{1}{48.4} = \frac{1}{64} = \frac{1}{64.34} = \frac{1}$$

Total no. of customers

Jotal Service Time

HYEROGE SERVICE

Time

Random digit for Service Time 84 10 74 53 17 91 79 67 38 89 sequentially. Calc. Any Service Time, probability of idle Service time, average blw arrivals & avg. time customer spent in System.

i Determine IAT Distribution Table

C·No	Probability (1/6)	Cumulative probability	Random digit assessment
1	٥،١٥	0.16	01-16
ચ	0.16	0.32	17-32
3	0.16	0.48	39-48
4	0.16	0.64	49-64
5	0.16	0 . 80	G5-80
G	0.16	0,96	81-9G

ii) Compute Arrival time from IAT

iv)	Compute	Service	lime
from	Distributi	on Table	<u>s</u>
1		0.5	OT

				A STATE OF THE PROPERTY OF THE			
2.No	RD	TAT	PΤ		S'No	RD	ST
4	-	-	0		1	84	4
a	13	1	1	n n	ą	10	1
3	२ २	2	3		3	74	4
4	15	1	4		4	. 53	3
5	48	3	7	*	5	17	ر ع
6	9	1	8		50A737	7	
7	22	2	10	"號("	G	91	5
8	53	4	14		7	79	4
9	35	3	17	10	8	67	4
10	೩	1	1.8		9	38	3
il De	termi	ne s	T Di	st. Table	10	89	5

SINO	Probability	CP	RDA
,	0.10	0.10	01-10
	0.20	0.30	11-30
ઢ		0.55	31-55
3	0.25	0.85	56-85
4	0.30	0.63	86-95

000	C2223	
1	2	1
(7)
/	1)

custo mens

imulation Table for 10

٥	Arrival	Service	Time Service	Time Service	Cust. time spent	Idle Server	Cust time wait
28	Time	Time	Begin	End	m/s uz	Time	in gueue
8	0	4	0	4	4	0	0
			4	Ŋ	4	0	(A)
	ჟ	4	Ŋ	6-	U	0	જ
Si .	4	ന	0-	<u>ਕ</u>	Qo ·	o	Ŋ
	tt	か	광	4	4	0	Ŋ
	φ	В	4	5	=	0	Ġ
	<u>o</u>	4	<u>ē</u>	6	<u> </u>	0	σ
	4	4	6)	ተ	<u>ത</u>	0	6
	-	ത	4 %	00	ū	0	0
	8	3	. 08	35	<u>†</u>	0	- -

erage Service Time = 35 = 3.5 min

0 o/g bability of Idle Scaver Time =

= & min rage Time blu arrivals = 18 01 min erage time Customer spent in system=

3. Consider a store with one checkout counter.

Prepare simulation table & find out average waiting time of customer in & waiting queue, probability of idle server, average service time

IAT: 3 2 6 4 4 5 8 7

ST: 4 5 5 8 4 6 2 3 4

Assume 1st customer arrives at t=0.

i) Interarrival distribution Table

C. No	TAT	PT
l	-	0
a	Э	3
3	2	5
4 5	နေ	11
5	4	15
6	4	19
7	5	24
8	8	32
9	7	39

ii) Simulation table for 9 customers

c. No	AΤ	ST	128	⊤s€	cust spent in sim.	Idle time	cust time wait in que
	0	4	0	4	4	0	O
2	3	5	4	9	G	O	1
3	5	5	.9	14	9	0	4
4	11	8	14	ર ૨	Ð	0	3
5	15	4	ર ૨	26	ıı ı	0	7
6	19	ေ	26	32	13	0	7
7	24	2	32	34	10	0	8
8	32	3	34	37	5	O	2
9	39	4	39	43	4	ચ	0.

Average waiting time of $=\frac{32}{7}=4.57$ min customer in waiting queue $=\frac{32}{7}=4.57$ min Probability of Idle Server $=\frac{2}{10}=0.2$ min Average Service Time $=\frac{41}{9}=4.56$ min

multichannel Problems :

Type I

4. Consider a simulation with a restaurant system where car & hope takes order & brings an item to the car. The car arrives in the manner:

Time blw arrival: 1 & 3 4
Probability: 0.25 0.40 0.20 0.15

Consider à persons Able & Baker. Able is better & bit faster than Baker.

Able Service Time :

ST: 2 3 4 5

Prob: 0.30 0.28 0.25 0.17

Baker Service Time:

ST: 3 4 5 6

Prob: 0.35 0.25 0.20 0.20

Take a random digit for arrival:

26 98 90 26 42 74 80 68 22

Random digit for service time:

95 21 51 92 89 38 13 61 50 49

1 De to	rmine Inter	Arrival dist	ribution Table			
c· No	Probability	Probability Cumulative				
*		Probability	Assessment			
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			

il Compute AT from

IAT distubution Table

c. No	RD	TAT	PT
1	-		0
ચ	26	2	2
3	98	4	6
4	90	4	10
5	26	શ્	12
6	42	2 (14
7	74	3	17
8	80	3	% 0
9	68	3	23
10	22	1	24

iii) Able Service Time
Distribution Table

S. No	Probability	CP	RDA
2	0.30	0.30	01-30
3	0.58	0.58	31-58
4	0.25	68.0	59-83
5	0.17	1.00	84-00

iv) Baker Service Time Distribution Table

S·No	Probability	CP	RDA
3	0.35	0 - 35	01-35
4	0.25	0.60	36-60
5	0.90	0.80	G1-80
G	0.80	1.00	81-00

V)Si	Simulation table for 10 customers C.No AT RD for 8T WhenAble When Baker Server Able Baker Cust. Idle was												
C.No	AT	RD for	ខា	when Able	when Baker is Available	Server Choosen	Ab TSB	U. TSE	Ba TSB	ker TSE	cust in 6/m	Idle	a cin
1	0	95 Seavice	6	0	. 0	A	0	5	_	-	5	time	que
a .	ર	81	·3. ₊	5	٥	В	-	-	೩	5	3.	2	0
3	6	-51	5)	F	5	A	6	9	-	-	3	1	0
4	10				5	P)	10	15	ar-	_	5	1	0
5	12	89	Æ.		5	В	-	-	12	18	G	7	0
6	14	3:	W.		18	A	15	18	-	-	4	0	1
7	17	13, 40		18	18	A	18	૱ ૦	-	-	3	0	1
8	೩೦	61	4	ર ૦	18	A	೩೦	24	_	-	4	0	0
8			-1									5	0
9	&ે3	50	4	24	18	В	-	-	&ે3	27	4		
10	84	49	3	24	२ न	В	24	ચ ન	_	-	3	0	0

5. Consider Simulation table for Able & Baker problem where time b/w arrival are:

Time blw arrival: 1 2 3 4 5

Probability: 0.20 0.15 0.05 0.20 0.40

Baker is faster than Able.

Service Time for Able :

ST: 3 4 5 6 2

Prob : 0.20 0.05 0.15 0.20 0.40

Service Time for Baker:

ST: 2 3 5 6 1

Prob: 0.15 0.20 0.05 0.20 0.40

Random Digit for Arrival:

98 90 42 80 22 26 74 26 68

Random Digit for Service Time:

49 50 61 13 38 89 92 51 21 95

i) Determine IAT distribution Table

e-No	Probability	CP	RDA
	0-20	0.20	01-20
. 2	0.15	0 • 35	21-35
3	0.05	0 • 4-0	36-40
4	0.20	0.60	41-60
5	0.40	1.00	61-00

ii) Compute Assival Time from IAT dist. table.

C.NO	RD	TAT	PT
1	*	-	0
2	98	5	5
3	90	5	10
4	42	4	14
5	80	5	19
6	22	2	21
7	&6	2	23
8	74	5	28
9	26	ર	30
10	68	5	35

iii) Able Service Time
Distribution Table

S·No	Р	СР	RDA .
3	0.90	0.20	01-20
4	0.05	0.85	21-25
5	0.15	0.40	26-40
6	0.20	0.60	41-60
. 2	0.40	1.00	61-00

iv) Baker Service Time Distribution Table

Р	CP	RDA
0.15	0.15	01-15
	0.35	16-95
	0.40	36-40
	0.65	41-60
	1-00	61-00
	P 0.15 0.20 0.05 0.20	0.15 0.15 0.20 0.35 0.05 0.40 0.20 0.60

y) Sim	ulation t	table to	54 [0	customers	S								
c. No	Arriva)	RD of	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		whenBaker			TSE	Bo	ker	Cust time spent in	Id b time of	Cast.
1	Time	Service	Time	is Avai labb		CHOOSED	158	156	186	156	spene	Server	d'uér
1	0	49	G	0	. 0	В	-	-	0	6	G	. 0	0
2	5	50	G	0	6	A	5	11	-	-	6	5	0
.3	10	: GI	1	11	6	8	-	-	10	11	1 7	4	0
10	14	13	2	11	11	В	-	-	14	16	2	3	0
4		38	5	1)	16	В	_	-	19	24	5	3	0
5	19	55	20		882,883	00000			0.50.000	1000		10	0
6	21	89	2	11	24	A	21	23	-	-	2		0
- 22	23	92	2	23	24	A	23	35	-	-	2	0	O
7	43	1	8 9		24						_	4	0
8	48	51	6	₹5	~4	В	-	-	28	34	6	-	0
_	30	21	4	25	34	В	30	34	-	-	4	5	
9	90	1		34	34		7	100.00	35	36	1	1	0
10	35	95	1		04	A	_	-	33	3.0			

Idu time of Server = TSB(n) - TSE(n-1)

Customer time waiting in queue = TSB-AT

Customer time Spent in S/m = TSE-A7

- 1	ww	\sim	105			no anteco		Described 1	5400 NO	-			
6.		er Abl							havir	19 0	qual	* •	
	probabi	ility o	atio 1	to	6 r	nin	apar	rt.					
k	Able	Service	Time	ha	ve eq	ual	Pao	babil	ity	rati	0 1 -	5 min	
	Baker	Service	Time	have	equ	al pr	obo	bility	rat	ho 1	1 - 4 m	in.	
		Digit									1-6		
	7 (2 (2) (2) (2) (2) (2) (2) (2)	9 9 (
											-		
1		n Digi											
1	59 ારી		29 28				5	14					
1		's fas											
1	Dote	enine.	TAT	Dista	ributi	on T	abl	e					
	C·No	ρ	CP	RDF									
1		0.16	0.16	01-	16			I d			-		
	2	0.16	0.33	17-	32								
	3	0.16	0.48	39-									
1	4	0.16	0.64	49-	-64								
ı	5	0.16	0.80	65-	- 80								
	6	0.16	0.96	81-	- q 6	1							
	ii) Comp	ute As	roci vol	Time	Laor	o If	TF	Dist.	Tabl	Ł			
1		0.00000	100 100	AT	AT	1							
1	C. No	-	-	-	0								
1	1	62		4	4								
ı	3	89		6	10						-		
	4	9			11								
	5	62		4	15				4				
	6	24		00	17								
	7	47	3	3	20								
	8	8		.	21								
	9	86		5	27								
	10	22		2	29	50						*	ja ja

- Distribution Table					Distribution labu							
S. No	Р	C	P	RDA		8 · No		Р	C	PA	RDA	
1	0.20	0	20	01-20				0.25	0.,	25	01-25	7
2	0.20	0.	40	21-40		2	1	0.25	0.	50	26-50	
3	0.20	0.60		41-60		3	3 0		0.	75	51-75	
4 0.20						4 0		.25 1.		00	76-0	0
5	0.90	1	00	81-00	-					-	1	_
mulat	ion To	able	tor	10 custo	erom							-
AT	RD of	a.T.	WhenA	100 March 1980 1980 1980 1980 1980 1980 1980 1980		Abu				Cust.	Idle	Cust.
			is Avail	able is Available	1		0.000	TSB	TSE	in sm	SGANGA	time wait in
0	59	3	0	0	A	0		-	-	3	0	.0
4	12	I	3	0	A	4	5	-	-	1	1	0
10	15	1	5	0	A	10	11	-	-	1	5	0
11-	ચ ૧	2	11	0	A	11	13	-	-	2	0	0
15	98	15	13	0	A	15	20	-	-	2	ર	0
17	83	4	40	0	8	-	-	17	21	2	17	0
೩೦	13	1	80	શ	В	20	21	-	-	1	0	0
21	16	1	21	શ1	A	ઢા	22	-	-	1	0	0
27	5	,	22	হ1	A	27	98	-	-	2	5	0
29	94	5	28	ર 1	A	å٩	34	-	-	5	1	0
	S. No 1 2 3 4 5 mulat AT 0 4 10 11 15 17 20 21 27 29	S.No P 1 0.20 2 0.20 3 0.20 4 0.20 5 0.20 MT RD of Service 0 59 4 12 10 15 11 29 15 98 17 83 20 13 21 16 27 5 29 94	S.No P C 1 0.20 0 2 0.20 0 3 0.20 0 4 0.20 0 5 0.20 1 mulation Table AT RD of ST Service 5 1 29 3 4 12 1 10 15 1 11 29 2 15 98 15 17 83 4 20 13 1 21 16 1 27 5 1 29 94 5	S.No P CP 1 0.20 0.20 2 0.20 0.40 3 0.20 0.80 4 0.20 0.80 5 0.20 1.00 mulation Table for AT RD of ST When A is Avail 0 59 3 0 4 12 1 3 10 15 1 5 11 29 2 11 15 98 15 13 17 83 4 20 20 13 1 20 21 16 1 21 27 5 1 22 29 94 5 28	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.80 G1-80 4 0.20 1.00 81-00 mulation Table for 10 custo AT RD of ST WhenAble WhenBaker is Available 0 59 3 0 0 4 12 1 3 0 10 15 1 5 0 11 29 2 11 0 15 98 15 13 0 17 83 4 20 0 20 13 1 20 21	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.80 G1-80 5 0.20 1.00 81-00 mulation Table for 10 customers AT RD of ST WhenAbly WhenBaker Server is Availably is Availably Chooses 0 59 3 0 0 A 1 12 1 3 0 A 10 15 1 5 0 A 11 29 2 11 0 A 15 98 15 13 0 A 20 13 1 20 21 A 21 16 1 21 21 A 29 94 5 28 21 A	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.80 G1-80 4 0.20 0.80 G1-80 5 0.20 1.00 81-00 mulation Table for 10 customers AT RD of ST WhenAblu WhenBaker Server Ab Service is Available is Available Chooseb TSB 0 59 3 0 0 A 0 10 15 1 5 0 A 10 11 29 2 11 0 A 15 11 29 2 11 0 A 15 11 83 4 20 0 B - 20 13 1 20 21 A 20 21 16 1 21 21 A A 21 29 94 5 28 21 A 29	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.60 41-60 4 0.20 0.80 G1-80 5 0.20 1.00 81-00 mulation Table for 10 customers AT RD of ST WhenAble WhenBaker Server Able is Available Choose TSB TSE 0 59 3 0 0 A 0 3 4 12 1 3 0 A 15 20 11 29 2 11 0 A 15 20 11 29 2 11 0 A 15 20 11 29 2 11 0 A 15 20 11 29 2 1 A 20 21 20 13 1 20 21 A 21 A 21 A 21 21 16 1 21 21 A A 21 A 28 29 94 5 28 A A A 29 34	S.No P CP RDA 0.20 0.20 01-20 2 0.25 2 0.20 0.40 21-40 3 0.25 4 0.20 0.80 G1-80 5 0.20 1.00 81-00 mulation Table for 10 customers AT RD of ST WhenAbly is Availably Choosen TSB TSE TSB 0 59 3 0 0 A 4 5 - 10 15 1 5 0 A 10 11 - 11 29 2 11 0 A 15 20 - 17 12 29 2 11 0 A 15 20 - 17 29 20 11 20 A 15 20 - 17 29 20 11 20 A 20 21 - 20 13 1 20 21 A 20 21	S.No P CP RDA 0.20 0.20 0.1-20 2 0.25 0.25 0.25 0.20 0.40 2.1-40 3 0.25 0.45 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.2	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.80 G1-80 5 0.20 1.00 81-00 Toulation Table for 10 customers AT RD of ST WhenAbly whenBoker Server TSB TSE TSB TSE is Availably is Availably Choose TSB TSE TSB TSE in sho 0 59 3 0 0 A 0 3 - 3 10 15 1 5 0 A 10 11 - 1 11 29 2 11 0 A 15 20 - 2 11 22 21 A 21 A 21 A 21 A 21 A 21 A	S.No P CP RDA 1 0.20 0.20 01-20 2 0.20 0.40 21-40 3 0.20 0.60 41-60 4 0.20 0.80 61-80 5 0.20 1.00 81-00 Toulation Table for 10 customers AT RD of ST WhenAbbi WhenBoker Server Abbi Baker Servitis ST is Available is Available Choose TSB TSE TSB TSE TSB TSE in sho Server 1 10 11 10 15 1 5 0 A 10 11 - 1 5 1 5 0 A 10 11 - 1 5 1 5 0 A 15 40 - 2 2 2 1 1 2 1 3 0 A 15 20 - 2 2 2 2 1 1 2 2 1 3 0 A 15 20 - 2 2 2 2 1 1 2 2 1 3 0 A 15 20 - 2 2 2 2 1 1 2 2 1 3 0 A 15 20 - 2 2 2 2 1 1 2 2 1 3 0 A 15 20 - 2 2 2 2 1 3 2 2 1 A 20 2 1