Assignment #12 Solutions

due Wednesday, December 4rd, 2019

1

(a)
$$\frac{3*4}{52} = \frac{3}{13}$$

(b)
$$\frac{4}{52} = \frac{1}{13}$$

(c)
$$\frac{13}{52} = \frac{1}{4}$$

$$\frac{1}{52}$$

2 Let X be the number of machines that were break down in a day.

$$P(X=3) = {10 \choose 3} 0.1^3 (1 - 0.1)^{10-3} = 0.057$$

3 Let X be number of trucks that have defective transmissions.

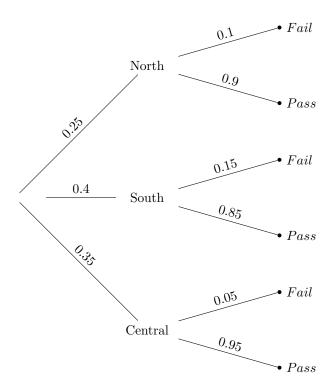
$$P(X \ge 3) = 1 - P(X \le 2) = 1 - \binom{7}{0}$$
$$= 0.2^{0} (1 - 0.2)^{7} + \binom{7}{1} 0.2^{1} (1 - 0.2)^{6} + \binom{7}{2} 0.2^{2} (1 - 0.2)^{5} = 0.15$$

4 The probability a given patient is a smoker if the patient has a serious illness is

$$P = \frac{0.23 * 0.18}{0.23 * 0.18 + 0.77 * 0.06} = 0.47.$$

5

(a) Below is the probability tree



(b)
$$P(Fail) = 0.25 * 0.1 + 0.4 * 0.15 + 0.35 * 0.05 = 0.1025$$

6

(a) Below is the excel table for 6(a).

1	Emergency Call					
2	Time btw					
	Emergency calls					
3	(hr.)	Prbability	Cumulative	Range		
4	1	0.05	0.00	[0,0.05]	Expected Value	3.65
5	2	0.10	0.05	(0.05,0.15]	Average	3.944444
6	3	0.30	0.15	(0.15,0.45]		
7	4	0.30	0.45	(0.45,0.75]		
8	5	0.20	0.75	(0.75,0.95]		
9	6	0.05	0.95	(0.95,1]		
10						
11	Day	Interarrivals	Service Time	Cumulative Time		
12	0	0.908240386	5	5		
13	0	0.994306853	6	11		
14	0	0.7595289	5	16		
15	0	0.108162916	2	18		
16	0	0.272107379	3	21		
17	1	0.380666699	3	24		
18	1	0.047170953	1	25		
19	1	0.912748126	5	30		
20	1	0.328741449	3	33		
21	1	0.574886413	4	37		
22	1	0.511095194	4	41		
23	1	0.604722732	4	45		
24	2	0.489741246	4	49		
25	2	0.156203357	3	52		
26	2	0.400499892		55		
27	2	0.80381764		60		
28	2	0.913955543	5	65		
29	2	0.988293226		71	-	
30	3	0.100908854	2	73		

- (b) The expected value of time is 3.65 hr, while the average time between calls is 3.94 hr. In this simulation, the average time between calls is slightly higher than the expected value of time.

 The expected value of time is a theoretical value. As the number of simulations increases, the sample mean of average time between calls would become close to the expected value.
- (c) 18 calls were made during the 3-day period. One cannot assume this is an average umber of calls per 3-day period. Run simulation many times. In each simulation, record the total number of calls made during the 3-day period. Then calculate the average of total number of calls made during the 3-day period.

7

Figure 1 shows the simulation results for problem 7. Among all trials, 3 out of 10 times that the robber is within 2 blocks of the store.

8

Figure 2 shows the simulation results for problem 8. The probability that the agency will not have a car available upon demand if $\frac{4}{14} = 0.29$. The agency should expand its fleet. To determine the optimal fleet size for the agency, one could try multiple simulation with more cars available.

1 Robbery															
2 Direction	Drhohility	, oviteliumi)	Coordinato	otcaibaco v otcaibaco v											
	ribability		v coolumate	y coolumate											
	0.25	0.00	0 0												
	0.25	0.50		0											
	0.25	0.75	-	0											
8															
9 Trial 1				Trial 2			Trial 3			Trial 4			Trial 5		
10 x coordinate y coordinate Random number	y coordinate	Random number		x coordinate	y coordinate	Random number	x coordinate y coordinate Random number	dinate Rai	ndom number	x coordinate y coordinate Random number	coordinate R	andom number	x coordinate y coordinate Random number	ordinate F	andom number
11 1	0	0.566778054		-1	0	0.903714844	1	0	0.561505832	0	-1	0.444299134	0	1	0.078334161
12 0	-1	0.3573903		1	0	0.602396029	0	1	0.149115135	0	-1	0.257061734	-1	0	0.900899476
·	0	0.890484896		0	-1	0.397069792	0	Ţ	0.303366015	0	1	0.046440918	1	0	0.707202489
14 0	1	0.201426324		0	-1	0.392105928	1	0	0.747004839	1	0	0.711208908	0	Н	0.053712376
15 1	0	0.632075578		-1	0	0.792021135	1	0	0.602477872	0	1	0.217462213	1	0	0.663846803
16 1	0	0.743434255		0	1	0.188497868	0	1	0.14112495	1	0	0.588299392	0	-1	0.314186507
17 0	1	0.081767467		-1	0	-1 0 0.773240597	0	1	0.11020338	0	-1	0.431246853	-1	0	0.850200533
18 0	-1	0.440262295		0	-1	0.350691056	0	Н	0.034049599	0	1	0.133030168	0	1	0.094118602
19 0	-1	0.410505971		0	-1	0.386081955	-1	0	0.93404328	1	0	0.711383417	1	0	0.597642401
20 1	0	0.669066631		1	. 0	0.554497363	1	0	0.671711395	1	0	0.604190415	1	0	0.533046281
21 3	-1			-1	-3		8	3		4	0		2	2	
22															
23 Trial 6				Trial 7			Trial 8			Trial 9			Trial 10		
24 x coordinate	y coordinate	x coordinate y coordinate Random number		x coordinate	y coordinate	Random number	x coordinate y coordinate Random number	dinate Rai	ndom number	x coordinate y coordinate Random number	oordinate R	andom number	x coordinate y coordinate Random number	ordinate F	andom number
25	0	0.732614371		0	1,	0 118982834	0	1	0.043196501	0	1	0.130888355	0	1	0.068386182
26 0	1	0.233653387		1	0	0.518350647	1	0	0.697017938	0	-	0.342252825	0	-1	0.482374992
27 -1	0	0.85543986		-1	0	0.934199423	-1	0	0.971118488	1	0	0.685296538	-1	0	0.981192522
28 0	-1	0.274293137		1	0		1	0	0.700550117	1	0	0.593539707	0	-1	0.45700424
29	0	0.621725294		1	0		0	Н	0.209279569	0	-1	0.264324486	0	1	0.246302244
30 0	-1	0.426414517		0	1	0.012596372	0	1	0.087644475	-1	0	0.772484821	0	-1	0.467892844
31 -1	0	0.894855939		0	-	0.086059611	0	П	0.208804101	0	1	0.003682592	-1	0	0.850968577
32 0	1	0.261328402		-1	0		0	Н	0.206307979	Ţ	0	0.76110943	0	1	0.183579371
33 -1	0	0.852708538		0	-1	0.396669988	0	-	0.251131912	0	1	0.110272034	0	Т	0.117134928
34 0	1	0.239713732		0	1	0.012187152	1	0	0.506085876	-1	0	0.797957205	-1	0	0.774982643
35 -1	-1			1			2	4		-1	1		-3	н	
															_

Figure 1: Problem 7

1 Rental Car Agency	gency									
Customers/D 3 ay	D Prbability	Cumulative	Range		Rental Duration (days)	Prbability	Cumulative	Range		
4 0	0.20	0.00	[0,0.2]		1	0.10	00:00	[0,0.1]		
1	0.20	0.20	(0.2,0.4]		2	0:30	0.10	(0.1,0.4]		
6 2	0.50	0.40	(0.4,0.9]		æ	0.40	0.40	(0.4,0.8]		
7 3	0.10	06:0	(0.9,1]		4	0.10	080	(0.8,0.9)		
∞ α					ıs	0.10	06.0	(0.9,1]		
Day	Number of Customers/Day	Random	Car 1: Rental Duration (days)	Random numbers	Random numbers Car 2: Rental Duration (days)	Random numbers	Car 3: Rental Duration (days)	Random numbers	Car 4: Rental Duration (days)	Random numbers
11 1	2	0.777728399		0.75996517	1	0.090130144	3	0.506117658	3	0.506117658
12 2	н	0.372967434		0.615701346	4	0.899604759	2	0.298177676	2	0.298177676
13 3	3	0.990338367		0.432761539	2	0.296059445	3	0.44937429	8	0.44937429
14 4	0	0.13194582	8	0.518049584	. 2	0.246561681	5	0.995761462	5	0.995761462
15 5	2	0.834522768		0.204004463	S	0.991171434	S	0.969482262	S	0.969482262
16 6	0	0.090353579		0.793533317	3	0.767082292	4	0.875176201	4	0.875176201
7 71	0	0.112179732		0.752180717		0.206805861	3	0.765245535	3	0.765245535
18 8	2	0.411397719		0.924985247	3	0.732658633	2	0.348925136	2	0.348925136
19 9	2	0.89489265		0.314472096	3	0.514550236	4	0.836215319	4	0.836215319
20 10	2	0.488239594	. 3	0.402947156	1	0.082793733	4	0.877946207	4	0.877946207
21 22 Avialability										
23 Day	Demannd	Car 1	Car 2	Car 3	Car 4	Cars Available in the begin Customer lost	Customer lost			
24 1	2	3	1	0	0		0			
25 2	1	2	4	0	0	3	0			
3 3	m	1			8	2	1			
27 4	0	0	2	. 2	2	1	0			
28 5	2	2			1	1	1			
29 6	0	1			0	3	0			
30 7	0	0			0	4	0			
31 8	2	5		0	0	4	0			
32 9	2	4		4	4	2	0			
33 10	2	3		. 3	3	0	2			
34	14	Ī					4			

Figure 2: Problem 8