

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)

$$\frac{13}{52} = \frac{1}{4}$$

(d)

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

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

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

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

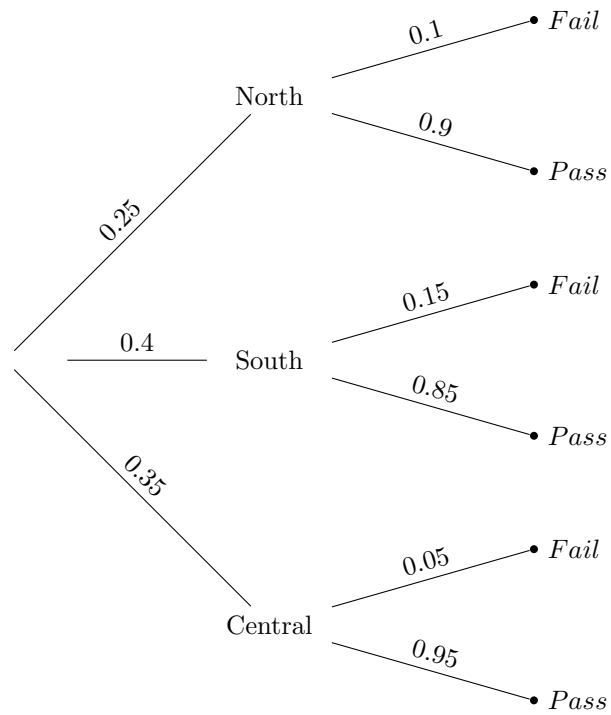
$$\begin{aligned} P(X \geq 3) &= 1 - P(X \leq 2) = 1 - \binom{7}{0} \\ &= 0.2^0 (1 - 0.2)^7 + \binom{7}{1} 0.2^1 (1 - 0.2)^6 + \binom{7}{2} 0.2^2 (1 - 0.2)^5 = 0.15 \end{aligned}$$

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						
3	Time btw Emergency calls (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	3.9444444
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	3	55		
27	2	0.80381764	5	60		
28	2	0.913955543	5	65		
29	2	0.988293226	6	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 number 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.

Figure 1: Problem 7

Figure 2: Problem 8