Student Information

Full Name : Kerem Karabacak
Id Number : 2644417

Answer 1

a)

Formula of expected value, E(x) is:

$$\sum xP(x)$$

According to that:
E(Blue) : 1*(1/6) + 2*(1/6) + 3*(1/6) + 4*(1/6) + 5*(1/6) + 6*(1/6) = 3.5
E(Yellow) : 1*(3/8) + 3*(3/8) + 4*(1/8) + 8*(1/8) = 3
E(Red) : 2*(1/2) + 3*(1/5) + 4*(1/5) + 6*(1/10) = 3

b)

Expected value is good parameter to evaluate this question.
Option 1 = E(Blue) + E(Yellow) + E(Red) = 9.5
Option 2 = 3*E(Blue) = 10.5
We have higher expected value for 3 blue dices. Selection should be 3 blues.

c)

Option 1 = E(Blue) + 8 + E(Red) = 14.5
Option 2 = 3*E(Blue) = 10.5
This time we have higher value for three color option. Selection should be 3 color.

d)

We can use Bayes theorem for P(dice is red | value is 3). Let's say P(X):

$$P(X) = \frac{P(value\ is\ 3 \mid dice\ is\ red) * P(dice\ is\ red)}{P(value\ is\ 3)}$$

Let's P(Y) for P(dice is red | value is 3):

$$P(Y) = 0.2$$

$$P(dice\ is\ red) = 0.33$$

We should use law of total probability for P(value is 3):

$$P(value\ is\ 3) = (1/3) * (1/6) + (1/3)(3/8) + (1/3)(1/5) = 0.247$$

$$P(X) = \frac{(0.2)(0.33)}{0.247} = \underline{0.267}$$

e)

We can evaluate the different cases and then sum them up:
P(Blue = 1, Yellow = 4) = (1/6) * (1/8) = 0.021
P(Blue = 2, Yellow = 3) = (1/6) * (3/8) = 0.063
P(Blue = 4, Yellow = 1) = (1/6) * (3/8) = 0.063
P(Blue + Yellow = 5) = $\underline{0.147}$

Answer 2

a)

We have large n and small p (n $\geq$ 30 and p $\leq$ 0.05). Because of that Poission approximation to Binomial can bu used, and also we know that frequency is 1, since tomorrow's probability is asked.

$$E(X) = np = 80.(0.025) = 2 = \lambda$$

Question is asking about at least 4 discount. That means P(X $\geq$ 4). In this way we can't use cdf table. So we should express it in different way:

$$P(X \geq 4) = 1 - P(X < 4) = 1 - P(X \leq 3) = 1 - F_X(3)$$

From cdf table of Poisson distribution $F_X(3) = 0.857$.

$$P(X \geq 4) = 1 - 0.857 = \underline{0.143}$$

b)

At least 1 discount offer from any distributor is enough to buy a phone. There is 2 case for days, we can get discount 1st day or 2nd day. Poisson approximation to binomial can be used again. We should look for two days indepentdently, so frequency should be evaluated as 1 for both days. λ is 2 from previous question. We can compute getting a discount from A distributors:

$$P(X \geq 1) = 1 - P(X = 0) = 1 - F_X(0) = 1 - 0.135 = 0.865$$

Now let's consider getting discount 1st day case. Since second day's discounts are not affecting the probability, no need to look for second day:

$$(0.865)(0.1) + (0.865)(0.9) + (0.135)(0.1) = 0.8785$$

For 2nd day we shouldn't get discount for 1st day, and we know getting a discount probability from 1st day case. Since 1st and 2nd days are independent, we can directly use multiplications:

$$(0.135)(0.9)(0.8785) = 0.107$$

$$0.8785 + 0.107 = \underline{0.9855}$$

Answer 3

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Blue = [1,2,3,4,5,6];
Yellow = [1,1,1,3,3,3,4,8];
Red = [2,2,2,2,2,3,3,4,4,6];
randomIndex = 0;
total1 = 0;
total2 = 0;
counter = 0;
for i = 0:999
temp1 = total1;
temp2 = total2;
randomIndex = randi(length(Blue),1);
total1 += Blue(randomIndex);
randomIndex = randi(length(Yellow),1);
total1 += Yellow(randomIndex);
randomIndex = randi(length(Red),1);
total1 += Red(randomIndex);
randomIndex = randi(length(Blue),1);
total2 += Blue(randomIndex);
randomIndex = randi(length(Blue),1);
total2 += Blue(randomIndex);
randomIndex = randi(length(Blue),1);
total2 += Blue(randomIndex);
if ((total2-temp2) > (total1-temp1))
counter++;
endif
endfor
total1Avg = total1/1000
total2Avg = total2/1000
percentageAvg = counter/10
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Name	Class	Dimension	Value	Attribute
percentageAvg	double	1x1	55	
total1Avg	double	1x1	9.4980	
total2Avg	double	1x1	10.516	

The average values are very close to expected values as expected. If we had more iterations those values will be closer and variance will be lower. Therefore every time we run the program we can see more accurate values. Option 2 is greater for 55 percent. Since expected value is bigger for 2nd case this value is normal to be bigger than 50.