Student Information

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Answer 1

a)

$$E(X) = x_1 f(x_1) + x_2 f(x_2).....$$

Expectation for blue: Probability of the variables are the same and it is 1/6. $E(X) = (1*1/6) + (2*1/6) + (3*1/6) + (4*1/6) + (5*1/6) + (6*1/6) = 21/6 = 7/2 = 3.5$
Expectation for yellow: Probability of the variables are the same and it is 1/8. $E(X) = (1*1/8) + (1*1/8) + (1*1/8) + (3*1/8) + (3*1/8) + (3*1/8) + (4*1/8) + (8*1/8) = 24/8 = 3$
Expectation for red: Probability of the variables are the same and it is 1/10. $E(X) = (2*1/10) + (2*1/10) + (2*1/10) + (2*1/10) + (2*1/10) + (3*1/10) + (3*1/10) + (4*1/10) + (4*1/10) + (6*1/10) = 30/10 = 3$

b)

Expectation of rolling a single die of each color is $3 + 3 + 3.5 = 9.5$. Expectation of rolling three blue dice is $3.5 * 3 = 10.5$ Since $10.5 > 9.5$, I prefer three blue dice.

c)

Of course i prefer yellow die with value 8 because its expectation value will be 14.5. $3 + 3.5 + 8 = 14.5 > 10.5$.

d)

The probability is $P(R|three) =$ The probability of choosing red under the condition the value of the die is 3. $P(R|three) = \frac{P(R \cap three)}{P(three)} = \frac{1/3*1/5}{(1/3*1/6)+(1/3*3/8)+(1/3*1/5)} = \frac{1/15}{89/360} = 24/89 = 0.2697$
where $P(R) =$ choosing red die and $P(three) =$ choosing the die with value 3.

e)

Because the two events are independent we can multiply them to calculate probability of two event.
The possible events which has the property of the sum of two values of dice is 5:
(the value of blue die, the value of yellow die):

$$(1, 4), (2, 3), (4, 1)$$

$P((1,4)) = 1/6 * 1/8 = 1/48$
$P((2,3)) = 1/6 * 3/8 = 3/48$
$P((4,1)) = 1/6 * 3/8 = 3/48$
$P((1,4)) + P((2,3)) + P((4,1)) = 7/48$.

Answer 2

a)

We can find the probability by using the poisson distribution.
$\lambda = 80 * 0.025 = 2$
$F(X) =$ probability that x distributors of company A will offer a discount tomorrow.
The probability that at least four distributors of company A will offer a discount tomorrow $=$ $1 - F(3)$
$F(3) = P(0) + P(1) + P(2) + P(3)$ where $P(x) = e^{-\lambda}\frac{\lambda^x}{x!}$
$P(0) = e^{-2}\frac{2^0}{0!} = 0.135335$
$P(1) = e^{-2}\frac{2^1}{1!} = 0.270671$
$P(2) = e^{-2}\frac{2^2}{2!} = 0.270671$
$P(3) = e^{-2}\frac{2^3}{3!} = 0.180447$
$F(3) = 0.857124$
$1 - F(3) = 1 - 0.857124 = 0.142876$
Therefore, the answer is 0.142876.

b)

We can find the values with poisson distribution. We should find the probabilities of zero distributors of companies, and we should subtract their sum from 1 to have at least one 1 company that offers a discount. $1 - (P_a(0)P_b(0))$ To find the unknown values $P_A(0)$ and $P_B(0)$: For A: $\lambda = n \cdot p \cdot 2 = 80 \cdot 0.025 \cdot 2 = 4$
From the equation for poisson distribution we have: $P(x) = e^{-\lambda}\lambda^x/x!$
$P_A(0) = e^{-4} = 0.018315$
For B: $\lambda = n \cdot p = 1 \cdot 0.1 \cdot 2 = 0.2$
From the equation for poisson distribution we have: $P(x) = e^{-\lambda}\lambda^x/x!$
$P_B(0) = e^{-0.2} = 0.818730$
$1 - (P_A(0)P_B(0)) = 1 - 0.014995 = 0.985005$
Another solution for B case:
We can find that probability of 0 discount from company B with $1 - P(0)P(0)$ where $P(0)$ is the 0 discount from B company a day. For two days it is $P_B(0) \cdot P_B(0) = 0.9 \cdot 0.9 = 0.81$.
$1 - (P_A(0)P_B(0)) = 1 - 0.0148351 = 0.985116$
Therefore, the answer is 0.985.

Answer 3

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AvgTotFirstOption = 9.4960
AvgTotSecondOption = 10.432
PercentageOfTheCases = 55.600
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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];
sum1=0;sum2=0;
no = 0;
for i = 1:1000
    roll1 = randi(6);
    roll2 = randi(8);
    roll3 = randi(10);
    sumfirst = blue(roll1)+yellow(roll2)+red(roll3);
    sum1 += sumfirst;
    roll1 = randi(6);
    roll2 = randi(6);
    roll3 = randi(6);
    sumsecond = blue(roll1)+blue(roll2)+blue(roll3);
    sum2 += sumsecond;
    if (sumsecond > sumfirst)
        no++;
    endif
endfor

AvgTotFirstOption = sum1/1000
AvgTotSecondOption = sum2/1000
PercentageOfTheCases = no / 1000 * 100
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We can see here the first two values are very close to the values we calculated in $Q1a$ but not the same because the calculations are only approximations of the real events. The third value is a little bit higher than 50 because expectation of the second option is 10.5, and the first option is 9.5. There is little difference. Because of that, it is a little bit higher than 50.