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Answer 1

a)

$E(Blue) = 1 * (1/6) + 2 * (1/6) + 3 * (1/6) + 4 * (1/6) + 5 * (1/6) + 6 * (1/6) = 3.5$
$E(Yellow) = 1 * (3/8) + 3 * (3/8) + 4 * (1/8) + 8 * (1/8) = 3$
$E(Red) = 2 * (5/10) + 3 * (2/10) + 4 * (2/10) + 6 * (1/10) = 3$

b)

We need to compare the expected values of two options.
The expected value of rolling one of each dice is $= E(Blue) + E(Yellow) + E(Red) = 9.5$
The expected value of rolling blue dice for 3 times is $= 3 * E(Blue) = 10.5$
So we should choose the second option.

c)

In this case the expected value of first option will change, it will be $E(Blue)+8+E(Red) = 14.5$.
But the expected value of second option is still the same, we should choose the first option.

d)

Here we need to use the Bayes' Rule to calculate

$$P(Red|3) = \frac{P(3|Red) * P(Red)}{P(3)}$$

$P(Red) = 1/3$ since each color has equal probability in random choosing.

$P(3|Red) = 2/10$ because 2 sides of the dice are red.

For $P(3)$ we will use the Law of Total Probability

$$P(3) = P(3|Red) * P(Red) + P(3|Blue) * P(Blue) + P(3|Blue) * P(Blue)$$

Which is $(1/3) * (2/10 + 1/6 + 3/8) = 0.24722$

When we plug in the values we get $P(Red|3) = 0.26966$

e)

There are $6 * 8 = 48$ different outcomes. Out of that 48, 7 outcomes makes the total value 5. So the answer is 7/48.

Answer 2

a)

We will use binomial distribution, becasue we have a fixed number of trials and each trial has a fixed probability of success. Let X be the number of distributors of company A that offer a discount tomorrow. Then for n = 80 and p = 0.025. We will find $P(X \geq 4)$.

$$P(X \geq 4) = 1 - P(X < 4) = 1 - (P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3))$$

If we plug in the values for each term in the formula,

$$\binom{n}{x} p^x q^{n-x}$$

We get 0.14057 as the result.

b)

Let P(A) be the probability that we can buy a phone from company A in two days and P(B) be the probability that we can buy a phone from company B in two days. We need to calculate

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

For A we know that there are 80 distributors, they offer a discount with a probability of 0.025. So, the probability that a distributor does not offer a discount is 1 - 0.025 = 0.975, and the probability that none of the 80 distributors offer a discount is $(0.975)^{80} = 0.131937$. We want to know the probability of buying a phone in two days. Since the events of offering a discount on different days are independent, the probability of not being able to buy a phone from Company A in two days is $(0.975^{80})^2 = 0.017407$. Therefore, the probability that we can buy a phone from Company A in two days is:

$$P(A) = 1 - 0.017407 = 0.982592$$

For B we know that there are only one distributor, they offer a discount with a probability of 0.1. So, the probability that a distributor does not offer a discount is 1 - 0.1 = 0.9. We want to know the probability of buying a phone in two days. Since the events of offering a discount on different days are independent, the probability of not being able to buy a phone from Company B in two days is $(0.9)^2 = 0.81$. Therefore, the probability that we can buy a phone from Company B in two days is:

$$P(B) = 1 - 0.81 = 0.19$$

For $P(A \cap B)$ since the events are independent we can use the formula $P(A \cap B) = P(A) * P(B)$ if we plug in the values

$$P(A \cap B) = 0.186692$$

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Finally,

$$P(A \cup B) = 0.9859004$$

Answer 3

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blue_dice = [1, 2, 3, 4, 5, 6];
yellow_dice = [1, 1, 1, 3, 3, 3, 4, 8];
red_dice = [2, 2, 2, 2, 2, 3, 3, 4, 4, 6];

function result = roll_die(die, num_rolls)

    if nargin < 2
        num_rolls = 1;
    end

    result = sum(randi([1, length(die)], 1, num_rolls));
end

function total = roll_one_of_each(blue_dice, yellow_dice, red_dice)
    total = roll_die(blue_dice) + roll_die(yellow_dice) + roll_die(red_dice);
end

function total = roll_three_blue(blue_dice)
    total = roll_die(blue_dice, 3);
end

option1_total = zeros(1, 1000);
for i = 1:1000
    option1_total(i) = roll_one_of_each(blue_dice, yellow_dice, red_dice);
end

option2_total = zeros(1, 1000);
for i = 1:1000
    option2_total(i) = roll_three_blue(blue_dice);
end

avg_option1_total = mean(option1_total);
avg_option2_total = mean(option2_total);
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percentage_option2_greater = sum(option2_total > option1_total) / 1000 * 100;

printf("Average total value for option 1: %.2f\n", avg_option1_total);
printf("Average total value for option 2: %.2f\n", avg_option2_total);
printf("Percentage of cases where option 2 is greater than option 1: %.2f%%\n", percenta
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Average total value for option 1: 12.79
Average total value for option 2: 10.45
Percentage of cases where option 2 is greater than option 1: 28.70%
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Here I was expecting that the average total value for option 2 to be grater than the average total value for option 1 since the expected value of option 2 is greater than the expected value of option 1 but the result is otherwise. I think this is because of the randomness of the events.