Student Information

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Answer 1

a)

Variables are discrete from each other. Therefore, we will use the equation $E(x) = \sum x * f(x)$.

For blue dice:
$E(x) = \sum x * f(x) = 1 * 1/6 + 2 * 1/6 + 3 * 1/6 + 4 * 1/6 + 5 * 1/6 + 6 * 1/6 = 3.5$
For yellow dice:
$E(x) = \sum x * f(x) = 1 * 3/8 + 3 * 3/8 + 4 * 1/8 + 8 * 1/8 = 3$
For red dice:
$E(x) = \sum x * f(x) = 2 * 5/10 + 3 * 2/10 + 4 * 2/10 + 6 * 1/10 = 3$

b)

I would choose the 3 blue dice option since the sum of expected values of that option is greater than the other choice.
Three blue dice: $3.5 + 3.5 + 3.5 = 10.5$
A single dice from each color: $3.5 + 3 + 3 = 9.5$

c)

I would choose a single die of each color because this time the expected value of the yellow die becomes 8 which makes the single die of each color option's expected value greater.
Three blue dice: $3.5 + 3.5 + 3.5 = 10.5$
A single dice from each color: $3.5 + 8 + 3 = 14.5$

d)

$T \rightarrow$ getting three as result
$R \rightarrow$ the dice is red

$$P(R|T) = \frac{P(T|R) * P(R)}{P(T|R) * P(R) + P(T|\overline{R}) * P(\overline{R})}$$

$P(R) = 1/3$, $P(\overline{R}) = 2/3$, $P(T|R) = 2/10 = 1/5$, $P(T|\overline{R}) = 1/2 * 1/6 + 1/2 * 3/8 = 13/48$

$P(R|T) = \dfrac{1/5 * 1/3}{1/5 * 1/3 + 13/48 * 2/3}$

$P(R|T) = 0.2696$

e)

When we roll blue and yellow dice together, the number of possible outcomes will be 48.(6*8)
Combinations of getting a total value of 5 are:

Blue Dice	Yellow Dice	Possibility
1	4	1/6*1/8 = 1/48
4	1	1/6*3/8 = 3/48
2	3	1/6*3/8 = 3/48
3	2	1/6*0 = 0

The result is 1/48 + 3/48 + 3/48 + 0 = 7/48 = 0.146

Answer 2

a)

Normally, this is a binomial distribution question because days are independent from each other. However, it is better to us poisson approximation to binomial because n = 80 $\geq$ 10, and p = 0.025 $\leq$ 0.05. The equation which leads to this approximation is $\lambda = n * p$. Moreover, the poisson distribution is $P(X = x) = \dfrac{e^{-\lambda} * \lambda^x}{x!}$.

p = possibity for A to make a discount on a specific day = 0.025
n = 80
λ = n*p = 80*0.025 = 2
At least 4 $\implies P(X \geq 4) = 1 - F(3)$
$P(X \geq 4) = 1 - F(3)$
$P(X \geq 4) = 1 - \dfrac{e^{-2} * 2^3}{3!} - \dfrac{e^{-2} * 2^2}{2!} - \dfrac{e^{-2} * 2^1}{1!} - \dfrac{e^{-2} * 2^0}{0!}$

$P(X \geq 4) = 1 - 0.8578 = 0.1428$

b)

Let A: A makes a discount,
Let B: B makes a discount.
In order to buy a telephone, A or B must make a discount.
P(A or B) = 1 - P(not A and not B)
Probability of A to not make a discount = $\binom{80}{0} * (0.025)^0 * (0.975)^80 = 0.131$
Probability of B to not make a discount = $\binom{1}{0} * (0.1)^0 * (0.9)^1 = 0.9$

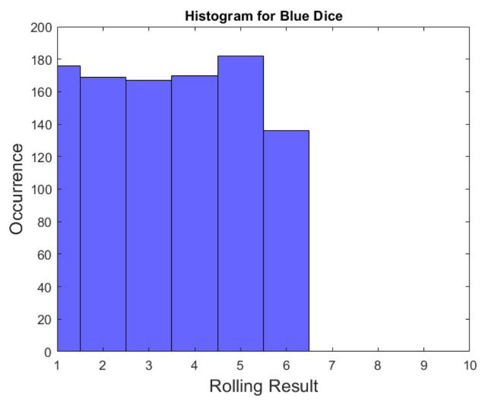
Probability of not making a discount in 2 days for A and B:
– A doen't make a discount on day 1.
– A doen't make a discount on day 2.
– B doen't make a discount on both days.
Then, Probability of not making a discount in 2 days for A and B = (0.131)*(0.131)*(0.9)*(0.9) = 0.139
P(A or B) = 1 - 0.139 = 0.986

Answer 3

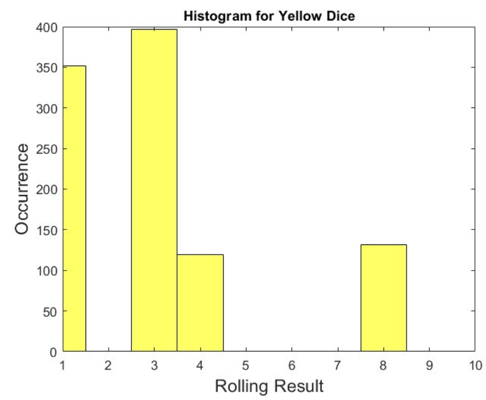
```
%%My Code
roll_dice_and_plot()
roll_dice_1000_times()

function []= roll_dice_1000_times()
    count = 0
    b_dice = randsample([1 2 3 4 5 6], 1000, true, [1/6 1/6 1/6 1/6
        1/6 1/6])
    y_dice = randsample([1 3 4 8], 1000, true, [3/8 3/8 1/8 1/8])
    r_dice = randsample([2 3 4 6], 1000, true, [5/10 2/10 2/10
       1/10])

    first_opt = [b_dice + y_dice + r_dice]
    second_opt = [b_dice + b_dice + b_dice]

    for n = 1:length(first_opt)
        if second_opt(n) > first_opt(n)
            count = count + 1
        end
    end
    per = count/1000
```

```
    disp(['Percentage of the cases where the total value of the
       second option is greater than the first option is ',num2str(
       per)])

end



function []= roll_dice_and_plot()

    N = 1000
    b_dice = randsample([1 2 3 4 5 6], N, true, [1/6 1/6 1/6 1/6
       1/6 1/6])
    y_dice = randsample([1 3 4 8], N, true, [3/8 3/8 1/8 1/8])
    r_dice = randsample([2 3 4 6], N, true, [5/10 2/10 2/10 1/10])

    av_val_op1 = sum(b_dice + y_dice + r_dice)/(N)
    av_val_op2 = sum(b_dice + b_dice + b_dice)/(N)

    if av_val_op1 > av_val_op2
        disp('Rolling a single die of each color is preferrable.')

    elseif av_val_op2 > av_val_op1
        disp('Rolling three blue dice is preferrable.')


    else
        roll_dice()
    end

    figure
        histogram(b_dice,FaceColor="b");
        xlim([1, 10]);
        xlabel('Rolling Result', 'FontSize', 14);
        ylabel('Occurrence', 'FontSize', 14);
        title('Histogram for Blue Dice')

        figure
        histogram(y_dice,FaceColor="y");
        xlim([1, 10]);
        xlabel('Rolling Result', 'FontSize', 14);
        ylabel('Occurrence', 'FontSize', 14);
        title('Histogram for Yellow Dice')
```

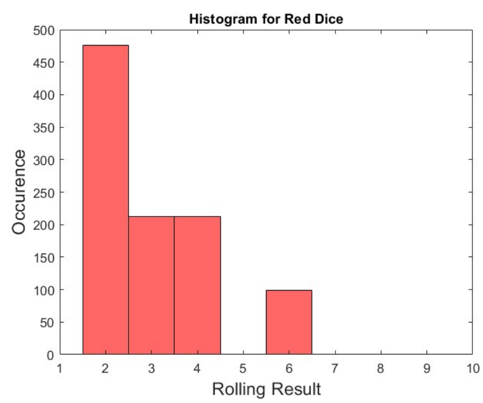
```
    figure
    histogram(r_dice,FaceColor="r");
    xlim([1, 10]);
    xlabel('Rolling Result', 'FontSize', 14);
    ylabel('Occurence', 'FontSize', 14);
    title('Histogram for Red Dice')
end
```



(a) Blue Dice



(b) Yellow Dice



(c) Red Dice

Figure 1: Graphs of Results

```
av_val_op1 =

    9.5290


av_val_op2 =

   10.2630

Rolling three blue dice is preferrable.
>>
```

(a) Printed Result of the Experiment

```
per =

    0.5720

Percentage of the cases where the total value of the second option is greater than the first option is 0.572
>>
```

(b) Printed Result of Percentage of Option 2 Wins