Student Information

Full Name: Batuhan Akçan
Id Number: 2580181

Answer 1

a)

For blue:
$P(1) = 1/6,\ P(2) = 1/6,\ P(3) = 1/6,\ P(4) = 1/6,\ P(5) = 1/6,\ P(6) = 1/6.$
$E(X) = \Sigma\ xP(x) = 1 \cdot 1/6 + 2 \cdot 1/6 + 3 \cdot 1/6 + 4 \cdot 1/6 + 5 \cdot 1/6 + 6 \cdot 1/6 = 3.5.$
For yellow:
$P(1) = 3/8,\ P(3) = 3/8,\ P(4) = 1/8, P(8) = 1/8.$
$E(X) = 1 \cdot 3/8 + 3 \cdot 3/8 + 4 \cdot 1/8 + 8 \cdot 1/8 = 3.$
For red:
$P(2) = 1/2,\ P(3) = 1/5,\ P(4) = 1/5, P(6) = 1/10.$
$E(X) = 2 \cdot 1/2 + 3 \cdot 1/5 + 4 \cdot 1/5 + 6 \cdot 1/10 = 3.$

b)

I would prefer rolling three blue dices because:
Expected total value of rolling a single dice of each colors: $E_{blue}(X) + E_{yellow}(X) + E_{red}(X) = 9.5.$
Expected total value of rolling 3 blue dices: $E_{blue}(X) \cdot 3 = 10.5.$
$10.5 > 9.5.$

c)

Expected total value of rolling a single dice of each colors would change to 14.5. That's why, I would choose rolling a single dice of each colors.
$E_{blue}(X) + 8 + E_{red}(X) = 14.5\ >\ E_{blue}(X) \cdot 3 = 10.5.$

d)

V: value of the dice is 3
R: the rolled dice is red
The question is asking us to find $P(R|V)$, which is equal to $\frac{P(V|R) \cdot P(R)}{P(V)}$.
$P(V|R) = 2/10 = 1/5.$
$P(R) = 1/3.$
$P(V) = 6/24 = 1/4.$ (total number of 3's divided by total number of values)
Hence, $P(R|V) = \frac{\frac{1}{5} \cdot \frac{1}{3}}{\frac{1}{4}} \approx 0.2667.$

e)

1 from blue, 4 from yellow: $P_{blue}(1) \cdot P_{yellow}(4) = 1/6 \cdot 1/8 = 1/48$.
2 from blue, 3 from yellow: $P_{blue}(2) \cdot P_{yellow}(3) = 1/6 \cdot 3/8 = 3/48$.
4 from blue, 1 from yellow: $P_{blue}(4) \cdot P_{yellow}(1) = 1/6 \cdot 3/8 = 3/48$.
Result: $1/48 + 3/48 + 3/48 = 7/48 \approx 0.1458$.

Answer 2

a)

I will use Poisson approximation of Binomial Distribution in this part.
$n = 80,\ p = 0.025\ \rightarrow \lambda = n \cdot p = 2$.
$P\{X >= 4\} = 1 - F(3) = 1 - 0.857 = 0.143$.

b)

I will use Poisson approximation of Binomial Distribution for Company A, Binomial Distribution for Company B.

A: company A offers a discount
B: company B offers a discount
C: a discount is offered

We will try to find $P_C\{X >= 1\}$ which means at least 1 discount is offered (assuming that we can buy a phone when at least 1 discount is offered).

$P_A\{X >= 1\}$ means that at least 1 discount is offered by company A. Since $\lambda = 2$ for one day for A (found in the previous part), for two days, $\lambda = 4$. $P_A\{X >= 1\} = 1 - F_A(0) = 0.982$.

$P_B\{X >= 1\}$ means that at least 1 discount is offered by company B. Since we are doing the experiment for 2 days, $n = 2$. Also, $p = 0.1$ which is given. $P_B\{X >= 1\} = 1 - F_B(0) = 0.190$.

With $\lambda = 4$, $P_A\{X = 0\} = 0.018$.

With $n = 2$ and $p = 0.1$, $P_B\{X = 0\} = 0.81$.

Hence, the result is:
$P_C\{X >= 1\} = P_A\{X >= 1\} \cdot P_B\{X = 0\} + P_A\{X = 0\} \cdot P_B\{X >= 1\}$
$= 0.982 \cdot 0.81 + 0.190 \cdot 0.018 = 0.79884$.

Answer 3

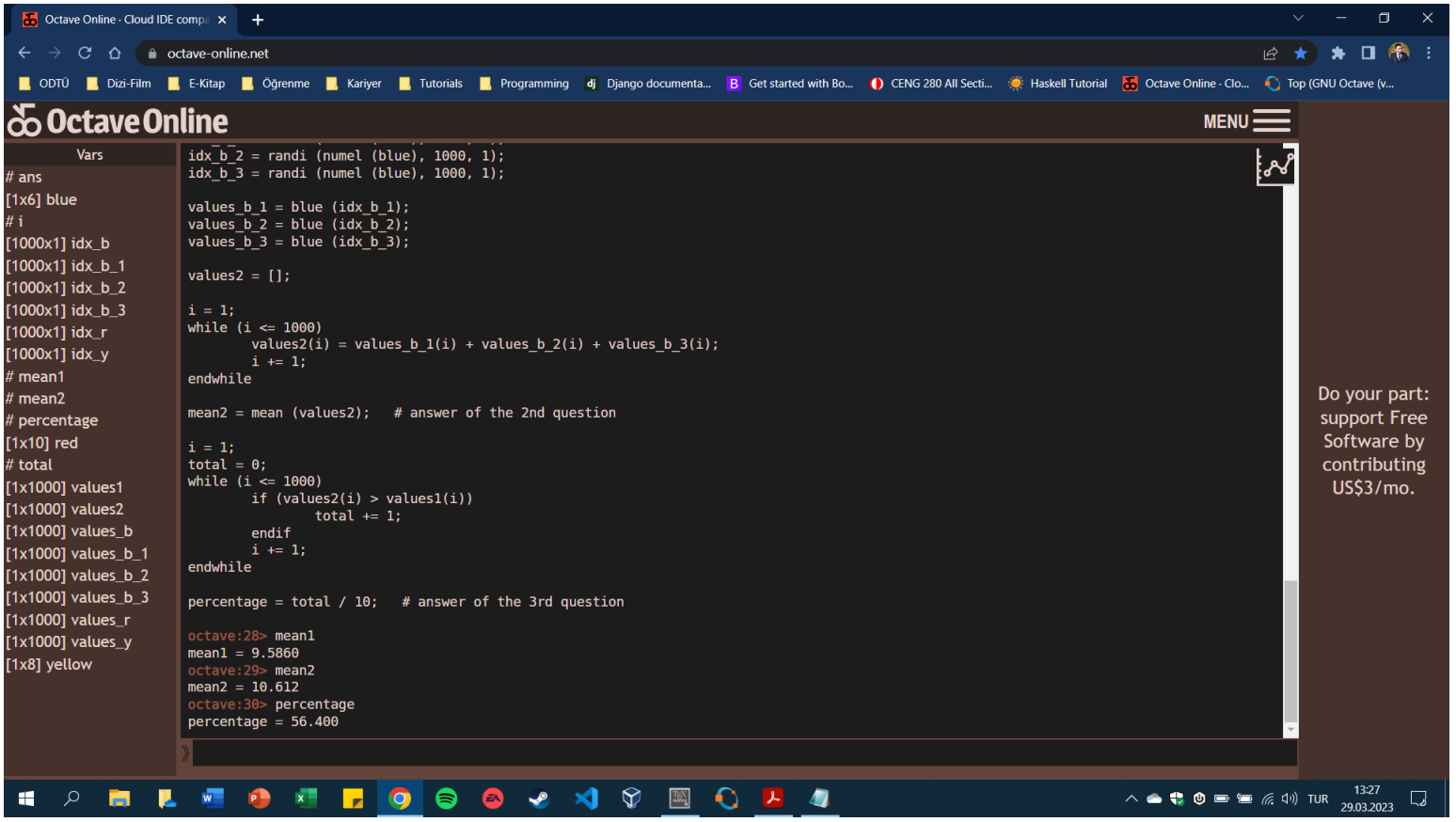
Average total value for the first option: 9.586
Average total value for the second option: 10.612
Percentage of the cases where the total value of the second option is greater than the first option: 56.4

My code:

```
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];

idx_b = randi (numel (blue), 1000, 1);
idx_y = randi (numel (yellow), 1000, 1);
idx_r = randi (numel (red), 1000, 1);

values_b = blue (idx_b);
values_y = yellow (idx_y);
values_r = red (idx_r);

values1 = [];

i = 1;
while (i <= 1000)
    values1(i) = values_b(i) + values_y(i) + values_r(i);
    i += 1;
endwhile

mean1 = mean (values1);   # answer of the 1st question

idx_b_1 = randi (numel (blue), 1000, 1);
idx_b_2 = randi (numel (blue), 1000, 1);
idx_b_3 = randi (numel (blue), 1000, 1);

values_b_1 = blue (idx_b_1);
values_b_2 = blue (idx_b_2);
values_b_3 = blue (idx_b_3);

values2 = [];

i = 1;
while (i <= 1000)
    values2(i) = values_b_1(i) + values_b_2(i) + values_b_3(i);
    i += 1;
endwhile

mean2 = mean (values2);   # answer of the 2nd question
```

```
i = 1;
total = 0;
while (i <= 1000)
    if (values2(i) > values1(i))
        total += 1;
    endif
    i += 1;
endwhile

percentage = total / 10;    # answer of the 3rd question
```

The screenshot:



Comments:

The results 9.586 and 10.612 are approximately equal to the results I have found in Q1b, that are 9.50 and 10.50.
The percentage is greater than 50%, which is what I expected because $10.612 > 9.586$. If the percentage had been 50%, then the resultant mean values would have been nearly equal to each other.