Assignment 1

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Task 1

The loop runs from 2 to n+1. So, the total number of times loop will run will be $n+1-2 = n-1$ times. Since we don't care about constants or lower terms while calculating time complexities,

in θ notation, time complexity of this function is n.

Task 2

Re-implementing the code from task 1 using recursive function, we get:

```
def factorial(n):
        result = 1
        if(n==1):
                return 1
        else:
                result= n * factorial(n-1)
        return result
```

Task 3

There is a nested loop in use here. For the first loop with i, it will run for n times and the second loop will have a run time depending on i. The run time of this code looks like an arithmetic series which will be

$$\frac{n(n+1)}{2} = \frac{n^2}{2} + \frac{n}{2} \tag{1}$$

we don't care about the constants and lower indexed value so, the time complexity for this function, in θ notation is n^2.

Task 4

We are given:

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \qquad B = \begin{bmatrix} e \\ f \end{bmatrix}$$

A * B =

$$\begin{bmatrix} ae + bf \\ ce + df \end{bmatrix}$$

Task 5

Given, the function: $f(x) = 3x^2 + 5x - 7$.
The first derivative $f'(x)$ would be

$$f'(x) = 6x + 5$$

If we use $x = 5$, $f'(5)$ would be

$$6 * 5 + 5 = 35$$

The second derivative $f''(x)$ would be

$$f''(x) = 6$$

And, if we use $x = 5$, $f''(x)$ would be just 6 as the second derivative of this function is constant.

Task 6

We are given, for two events A and B which are independent of each other, P(A)=0.3 and P(B)=0.6

P(A and B) = 0.3*0.6 =0.18 (*Because these are independent events*)

P(A or B) = 0.3 + 0.6 -0.3*0.6 = 0.72

P(not A) = P(universal) - P(A) = 1-0.3 = 0.7 (*Total probability is 1.*)

$P(A|B)$

$$= \frac{P[AandB]}{P[B]} = \frac{0.18}{0.6} = 0.3$$

Hence, Probability of getting A given B is 0.3.

Task 7

the python file is together in the zipped folder

Task 8

Here, total number of hats available is 40+70+35+15+50+30+60+20+80 = 400.

Part a

P(price <$75)

$$= \frac{40 + 70 + 15 + 50 + 60 + 20}{400} = \frac{255}{400} = \frac{51}{80}$$

Part b

P(price <$75 | color = green)

$$= \frac{P[under75andgreen]}{P[green]} = \frac{\frac{50+15}{400}}{\frac{15+50+30}{400}} = \frac{65}{90} = \frac{13}{19}$$

Part c

P(price <\$75, color = green)

$$= \frac{50 + 15}{400} = \frac{65}{400} = \frac{13}{80}$$