

CSE 4309 Assignment 1

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Task 1

The time complexity of the factorial function: $O(n)$ since the function iterates over the loop once only.

Task 2

Factorial function implementation without loops:

```
def factorial(index):  
    if index == 0 or index == 1:  
        return 1  
    else:  
        return index * factorial(index - 1)
```

Task 3

The time complexity of this function is $O(n^2)$ since there is an outer loop that loops around n times and there is an inner loop that loops around $n + 1$ times.

Task 4

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ and } B = \begin{pmatrix} e \\ f \end{pmatrix}$$

Then, the product $A \times B$ is given by:

$$A \times B = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \times \begin{pmatrix} e \\ f \end{pmatrix} = \begin{pmatrix} ae + bf \\ ce + df \end{pmatrix}$$

Task 5

- a. $f'(x) = 6x + 5$
- b. $f'(5) = 6(5) + 5 = 35$
- c. $f''(x) = 6$
- d. $f''(5) = 6$

Task 6

- a. $\frac{\partial f}{\partial x} = 6xy + 5$
- b. $\frac{\partial f}{\partial x}(x = 5, y = 2) = 6(5)(2) + 5 = 65$

Task 7

- a. $P(A \text{ and } B) = P(A) \times P(B) = 0.3 \times 0.6 = 0.18$
- b. $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.3 + 0.6 - 0.18 = 0.72$
- c. $P(\text{not}(A)) = 1 - 0.3 = 0.7$
- d. $P(A|B) = P(A) = 0.3$ (Since A and B are independent events).

Task 8

- a. Total hats (any color, any price) = $40 + 15 + 60 + 70 + 50 + 20 + 35 + 30 + 80 = 400$
Total hats (under \$75) = $40 + 15 + 60 + 70 + 50 + 20 = 255$
 $P(\text{price} \leq 75) = \frac{255}{400} = 0.6375$

- b. Total Green Hats = $15 + 50 + 30 = 95$
 Total Green Hats (under \$75) = $15 + 50 = 65$
 $P(\text{price} \leq 75 \mid \text{color} = \text{green}) = \frac{65}{95} = 0.6842$
- c. Total Hats (under 75 and green) = $15 + 50 = 65$
 Total Hats = 400 (calculated in part a)
 $P(\text{under } 75, \text{color} = \text{green}) = \frac{65}{400} = 0.1625$

Task 9

$$\text{Probability} = \frac{2 \text{ eggs}}{2 \text{ hens} \times 2 \text{ days}} = 0.5 \text{ eggs per hen per day}$$

$$\text{Total eggs} = 0.5 \text{ eggs per hen per day} \times 10 \text{ hens} \times 10 \text{ days} = 50 \text{ eggs}$$

Task 10

Python file is attached to this document.

Task 11

Python file is attached to this document.

Task 12

- a. C
- b. C

Task 13

Answer is C