Worksheet 13 Review

March 31, 2020

Question 1

a. Since the loop starts from $i = 0$ and ends at $i = n - 1$. The loop has

$$n - 1 - 0 + 1 = n \tag{1}$$

iterations.

Since each iteration runs 5 steps, the loop has total cost of

$$5 \cdot n = 5n \tag{2}$$

steps.

Because we know $i = 0$ at line 2 has cost of 1, we can conclude that the algorithm has total cost of $5n + 1$ steps.

Correct Solution:

Because we know the loop starts from $i = 0$ and ends at $i = n - 1$ with i increasing by 5 per iteration, we can conclude the loop has

$$\left\lceil \frac{n}{5} \right\rceil \tag{3}$$

iterations.

Since each iteration takes constant time, the loop has runtime of $\Theta(n)$

Notes:

- How does professor begin a proof after 'We will prove that...' or at the beginning of each case/parts?
- Noticed professor doesn't provide a detailed explanation for the number of iterations.
- Realized the goal of this problem is to determine the exact cost and runtime of each loop.

> There are $\lceil \frac{n}{5} \rceil$ iterations. $\cdots$

b. Because we know the loop starts at $i = 4$ and ends at $i = n - 1$ with i increasing by 1 per iteration, we can conclude that the loop has

$$\lceil n - 14 + 1 \rceil = n - 4 \tag{1}$$

iterations.

Since each iteration takes a constant time, we can conclude that the loop has runtime of $\mathcal{O}(n)$.

Correct Solution:

Because we know the loop starts at $i = 4$ and ends at $i = n - 1$ with i increasing by 1 per iteration, we can conclude that the loop has **at most**

$$\lceil n - 14 + 1 \rceil = n - 4 \tag{1}$$

iterations.

Since each iteration takes a constant time, we can conclude that the loop has runtime of $\mathcal{O}(n)$.

Question 2

Question 3

Question 4