

# Worksheet 14 Review

April 1, 2020

## Question 1

- a. Since the inner loop starts at  $j = 0$  and finishes at  $j = n - 1$  with  $j$  increasing by 1 per iteration, we can conclude that the inner loop has

$$\lceil n - 1 - 0 + 1 \rceil = n \quad (1)$$

iterations.

Since the inner loop takes 1 step per iteration, we can conclude that the inner loop has the total cost of

$$n \cdot 1 = n \quad (2)$$

steps.

For the outer loop, because it starts at  $i = 0$  and ends at  $i = n - 1$  with  $i$  increasing by 5 per iteration, we can conclude that the outer loop has

$$\left\lceil \frac{n - 1 - 0 + 1}{5} \right\rceil = \left\lceil \frac{n}{5} \right\rceil \quad (3)$$

iterations.

Since each iteration in the outer loop takes  $n$  steps, we can conclude the outer loop has the total cost of

$$n \cdot n = n^2 \tag{4}$$

steps.

Since we are ignoring the cost of the loop variables, the total cost of the algorithm is  $n^2 + n$  steps.

Then, because we know the algorithm takes total of  $n^2 + n$  steps, we can conclude the algorithm has the runtime of  $\Theta(n^2)$ .

## Question 2