Worksheet 13 Solution

March 22, 2020

Question 1

a. **Exact number of iterations:** n
Simplest theta expression: $f_1 \in \Theta(n)$

Correct Solution:
Exact number of iterations: $\frac{n}{5}$
Simplest theta expression: $f_1 \in \Theta(n)$

b. **Exact number of iterations:** $n - 4$
Simplest theta expression: $f_2 \in \Theta(n)$

c. **Exact number of iterations:** n
Simplest theta expression: $f_3 \in \Theta(n)$

Correct Solution:
Exact number of iterations: $\frac{n}{\frac{n}{10}} = 10$
Simplest theta expression: $f_3 \in \Theta(1)$

d. **Exact number of iterations:** $n^2 - 20$
Simplest theta expression: $f_4 \in \Theta(n^2)$

Correct Solution:
Exact number of iterations: $\frac{n^2-20}{3}$
Simplest theta expression: $f_4 \in \Theta(n^2)$

e. **Exact number of iterations:** $n^2 - 20 + n$

Simplest theta expression: $f_5 \in \Theta(n^2)$

Correct Solution:

Exact number of iterations: $\frac{n^2-20}{3} + 100n$

Simplest theta expression: $f_5 \in \Theta(n^2)$

Question 2

a. $i_3 = 8$

$i_4 = 16$

$i_k = 2^k$

b. **Exact number of iterations:** $\lceil \sqrt{n} \rceil$

Correct Solution:

The goal is to find the smallest k where the condition returns false.

So,

$$i_k \geq n \tag{1}$$
$$2^k \geq n \tag{2}$$
$$k \geq log(n) \tag{3}$$

Hence, the exact number of iteration that occurs if $\lceil log(n) \rceil$.

c. With $i = 0$, the i in loop will be forever 0. This will result in the while loop running indefinitely.

d. $f \in \Theta(n^{\frac{1}{2}})$

Question 3