

CSC 225 Assignment 1 – Theoretical Part

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Question 1.

Algorithm ComputeAverage(A,n)

Input: positive integer n

Output: sum of all integers from 1 to n divided by n (average value of n elements)

A: array [0... n-1]

avg \leftarrow 0

sum \leftarrow 0

for i \leftarrow 0 **to** n-1 **do**

 sum \leftarrow sum + A[i]

end

avg \leftarrow sum/n

return avg

Question 2 & 3.

a) (Counting assignments, comparisons and returns)

Assignment = 1

For loop:

 Assignment = 1

 Loop runs n times: $1 \cdot n$

Loop condition = n

Loop termination = 1

Loop increments = n

Return = 1

Total: $1 + n + n + 1 + n + 1$

= $3n + 4$

b) **Algorithm** RecursiveCompute(n)

Input: positive integer n

Output: sum of all integers from 1 to n

if n = 1 **then**

return 1

else

return n + RecursiveCompute(n-1)

end

c) (Counting assignments, comparisons and returns)

$$T(n) = \begin{cases} 2 & \text{if } n=1 \\ T(n-1) + 2 & \text{if } n \geq 2 \end{cases}$$

If:

Comparison = 1

Return = 1

Total for base case = 2

If:

Comparison = 1

Else:

Return statement = 1

Total = $T(n-1) + 2$

d) **Algorithm** ComputeFast(n)

Input: positive integer n

Output: sum of all integers from 1 to n in constant time

If n = 1 **then**

return 1

else

sum \leftarrow 0

sum \leftarrow n*(n+1)/2

return sum

Question 4.

a)

$$f_7(n) = 1^n$$

$$f_0(n) = \lg n$$

$$f_1(n) = 17n + \sqrt{n}$$

$$f_4(n) = n \lg n^3$$

$$f_6(n) = 28n^2 + 3$$

$$f_2(n) = n^3 + 882$$

$$f_5(n) = n^3 \lg n$$

$$f_3(n) = 112 * 3^n$$

b)

$$g_5(n) = 881n \text{ and } g_0(n) = 17 * 2^{\lg n}$$

$$g_7(n) = 1^n \text{ and } g_1(n) = 1032$$

Question 5. (Counting assignments, comparisons and returns)

Assignment = 1

While:

 If:

 Comparison = 1

 Else:

 Assignment = 1

 Loop runs n times: $2n$

Loop condition = n

Loop termination = 1

Return = 1

Total: $1 + 2n + n + 1 + 1$

$T(n) = 3n + 3$

Assignment = 1

While:

 Comparison = 1

 If:

 Assignment = 1

 Return = 1

Total: $1 + 1 + 1 + 1$

$T_b(n) = 4$