COMP 2310 DATA STRUCTURES AND ALGORITHMS :Assignment-1

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1. Order the following functions by growth rate:
   1. 3n
   2. *n*
   3. n2

d. 12/*n*

e. n1.9

f. n log n2

g. 2n

h . 2n/2

i . n2log n

j. n3

1. Answer:
   1. 12/*n*
   2. *n*
   3. n log n2

d. n1.9

e. n2

f. n2log n

g. n3

h . 2n/2

i . 2n

j. 3n

2.What are Big-O expressions for the following runtine functions?

a) T(n)= nlog n + n log (n3 ) = O(nlogn)

b) T(n)= (nnn)2 = O(n6)

c) T(n)= n1/3 + n1/4 + log n = O(n1/3)

d) T(n)= 23n + 32n = O(32n)

e) T(n)= n! + 2n = O(n!)

3. For each of the following six program fragments:

Give an analysis of the running time (Big-O will do).

1. s = 0;

for (i = 0; i < n; i++)

s++;

Answer: O(n)

**(2)** s = 0;

for (i = 0; i < m; i++)

for (j = 0; j < n; j++)

s++;

Answer: O(n2)

**(3)** s = 0;

for (i = 0; i < m; i++)

for (j = 0; j < m\*m; j++)

s++;

Answer: O(n3)

**(4)** s = 0;

for (i = 0; i < m; i++)

for (j = 0; j < i; j++)

s++;

Answer: O(n2)

**(5)** s = 0;

for (i = 0; i < m; i++)

for (j = 0; j < i\*i; j++)

for (k = 0; k < j; k++)

s++;

Answer: O(n5)

4. Write algorithm and program : Find the sum of the integers from 1 through n.

a)Use iterative algorithm and program

Algorithm (psuedocode):

sum = 0;

for (i = 0; i < n; i++)

sum = sum + i;

Program (C++):

//iterative solution

#include <iostream>

using namespace std;

int main()

{

int n = 10;

int sum = 0;

for (int i = 1; i <= n; i++) {

sum += i;

}

cout << "sum from 1 through " << n << ": " << sum << endl;

return 0;

}

b) Use recursive algorithm and program.

Algorithm (pseudocode):

sum\_rec(n) {

if (n == 1) return 1

return n + sum\_rec(n - 1)

}

Program (C++):

//recursive solution

#include <iostream>

using namespace std;

// termination condition as n <= 0 so that passing in a negative number would not cause infinite recursion (could have put if(n == 1) return 1; as well but then passing a negative number (or zero) would cause infinite recursion)

int sum\_rec(int n) {

if (n <= 0) return 0;

return n + sum\_rec(n - 1);

}

int main()

{

int n = 10;

cout << "sum from 1 through " << n << ": " << sum\_rec(10) << endl;

return 0;

}