

CPTR 318 Data Structures and Algorithms Assignment #3

Name _____

The point values for each question is given within []. The total number of points for this assignment is 10.

Please submit your typeset (L^AT_EX or Scientific WorkPlace) or word-processed (Microsoft Word) solutions to eclass.

- [2] 1. Prove using mathematical induction that the sum of the first n even integers is $n^2 + n$.
- [3] 2. A particular algorithm can solve a problem of input size 100 in 5 milliseconds. Estimate the size of the problem the algorithm can solve in 1 minute if the algorithm's asymptotic complexity is each of the following:
- (a) $\Theta(n)$
 - (b) $\Theta(\log n)$
 - (c) $\Theta(n \log n)$
 - (d) $\Theta(n^2)$
 - (e) $\Theta(n^3)$
 - (f) $\Theta(2^n)$

Provide mathematical justification for your answers.

[5] 3. Determine the Θ asymptotic time complexity of each of the following C++ code fragments (n is the data size):

- (a)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    sum++;
```
- (b)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    for ( int j = 0; j < n; j++ )
        sum++;
```
- (c)

```
int sum = (n < 100000)? n : 100000;
```
- (d)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    for ( int j = 0; j < n; j++ )
        for ( int k = 0; k < n; k++ )
            sum++;
```
- (e)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    sum++;
for ( int i = 0; i < 2*n; i++ )
    sum++;
```
- (f)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    for ( int j = 0; j < n*n; j++ )
        sum++;
```
- (g)

```
int sum = 0;
for ( int i = 0; i < 100; i++ )
    sum++;
```
- (h)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    for ( int j = 0; j < i; j++ )
        sum++;
```
- (i)

```
int sum = 0;
for ( int i = 0; i < n; i++ )
    for ( int j = 0; j < i*i; j++ )
        for ( int k = 0; k < j; k++ )
            sum++;
```
- (j)

```
int sum = 0;
for ( int i = n; i > 0; i /= 2 )
    sum++;
```