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 answers electronically to eclass. You may typeset your solutions with LaTeX or use Microsoft Word's equation editor.

[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++;
```