Mini Assignment 2

Due: 11:20am on February 12^{th}, 2019

20 points

Give the worst-case analysis for the following functions in terms of big-Θ. You should submit your pdf solution using LaTeX if possible.

1.

```
for(i = 0; i < 3; i++){
    for(j = 0; j < 10; j++){
        print i+j;
    }
}
```

There are two nested for loops which run a finite amount of iterations that each add 1 to their variable after completion, and there is one constant time operation performed in the second for loop, therefore, this function has a run time of $\boxed{\Theta(1)}$.

2.

```
//n and m are some positive integers
for(i = 0; i < n; i++){
    for(j = 0; j < m; j++){
        print i+j;
    }
}
```

There are two nested for loops similar to the ones above with one constant time operation in the middle, therefore, this function has a run time of $\boxed{\Theta(nm)}$.

3.

```
//n and m are some positive integers
for(i = 0; i < n; i++){
    for(j = 0; j < m; j++){
        for(int k = 1; k < 1000; k *= 2){
                print i+j+k;
        }
    }
}
```

Although there are 3 nested for loops, the innermost one runs a constant number of times and can be ignored. This reduces the problem to one similar to the one above. There are two nested for loops that depend on two variables n and m, therefore, the run time of this function is $\boxed{\Theta(nm)}$.

4.

```
//n and m are some positive integers
for(i = 0; i < n - 10; i++){
    for(j = 0; j < m/2; j++){
        print i+j;
    }
}
```

Similar to the one above, there are two nested for loops each dependent on the two variable integers n and m, however it differs from above by the constants that are appended in each loop. Since these are constants however, they can be ignored and the function would, therefore, have a run time of $\boxed{\Theta(nm)}$.

5.

```
//n and m are some positive integers
for(i = 0; i < n; i++){
    print i;
}
//n and m are some integers
for(j = 1; j < m; j *= 2){
    print j;
}
```

These for loops are not nested, and therefore must be con considered separately. The top for loop looks similar to the ones above and would have a run time of about n. The bottom for loop, however, would have a run time of $\log(n)$ because the value of j grows much faster than i in the previous loop, therefore, the function would have an overall big theta value of $\boxed{\Theta(n)}$.