Holland-A6-Part-1-Runtime.docx

**Assignment 06 PART 1 Runtime Analysis (50 points) - Note Part 1 is a separate deliverable:**

1. Use Big O notation to estimate the time complexity of each of the following code fragments. Clearly show all steps of your work. Review examples in textbook pp. 822-827

1.1 sum = 0;

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

sum++;

}

The loop here is executed n times. Meaning this loop executes O(n) times. Using the formula T(n) = ( a constant c ) \* n = O(n).

1.2 sum = 0;

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

{

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

sum++;

}

}

The out loop runs n times. Each time the outer loop runs the inner loop also runs n times. So that means sum++ is executed n \* n times. Which means the time complexity is O(n2) or O(n^2).

1.3

sum = 0;

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

for (int j = 0; j < n \* n; j++) {

sum++;

}

}

This loop is similar to 1.2. The outer loops runs n times. Each time the outer loop runs the inner loop runs n \* n times. Which means sum++ is executed n \* n \* n times. Thus the time complexity is O(n3) or O(n^3).

1.4 sum = 0;

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

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

sum++;

}

}

Despite looking different from 1.2 this loop still has the same time complexity. The inner loops runs I times which is the same as n since eventually the outer loop will be ran n times. Thus the time complexity is O(n2) or O(n^2).

1.5

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++;

}

}

}

The time complexity is O(n5) or O(n^5). The Outer loops runs n times. Then each time the outer loop runs, the middle loop runs I^2 or i2 times I is the current iteration of the outer loop. Then each time the inner loop runs the bottom or the innermost loop runs j times where j is the current iteration of the outer loop. So this means that the sum++ statement is executed i^2 + 2^2 + 3^3 + …… + n ^2 for each I, and this continues each j up to i^2. Thus the time complexity is O(n5) or O (n^5).

Note: I included the superscript notation and the caret notation in all my problems as the superscript is barely readable on my screen.