Assignment #1

Original Due: 3:00 PM, Wednesday, February 17
Extended: 3:00 PM, Wednesday, February 24

You must complete this assignment by yourself. You cannot work with anyone else in the class or with someone outside of the class. You may not copy solutions from the world wide web.

Submission

i. Choose either (a) handwriting or (b) typing:

a) Write out your answers "neatly" (credit cannot be given for illegible answers) on paper, take photo(s) of your handwritten work, copy and paste the photo(s) into a Microsoft Word document named **A1.docx**.

b) Type your answers in a Microsoft Word document named **A1.docx**

ii. Add a header (below) to your **A1.docx** file. You shall replace ***<Your Full Name>*** with your full name

`On my honor,` ***`<Your Full Name>`***`, this assignment is my own work. I,` ***`<Your Full Name>`***`, will follow the instructor's rules and processes related to academic integrity as directed in the course syllabus.`

iii. Submit **A1.docx** using D2L.

You may use the following formulas for this assignment.

$$1+2+3+\cdots+(\mathrm{n}-2)+(\mathrm{n}-1)+\mathrm{n} = \frac{\mathrm{n}(\mathrm{n}+1)}{2} = \frac{1}{2}n^2 + \frac{1}{2}n$$

$$1^2 + 2^2 + 3^2 + \cdots + (n-2)^2 + (n-1)^2 + n^2 = \frac{n(n+1)(2n+1)}{6} = \frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n$$

$$1^3 + 2^3 + 3^3 + \cdots + (n-2)^3 + (n-1)^3 + n^3 = \frac{n^2(n+1)^2}{4} = \frac{1}{4}n^4 + \frac{1}{2}n^3 + \frac{1}{4}n^2$$

$$1^4 + 2^4 + 3^4 + \cdots + (n-2)^4 + (n-1)^4 + n^4 = \frac{1}{5}n^5 + \frac{1}{2}n^4 + \frac{1}{3}n^3 - \frac{1}{30}n$$

(1) (4 points) What is the time function T(n) and Big-Oh, in terms of n, of the following program fragment? Justify your answer.

```
public static int m(int[] arr) {

     int n = arr.length;

     int total = 0;

     for (int j = 0; j < n; j++)
          total += arr[j];

     return total;

}
```

T(n) = ____________ O(_____)

(2) (4 points) What is the time function T(n) and Big-Oh, in terms of n, of the following program fragment? Justify your answer.

```
public static int m(int[] arr) {

     int n = arr.length;      // assume that n is an even number

     int total = 0;

     for (int j = 0; j < n; j += 2)
          total += arr[j];

     return total;

}
```

T(n) = ______________   O(______)

(3) (4 points) What is the time function T(n) and Big-Oh, in terms of n, of the following program fragment? Justify your answer.

```
public static int m(int[] arr) {

     int n = arr.length;

     int total = 0;

     for (int j = 0; j < n; j++)
          for (int k = 0; k <= j; k++)
               total += arr[j];

     return total;

}
```

T(n) = ______________   O(______)

(4) (4 points) What is the time function T(n) and Big-Oh, in terms of n, of the following program fragment? Justify your answer.

```
public static int m(int[] arr) {

     int n = arr.length;

     int prefix = 0;

     int total = 0;

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

          prefix += arr[j];

          total += prefix;
     }

     return total;

 }
```

T(n) = _____________ O(______)

(5) (4 points) What is the time function T(n) and Big-Oh, in terms of n, of the following program fragment **in the worst case**? Justify your answer.

```
public static int m(int[] first, int[] second) {

     int n = first.length;  //assume that n == second.length

     int count = 0;

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

          int total = 0;

          for (int j = 0; j < n; j++)
               for (int k = 0; k <= j; k++)
                    total += first[k];

          if (second[i] == total)
               count++;

     }

     return count;
}
```

T(n) = ______________   O(______)