**CS 601: Advanced Algorithms**
**Instructor: Professor Zahra Derakhshandeh**
**Assignment 1**

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## Q1 Solution:

(a) Algorithm is a step-by-step procedure to solve a problem to accomplish some end given an initial situation(input).
Or
It is a finite sequence of unambiguous executable steps that will terminate if followed.

Properties of algorithm:

- Definiteness- Each step must be precisely defined.
- Finiteness- Algorithm must be finite, it should come to a solution after a finite number of steps is executed.
- Input and Output- An algorithm has zero or more inputs and Outputs.
- Efficiency- Algorithms will consume time and space as necessary.

1. As we use laundry machine in our everyday life to make washing clothes easier. I have mentioned the example of doing laundry with all the steps.

Step 1: start

Step 2: Separate clothes into white clothes and colored clothes.

Step 3: Add 1 cup of laundry detergent to tub.

Step 4: For white clothes: Set water temperature to hot. Place white clothes in tub.

Step 5: For colored clothes: Set water temperature to cold. Place colored clothes in tub.

Step 6: Close machine door, add coins and press the start button.

Step 7: When washer is done, put your clothes into the dryer.

Step 8: Fold the clothes after they dry and keep them in cupboard.

Step 9: Stop

**Q2 Solution: (a) and (b)**

```
package sumComplexity;
import java.util.Scanner;
public class assignment1 {
public static void main(String[] args)
        {
           Scanner inputRead = new Scanner(System.in);
           int n;
           double[] a;
           System.out.print("How many numbers in input , i.e range of n : ");
           n = inputRead.nextInt();                //1 assignment operation
          // Create an array of n elements
           a = new double[n];                              //1 assignment operation
           int i;
           // Read the inputs to the list
           for ( i = 0; i < a.length; i++ )                        //1 + (n+1) + n
```

```
        {
          System.out.print("Enter a number till the \"n\" items are read : ");
          a[i] = inputRead.nextDouble();  //1 assignment operation
        }
        // calculate the summation of numbers inputed
      double sum;
        sum = 0;                                  //1 assignment operation
        for ( i = 0; i < a.length; i++ )                        // 1 + (n+1) + n
        {
          sum = sum + a[i];                       //1 assignment operation
        }
        System.out.println( sum );
      }
}
```

Each element of the input is processed and is a Linear time. Basic number of operations in each loop for above algorithm is

f(n) = 1 + 1 + [1 + (n+1) + n] + 1 + [1 + (n+1) + n] + 1

where n is the number of input elements.

f(n) = 8+ 4(n)

- ⇨ 4 [2 + n]
- ⇨ 4[n] // [ignore 2 as it is smaller than n]
- ⇨ n //[ignore 4 as n is too big and 4 is negligible ]
- ⇨ n can be read as Big O of N complexity
- ⇨ O(n)

Screenshot of output: