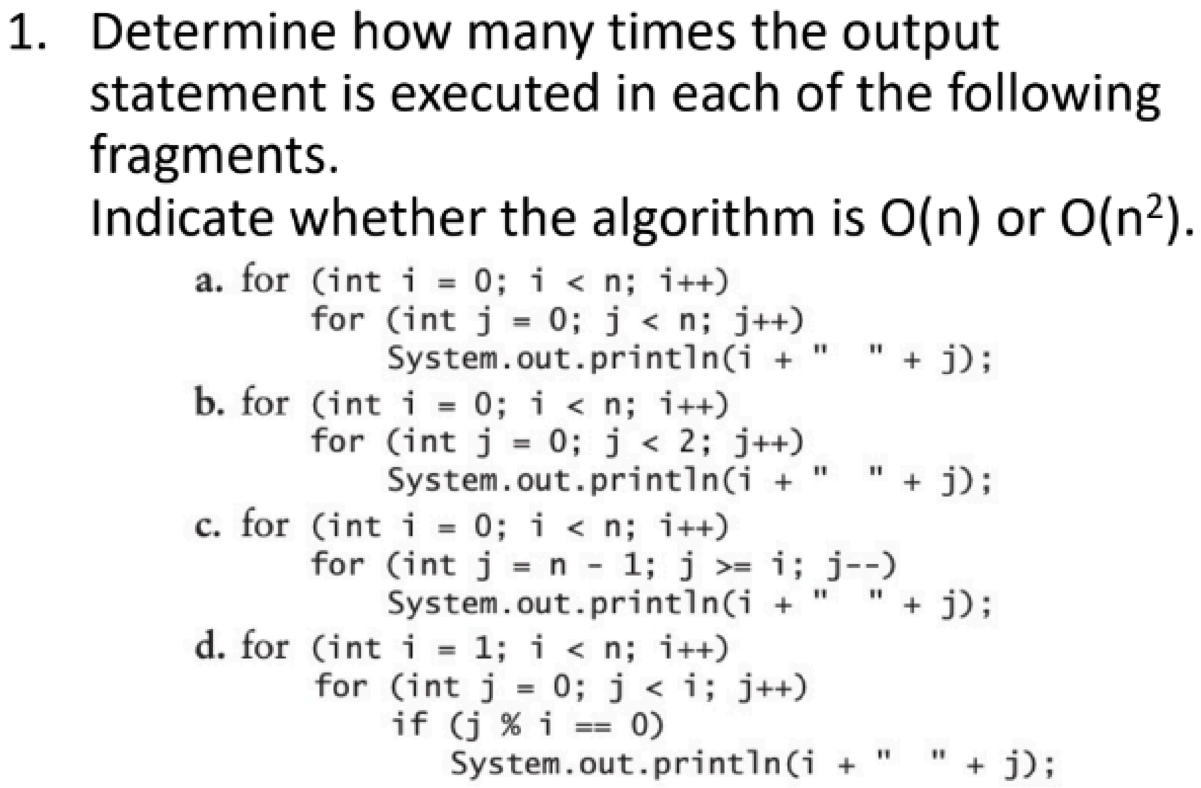
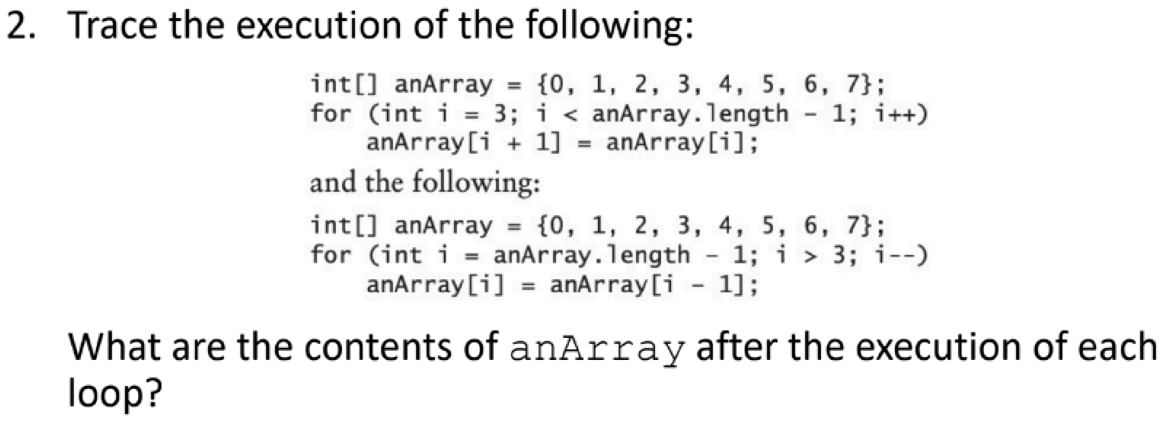


1. Determine how many times the output statement is executed in each of the following fragments.
Indicate whether the algorithm is O(n) or O(n^2).

```
a. for (int i = 0; i < n; i++)
       for (int j = 0; j < n; j++)
           System.out.println(i + "  " + j);
b. for (int i = 0; i < n; i++)
       for (int j = 0; j < 2; j++)
           System.out.println(i + "  " + j);
c. for (int i = 0; i < n; i++)
       for (int j = n - 1; j >= i; j--)
           System.out.println(i + "  " + j);
d. for (int i = 1; i < n; i++)
       for (int j = 0; j < i; j++)
           if (j % i == 0)
              System.out.println(i + "  " + j);
```

a. O(n^2)
b. O(n)
c. O(n)
d. O(n)



2. Trace the execution of the following:

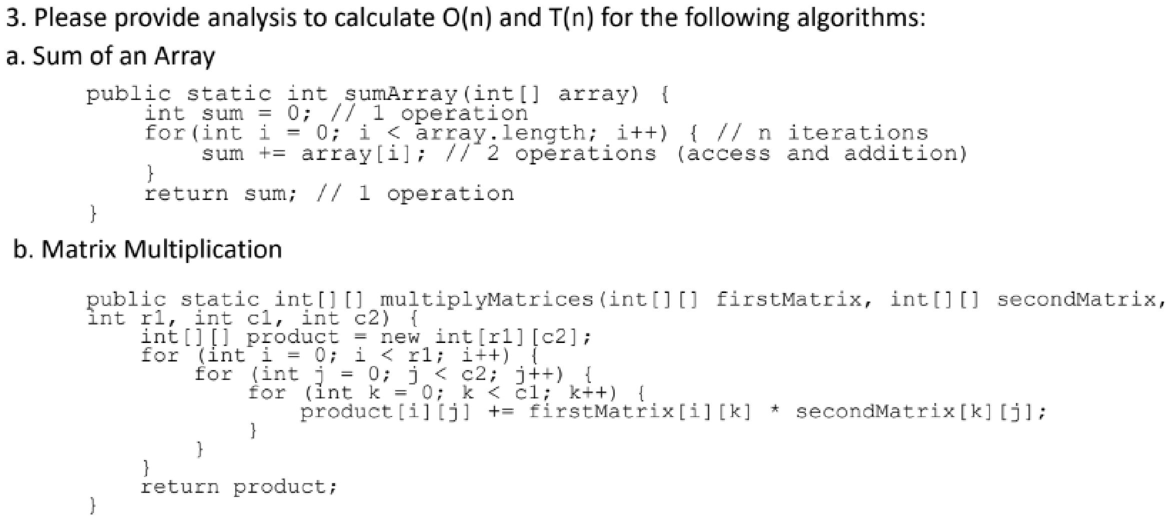
```
int[] anArray = {0, 1, 2, 3, 4, 5, 6, 7};
for (int i = 3; i < anArray.length - 1; i++)
    anArray[i + 1] = anArray[i];
```

and the following:

```
int[] anArray = {0, 1, 2, 3, 4, 5, 6, 7};
for (int i = anArray.length - 1; i > 3; i--)
    anArray[i] = anArray[i - 1];
```

What are the contents of `anArray` after the execution of each loop?

a. [0, 1, 2, 3, 3, 3, 3, 3]
b. [0, 1, 2, 3, 3, 4, 5, 6]



3. Please provide analysis to calculate O(n) and T(n) for the following algorithms:

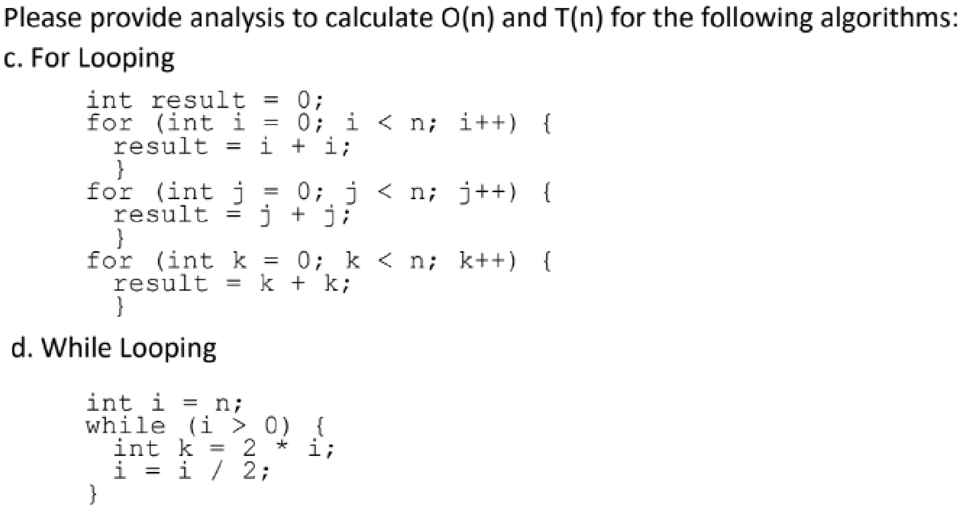
a. Sum of an Array

```
public static int sumArray(int[] array) {
    int sum = 0; // 1 operation
    for(int i = 0; i < array.length; i++) { // n iterations
        sum += array[i]; // 2 operations (access and addition)
    }
    return sum; // 1 operation
}
```

b. Matrix Multiplication

```
public static int[][] multiplyMatrices(int[][] firstMatrix, int[][] secondMatrix,
int r1, int c1, int c2) {
    int[][] product = new int[r1][c2];
    for (int i = 0; i < r1; i++) {
        for (int j = 0; j < c2; j++) {
            for (int k = 0; k < c1; k++) {
                product[i][j] += firstMatrix[i][k] * secondMatrix[k][j];
            }
        }
    }
    return product;
}
```

a. T(n) = 2n + 2
b. T(n) = n^3 + 2



Please provide analysis to calculate O(n) and T(n) for the following algorithms:

c. For Looping

```
int result = 0;
for (int i = 0; i < n; i++) {
  result = i + i;
  }
for (int j = 0; j < n; j++) {
  result = j + j;
  }
for (int k = 0; k < n; k++) {
  result = k + k;
  }
```

d. While Looping

```
int i = n;
while (i > 0) {
  int k = 2 * i;
  i = i / 2;
}
```

c. T(n) = 3n
d. “I dont understand”

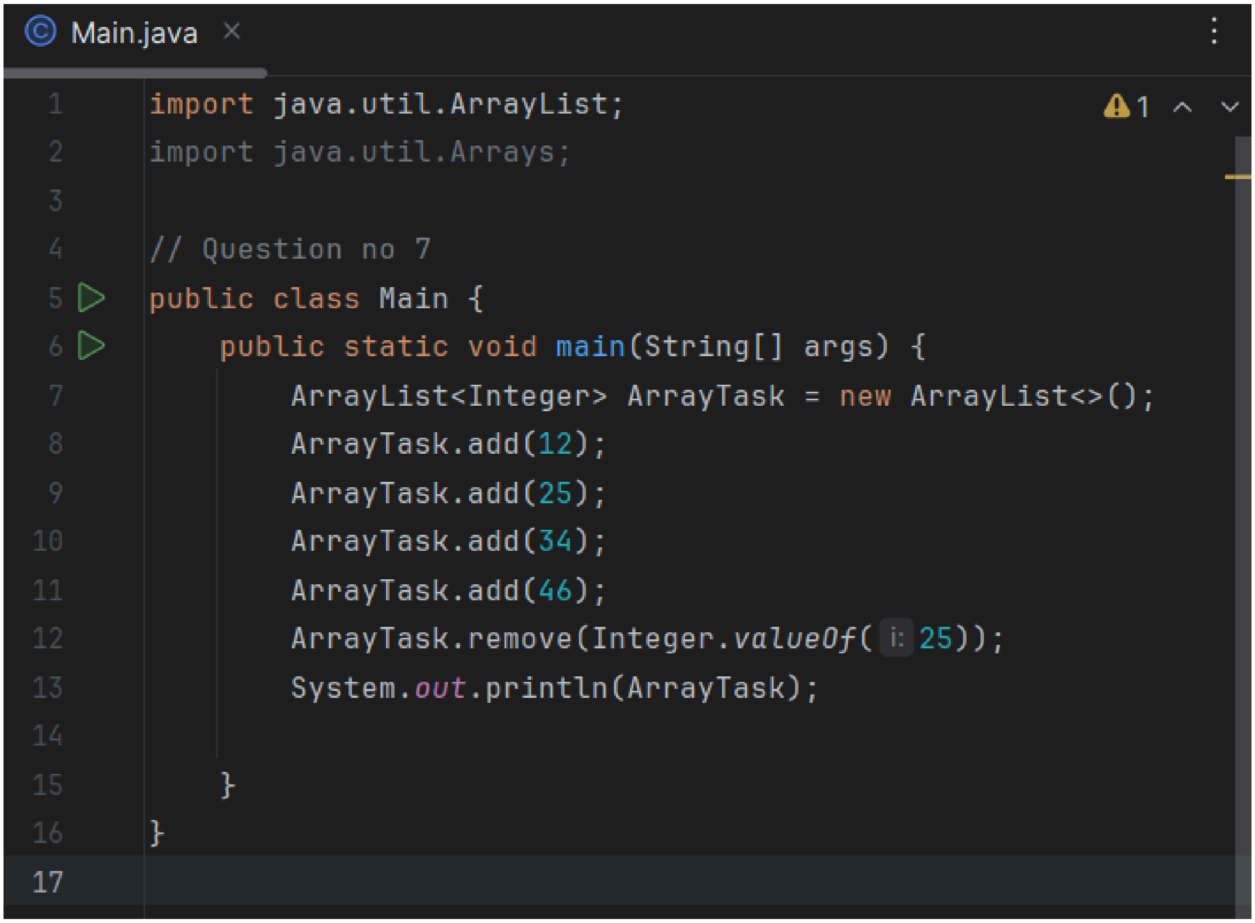
4.
Constant Time Complexity - O(1)
Linear Time Complexity - O(n)
Logarithmic Time Complexity - O(log n)
Quadratic Time Complexity - O(n^2)
Exponent - O(2^n)

5.
ADT defines a set of operations on the data and their behavior. It provides a logical description of the data and operations.
Examples - Stack, Queue, Set

6.

List	ArrayList
Slower for random access, yet efficient for adding/removing elements in the middle index	Faster for random access
Can have different implementations such as arraylist and linkedlist	Specifically uses an array to store elements

7.



```
import java.util.ArrayList;
import java.util.Arrays;

// Question no 7
public class Main {
    public static void main(String[] args) {
        ArrayList<Integer> ArrayTask = new ArrayList<>();
        ArrayTask.add(12);
        ArrayTask.add(25);
        ArrayTask.add(34);
        ArrayTask.add(46);
        ArrayTask.remove(Integer.valueOf( i: 25));
        System.out.println(ArrayTask);

    }
}

```