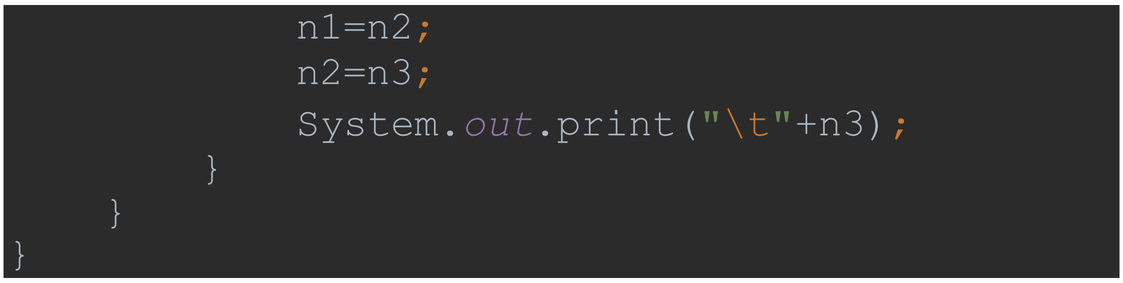
1. Write java program to display Fibonacci series up to a limit.
   Class diagram:
   Fib
   ~n1: int=0
   ~n2:int=1
   ~n3: int
   ~limit: int
   ~i: int

```
import java.io.*;
import java.util.*;
class Fib
{
    public static void main(String args[])
    {
        Scanner in=new Scanner(System.in);
        int n1=0,n2=1,n3,limit,i;
        System.out.println("ENTER THE 
LIMIT:");
        limit=in.nextInt();
        System.out.print(n1+"\t"+n2);
        for(i=2;i<limit;i++)
        {
            n3=n1+n2;
```



```java
            n1=n2;
            n2=n3;
            System.out.print("\t"+n3);
        }
    }
}
```

output:

ENTER THE LIMIT:

5

```
0        1        1        2        3
```

2. Write java program to display Armstrong numbers within a range.

Class diagram:

Armstrong

~l: int

~h:int

~i: int

~rem: int

~sum: int

~num=int

```java
import java.io.*;
import java.util.*;

class Main {
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      int n1 = 0, n2 = 0, n3 = 0;
      System.out.println("Enter lower limit:");
      int lower = scanner.nextInt();
      System.out.println("Enter upper limit:");
      int upper = scanner.nextInt();
      for (int num = lower; num <= upper; num++) {
         int j = num;
         int original = num;
         int sum = 0;
         int length = Integer.toString(num).length();
         while (j != 0) {
            int remainder = j % 10;
            sum += Math.pow(remainder, length);
            j = j / 10;
         }
         if (sum == original) {
            System.out.println(original + " is an Armstrong number.");
         }
      }
   }
}
```

output:

```
Enter lower limit:
1
Enter upper limit:
50
1 is an Armstrong number.
2 is an Armstrong number.
3 is an Armstrong number.
4 is an Armstrong number.
5 is an Armstrong number.
6 is an Armstrong number.
7 is an Armstrong number.
8 is an Armstrong number.
9 is an Armstrong number.
```

3. Write a program to perform base conversion

a) Integer to binary

b) Integer to Octal

c) Integer to Hexadecimal

class diagram:

Base

~num: int

~rem:int

~base: int

~str: String

~dig[]: char

```java
import java.io.*;
import java.util.*;
class Base
{
    public static void main(String args[])
    {
        Scanner in =new Scanner(System.in);
        int num,rem,base;
        String str="";
        char
dig[]={'0','1','2','3','4','5','6','7','8','9','A'
,'B','C','D','E','F'};
        System.out.println("ENTER THE NUMBER:");
        num=in.nextInt();
        System.out.println("ENTER THE BASE TO
CONVERT:");
        base=in.nextInt();
        while(num>0)
        {
            rem=num%base;
            str=dig[rem]+str;
            num=num/base;
        }
        System.out.println(str);
    }
}
```

output:

```
ENTER THE NUMBER:

10

ENTER THE BASE TO CONVERT:

2

1010
```

4. Write a program to merge two arrays.

Class diagram:

Merge

~m: int

~n:int

~i: int

~i: int

~j: int

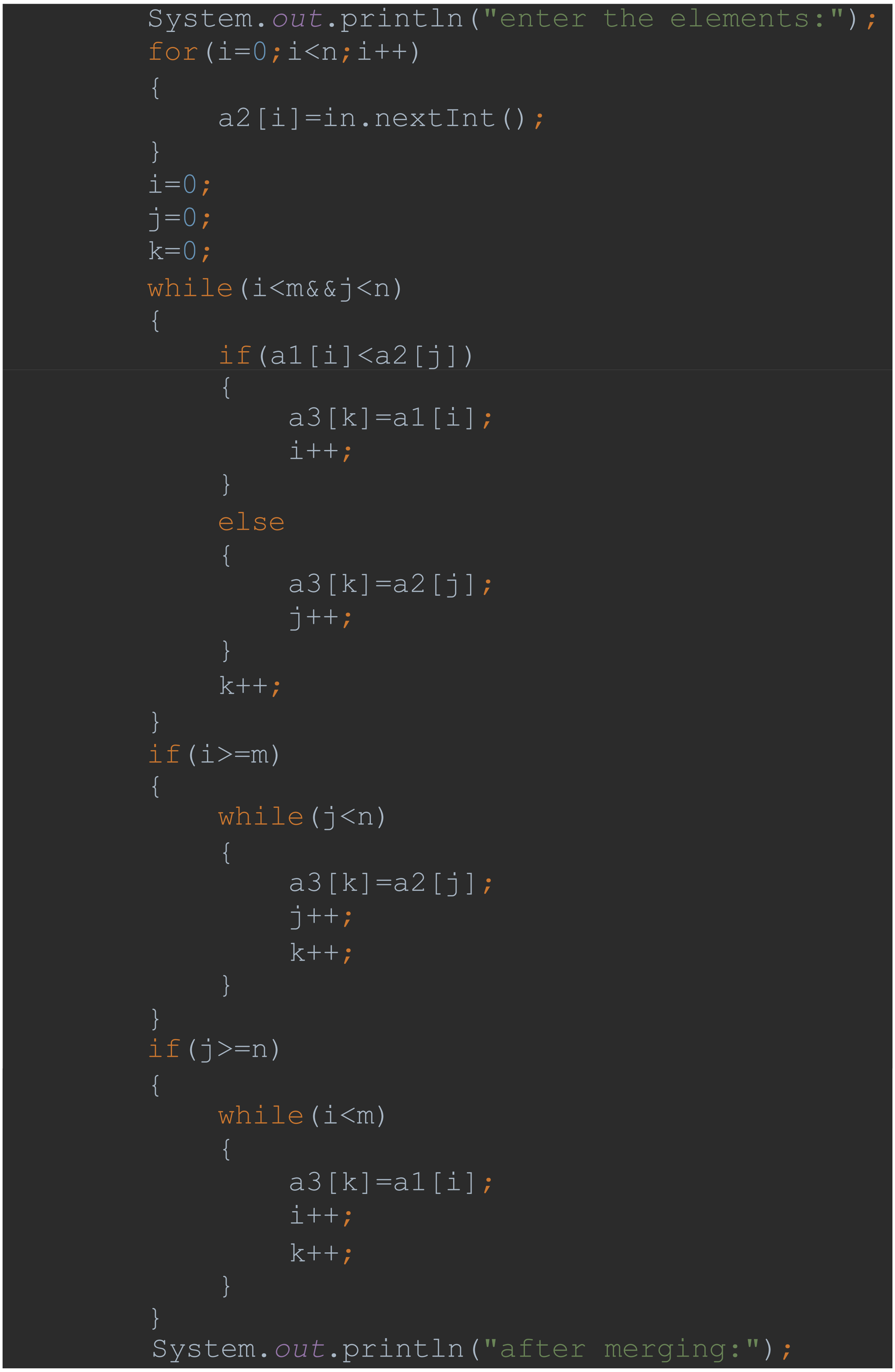
~k: int

~a1[]: int

~a2[]: int

~a3[]: int

```
import java.io.*;
import java.util.*;
class Merge
{
    public static void main(String args[])
    {
        Scanner in=new Scanner(System.in);
        int m,n,i,j,k=0;
        int a1[]=new int[10];
        int a2[]=new int[10];
        int a3[]=new int[20];
        System.out.println("enter the size of
array 1:");
        m=in.nextInt();
        System.out.println("enter the elements:");
        for(i=0;i<m;i++)
        {
            a1[i]=in.nextInt();
        }
        System.out.println("enter the size of
array 2:");
        n=in.nextInt();
```



```java
System.out.println("enter the elements:");
for(i=0;i<n;i++)
{
    a2[i]=in.nextInt();
}
i=0;
j=0;
k=0;
while(i<m&&j<n)
{
    if(a1[i]<a2[j])
    {
        a3[k]=a1[i];
        i++;
    }
    else
    {
        a3[k]=a2[j];
        j++;
    }
    k++;
}
if(i>=m)
{
    while(j<n)
    {
        a3[k]=a2[j];
        j++;
        k++;
    }
}
if(j>=n)
{
    while(i<m)
    {
        a3[k]=a1[i];
        i++;
        k++;
    }
}
System.out.println("after merging:");
```

```
          for(i=0;i<m+n;i++)
          {
               System.out.println(a3[i]);
          }
     }
}
```

output:

```
enter the size of array 1:
3
enter the elements:
10
30
50
enter the size of array 2:
2
enter the elements:
20
40
after merging:
10
20
30
40
50
```

5. Write a program to find the trace and transpose of a matrix.

Class diagram:

Matrix

~n: int

~m: int

~i: int

~j: int

~trace: int=0

~a[][]: int

~b[][]: int

```java
import java.io.*;
import java.util.*;
class Matrix
{
    public static void main(String args[])
    {
        Scanner in=new Scanner(System.in);
        int n,m,i,j,trace=0;
        int a[][]=new int[10][10];
        int b[][]=new int[10][10];
        System.out.println("ENTER THE ORDER OF THE 
MATRIX:");
        m=in.nextInt();
        n=in.nextInt();
        System.out.println("ENTER THE ELEMENTS:");
        for(i=0;i<m;i++)
        {
            for(j=0;j<n;j++)
            {
                a[i][j]=in.nextInt();
            }
        }
        for(i=0;i<m;i++)
        {
            for(j=0;j<n;j++)
            {
                b[j][i]=a[i][j];
                if(i==j)
                {
                    trace=trace+a[i][j];
                }
            }
        }
        System.out.println("TRACE:"+trace);
        System.out.println("TRANSPOSE");
        for(i=0;i<m;i++)
        {
            for(j=0;j<n;j++)
            {
                System.out.print(b[i][j]);
            }
            System.out.println(" ");
        }
    }
}
```

output:

```
ENTER THE ORDER OF THE MATRIX:

3

3

ENTER THE ELEMENTS:

1 2 3

4 5 6

7 8 9
```

TRACE:15

TRANSPOSE

147

258

369

6. Write java program to find the sum of the digits and reverse of a given number using class and objects

class diagram:

Ten

~num: int

~rem: int

~sum: int=0

~rev: int=0

~sumrev()

```java
import java.io.*;
import java.util.*;
class Ten
{
    int num,rem,sum=0,rev=0;
    public static void main(String args[])
    {
        Ten obj=new Ten();
        obj.sumrev();
    }
    void sumrev()
    {
        Scanner in=new Scanner(System.in);
        System.out.println("ENTER THE NUMBER:");
        num=in.nextInt();
        while(num!=0)
        {
            rem=num%10;
            sum=sum+rem;
            rev=rem+(rev*10);
```

```
                num=num/10;
            }
            System.out.println("SUM:"+sum);
            System.out.println("REVERSE:"+rev);
        }
}
```

output:

```
ENTER THE NUMBER:

123

SUM:6

REVERSE:321
```

7. Using class and objects, write a java program to find the sum of two complex numbers (Hint: Use object as parameter to function).

Class diagram:

Complex

~real: int

~image: int

add(complex c1, complex c2):Complex

```
import java.io.*;
import java.util.*;
class Complex
{
    int real,image;
    public static void main(String args[])
    {
        Scanner in=new Scanner(System.in);
        Complex c1=new Complex();
        Complex c2=new Complex();
        System.out.println("ENTER THE FIRST
COMPLEX NUMBER:");
        c1.real=in.nextInt();
        c1.image=in.nextInt();
        System.out.println("ENTER THE FIRST
COMPLEX NUMBER:");
        c2.real=in.nextInt();
        c2.image=in.nextInt();
        c1.add(c1,c2);
    }
    void add(Complex c1,Complex c2)
    {
        Complex c3=new Complex();
        c3.real=c1.real+c2.real;
        c3.image=c1.image+c2.image;

System.out.println("SUM:"+c3.real+"+"+c3.image);
    }
}
```

output:

```
ENTER THE FIRST COMPLEX NUMBER:

10

20

ENTER THE FIRST COMPLEX NUMBER:

30

40

SUM:40+60
```

8. Write a multi thread java program for displaying odd numbers and even numbers up to a limit (Hint: Implement thread using Runnable interface).

Class diagram:

Odd

~i:int

~n:int=10

+run: void

Even

~i:int

~n:int=10

+run: void

OddEvenThread

ob1:Odd

ob2:Even

```java
import java.io.*;
import java.util.*;
class Odd implements Runnable
{
    int i,n=10;
    public void run()
    {
        for(i=1;i<n;i=i+2)
        {
            System.out.println("ODD:"+i);
        }
    }
}
class Even implements Runnable
{
    int i,n=10;
    public void run()
    {
        for(i=0;i<n;i=i+2)
        {
            System.out.println("EVEN:"+i);
        }
    }
}
```

```
class OddEvenThread
{
    public static void main(String args[])
    {
        Even ob2=new Even();
        Thread obj2=new Thread(ob2);
        obj2.start();
        Odd ob1=new Odd();
        Thread obj1=new Thread(ob1);
        obj1.start();
    }
}
```

output:

```
ODD:1

ODD:3

ODD:5

ODD:7

ODD:9

EVEN:0

EVEN:2

EVEN:4

EVEN:6

EVEN:8
```