

# Computer Project

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## Assignment 1

Write a program to take lower and upper range from the user and print all the Kaprekar numbers within that range. (A number  $n$  having  $d$  digits is squared and split into two pieces, right hand piece having  $d$  digits and left hand piece having  $d$  or  $d-1$  digits. If sum of the two pieces is equal to the number then  $n$  is Kaprekar number). Eg: 9, 45, [55], 297

### Algorithm:

#### Class Kaprekar\_main:

##### Method Main:

- Step 1: declare  $lr$  and  $ur$  as lower and upper limit respectively
- Step 2: accept input from the user the lower and upper limit in  $lr$  and  $ur$
- Step 3: check if the numbers are greater than zero and  $ur \geq lr$ . if not then return
- Step 4: initialize a Kaprekar object.
- Step 5: call the display method of Kaprekar object

#### Class Kaprekar:

##### Method display:

- Step 1: declare  $i$  as a loop control variable
- Step 2: start a 'for' loop from lower\_range to upper\_range with  $i$  as the loop control.
- Step 3: call iskaprekar method passing  $i$  as the actual parameter.
- Step 4: if iskaprekar returned true then print the number to screen.

##### Method iskaprekar:

- Step 1: store the square of the formal parameter in  $sq$ .
- Step 2: store the length of  $sq$  in  $len$  by using the formula  $\log_{10}(sq)+1 = len$ .
- Step 3: store the value of  $sq \% 10^{\lfloor len/2 \rfloor + 1}$  in  $part1$  if  $len$  is odd.
- Step 4: store the value of  $sq \% 10^{\lfloor len/2 \rfloor}$  in  $part2$  if  $len$  is even.
- Step 5: return the value of  $part1 + part2 == x$

### Source code:

---

```
public class Kaprekar
{
    private int lower_range ; // stores lower range
```

```

private int upper_range ; // stores upper range

/* initializes the whole system */
Kaprekar(int lr, int ur)
{
    this.lower_range = lr ;
    this.upper_range = ur ;
}

/* displays the kaprekar numbers in order of their existence */
void display()
{
    for(int i = lower_range; i < upper_range; i++)
    {
        if(iskapraker(i))
            System.out.print(i+", " ) ;
    }
    System.out.println() ;
}

/* the main function that will determine if the number is really kapraker
    ↪ */
boolean iskapraker(int x)
{
    int sq = x*x ; // the square of the number
    int len = (int)(Math.log10(sq)+1) ; // the total number of digits in sq

    // the half of the number using mathematics
    int part1 = sq % (int)Math.pow(10, (int)Math.floor((len * 1.0)/2.0) + (
        ↪ len % 2 == 1 ? 1 : 0)) ;
    int part2 = sq / (int)Math.pow(10, (int)Math.ceil((len * 1.0)/2.0)) ;

    //System.out.println(part2+" "+part1) ;

    return (part1+part2 == x) ;
}
}

```

---

```

import java.util.Scanner ;
public class Kaprekar_main
{
    /* main entry point */
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ; // input handler
        int lr = 0, ur = 0;

        do
        {
            System.out.print("Enter a lower range: ") ;
            lr = sc.nextInt() ;

```

```

        System.out.print("Enter a upper range: ") ;
        ur = sc.nextInt() ;
        if(lr <= 0 || ur <= lr || ur <= 0)
            System.out.println("Wrong Input") ;
    }while(lr <= 0 || ur <= lr || ur <= 0) ;

    Kaprekar kp = new Kaprekar(lr, ur) ;
    kp.display() ; // main interface
}
}

```

---

## Variable Listing:

Name	Function	Type	Scope
lower_range	it stores the lower range of number	int	object
upper_range	it stores the upper range of number	int	object
lr	it is a temporary variable to store range of number	int	main(),Kaprekar()
ur	it is a temporary variable to store range of number	int	main(),Kaprekar()
i	iterator variable to control the for loop	int	display()
x	it is the input to the iskaprekar func.	int	iskaprekar()
sq	it stores the square of the input	int	iskaprekar()
len	it is the number of digits in sq	int	iskaprekar()
part1	it is the first part	int	iskaprekar()
part2	it is the second part	int	iskaprekar()
sc	it is a input handler	Scanner	main()
kp	it is the control object	Kaprekar	main()

## Assignment 2

Write a Java Program to print the first N numbers of the Pell series.

In mathematics, the Pell numbers are an infinite sequence of integers. The sequence of Pell numbers starts with 0 and 1, and then each Pell number is the sum of twice the previous Pell number and the Pell number before that.:

thus, 70 is the companion to 29, and  $70 = 2 * 29 + 12 = 58 + 12$ .

The first few terms of the sequence are :

0, 1, 2, 5, 12, 29, 70, 169, 408, 985, 2375, 5741, 13860

### Algorithm:

#### Class Pell\_main:

##### Method Main:

Step 1: create a input handler and take the number of terms as input

Step 2: if the terms have a less number than 0 then prompt user for reinput

Step 3: create a object of Pell class and call display method

#### Class Pell:

##### Method display:

Step 1: create two variable for first and second pell numbers

Step 2: start a 'for' loop from 0 to N with the loop control i

Step 3: print  $2 * \text{second term} + \text{first term}$  to the screen and also store it in c

Step 4: set first term to second term and second term to c.

### Source code:

---

```
public class Pell
{
    /* displays the whole series from start to finish */
    void display(int N)
    {
        int a = 0 ; // starting you know right
        int b = 1 ; // next number
        for(int i = 0; i < N; i++)
        {
            System.out.print(a+", ") ;
            // store result temporarily
            int c = b * 2 + a ;
            a = b ;
            b = c ;
        }
        System.out.println() ;
    }
}
```

```

    }
}

import java.util.Scanner ;
public class Pell_main
{
    /* entry point of the whole program */
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in);
        int N = 0 ;

        do // I don't want the whole program to collapse
        {
            System.out.print("Enter the value of number of Pell numbers: ") ;
            N = sc.nextInt() ;
            if(N <= 0)
                System.out.println("Number less than 0") ;
        }while(N <= 0) ;

        Pell px = new Pell() ; // object for no damn reason at all
        px.display(N) ; // displays series
    }
}

```

## Variable Listing:

Name	Function	Type	Scope
sc	input handler object that is used for input	Scanner	main()
N	number of pell series terms	int	main(),display()
a	first term of pell series	int	display()
b	second term of pell series	int	display()
c	temporary variable that is used for storing tmp value of stuff	int	display()
px	Pell Class object used to call display()	Pell	main()

# Assignment 3

Write a program to take lower and upper range from the user and print all the octa prime numbers within that range. (A octaprime number is a number whose octal equivalent is prime number.) Example: 15 is a octaprime number as its octal equivalent is 17 which is a prime number.

## Algorithm:

### Class OctaPrime\_main:

#### Method Main:

- Step 1: create a input handler and accept the lower and upper limits
- Step 2: bounds check on the input and if they fail reinput the data
- Step 3: call the printoctalprimes function for the execution of the program

### Class OctaPrime\_main:

#### Method printoctalprimes:

- Step 1: declare i as a loop control variable
- Step 2: start a 'for' loop from lower\_range to upper\_range with i as the loop control.
- Step 3: get a new octal number from the octal function and i as the input
- Step 4: print the octal as a octoprime if it is a prime.

#### Method octal:

- Step 1: create variable to create octal number and a stabilizer.
- Step 2: get into a while loop until x becomes zero
- Step 3: add (x % 8) \* dmz to the value of oc
- Step 4: increase dmz by 10
- Step 5: return the value of oc

#### Method isPrime:

- Step 1: if x less than or equals to one then return false
- Step 2: if numbers starting from 2 till x-1 are a factor of x then return false
- Step 3: if non of the cases match return true

## Source code:

---

```
public class Octaprime
{
    /* returns the octal variant of the number */
    int octal(int x)
    {
        int oc = 0 ; // octal numbers
        int dmz = 1;
        while(x != 0)
        {
            oc += (x % 8) * dmz;
            dmz *= 10;
        }
    }
}
```

```

        x /= 8 ;
    }
    return oc ;
}

/* checks if the number is prime or not */
boolean isPrime(int x)
{
    if(x <= 1) return false ;
    for(int i = 2; i < x; i++) if(x % i == 0) return false ;
    return true ;
}

/* prints the primes accorsding to the instructions */
void printoctaprimes(int lr, int ur)
{
    for(int i = lr; i < ur; i++)
    {
        int o = octal(i) ;
        if(isPrime(o))
            System.out.print(i+", " ) ;
    }
    System.out.println() ;
}
}

```

---

```

import java.util.Scanner ;
public class Octaprime_main
{
    /* entery point of the stuff */
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        int lr = 0, ur = 0 ;

        do
        {
            System.out.print("Enter lower ranger: ") ;
            lr = sc.nextInt() ; // lower limit
            System.out.print("Enter upper ranger: ") ;
            ur = sc.nextInt() ; // upper limit
        }while(lr <= 0 || ur <= 0 || ur <= lr) ;

        Octaprime op = new Octaprime() ;
        op.printoctaprimes(lr, ur) ; // outputs the octaprimes
    }
}

```

---

## Variable Listing:

Name	Function	Type	Scope
op	object to access methods	OctalPrime	main()
x	input to the octal function	int	octal()
dmz	octal number's position stabilizer	int	octal()
oc	octal number that is generated	int	octal()
x	input to the is prime function	int	isPrime()
i	controls the for loop	int	isPrime(), printoctalprimes()
lr	lower range limit	int	printoctalprimes(), main()
ur	upper range limit	int	printoctalprimes(), main()
sc	input handler for input (duh)	int	main()
o	octal number that was generated	int	printoctalprimes()



# Assignment 4

Write a program in java which take as input the name of a student and marks of 5 subjects of the student. The average marks is calculated for the student. This repeated for N students. The program will display the name and the average marks of the student with the lowest average. (No sorting or searching technique to be applied)

## Algorithm:

### Class Avarage.main:

#### Method Main:

- Step 1: create a input handle to accept input from the user
- Step 2: take the input of number of students in N
- Step 3: Check if the input makes sense if not exit
- Step 4: create temporary and call displaySmall

### Class Avarage:

#### Method displaySmall:

- Step 1: create 2 values avgl and namel to store the name and the average of least student
- Step 2: start a loop and continue looping until N is 0.
- Step 3: take input of 5 subjects from the stdin.
- Step 4: create a temporary variable and store the average of the 5 subjects.
- Step 5: check if the average of tmp variable is lower than the avgl.
- Step 6: if the check passes then replace the value of avgl with avg.
- Step 7: and also replace the name depending on Step 5 condition.
- Step 8: reduce N by 1.
- Step 9: after completing the whole loop print the results.

## Source code:

---

```
import java.util.Scanner ;
public class Avarage
{
    /* display smallest */
    void displaySmall(Scanner sc, int N)
    {
        // a very big number which is way above 100 so it will accomodate
        int avgl = 0xffffffff ; /* least average of the const */
        String namel = "" ; /* name of the person begin tortured by society */
        while(N!=0)
        {
            System.out.println("Enter name and marks of 5 subjects: ") ;
            String name = sc.next() ;
            int a[] = {sc.nextInt(), sc.nextInt(), sc.nextInt(), sc.nextInt(), sc
                ↪ .nextInt()} ;
            int avg = (a[0] + a[1] + a[2] + a[3] + a[4])/5 ;
```

```

        if(avg < 0) return ; // best kind of err handling

        if(avg < avgl)
        {
            avgl = avg ;
            namel = name ;
        }

        N-- ;
    }

    System.out.println("Least avg marks: "+avgl+" ; Name: "+namel) ;
}
}
}

import java.util.Scanner ;
public class Avarage_main
{
    /* entery point like who in the right mind would have guessed*/
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        System.out.print("Enter number of students: ") ;
        int N = sc.nextInt() ;
        if(N < 0) return ; // best kind of err handling
        new Avarage().displaySmall(sc, N) ;
    }
}
}

```

## Variable Listing:

Name	Function	Type	Scope
avgl	least average of the cost	int	displaySmall
namel	name of the person with smallest number	String	displaySmall
a	stores the value of all 5 subject marks	int[]	displaySmall
avg	temporary avarage of the 5 subjects	int	displaySmall
N	number of students input	int	displaySmall, main
sc	input handler using scanner	Scanner	displaySmall, main

## Assignment 5

Write a program which takes N integers from the user in an array and removes the duplicate elements from the array and display the new array.

Example:

Enter no of integers : 7

Input array elements: 1,2,3,1,2,3,4

Output

### Algorithm:

#### Class Duplicate\_main:

##### Method Main:

Step 1: create a input handle

Step 2: take the number of elements as input

Step 3: fill up the array with input data

Step 4: create a temporary object and call the appropriate method

#### Class Duplicate:

##### Method removeDupAndPrint:

Step 1: create a string to store out put

Step 2: Iterate through the array.

Step 3: Check the first index of the element in out

Step 4: if it exists in out then don't add else add it.

Step 5: replace the "[space]" with ",[space]" and print it

### Source code:

---

```
public class Duplicate
{
    void removeDupAndPrint(int x[])
    {
        String out = "" ; // output

        // finds out the elements that are duplicate
        for(int i = 0; i < x.length; i++)
        {
            // index of returns -1 if element does not exist
            if(out.indexOf(x[i]+" ") < 0)
                out = x[i]+" "+out ;
        }

        // prints with a ,
        System.out.println(out.replace(" ", ", "));
    }
}
```

```

}
import java.util.Scanner ;
public class Duplicate_main
{
    // entry point of Duplicate_main
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ; // input handler
        int num = sc.nextInt() ; // number of elements of array because java is
            ↪ retarded
        int nx[] = new int[num] ; // the array because java does not do it for
            ↪ me
        while(num-- != 0) nx[num] = sc.nextInt() ; // inputs the numbers
            ↪ required

        // did all the array resizing and printing so nothing left to do
        new Duplicate().removeDupAndPrint(nx) ;
    }
}

```

## Variable Listing:

Name	Function	Type	Scope
sc	input handler	Scanner	main
num	number of elements of array	int	main
nx	the array of input data	int[]	main

# Assignment 6

A class Mixer has been defined to merge two sorted integer array in ascending order. Some of the members of the class are given below:

<b>Class Name:</b>	<b>Mixer</b>
<b>Data members/instance variables:</b>	
int arr[]	: to store elements of an array
int n	: to store the size of the array
<b>Member functions:</b>	
Mixer(int nn)	: constructor to assign n = nn
void accept()	: to accept the elements of the array in ascending order without any duplicates
Mixer mix(Mixer A)	: to merge the current object array elements with the parameterized array elements and return the resultant object.
void display()	: to display elements of the array

## Algorithm:

### Class Pell\_main:

#### Method Main:

- Step 1: create a input handler using Scanner class.
- Step 2: create 2 variables to hold the length of the mixer arrays
- Step 3: check if the input is sensible and greater than 0
- Step 4: if the check fails prompt the user again to input number
- Step 5: create two objects of mixer class using the previously declared variables.
- Step 6: accept input from the user using the accept() method.
- Step 7: call the mix method using the mix objects that are created.
- Step 8: display the mixed arrays.

### Class Mixer:

#### Method Mixer:

- Step 1: set the object variable n to nn
- Step 2: create an array of size n and store it in object variable to arr

#### Method mix:

- Step 1: create a new object for mixer with the size of the two input mixer arrays.
- Step 2: fill the newly created array with the elements of A and this.
- Step 3: sort the array of the newly created object using insertion sort.
- Step 4: return the object.

#### Method accept:

- Step 1: create a input handler using Scanner class.
- Step 2: loop through the arr array of the current object and fill it with input.

#### Method display:

Step 1: loop through the whole arr array of current object and print the elements.

Step 2: print a newline for aesthetics.

## Source code:

---

```
import java.util.Scanner ;
public class Mixer
{
    int arr[] ; // to store elements of an array
    int n ; // to store the size of the array

    Mixer(int nn)
    {
        this.n = nn ;
        this.arr = new int[nn] ;
    }

    // accepts all the input in the arr array
    void accept()
    {
        Scanner sc = new Scanner(System.in) ;
        for(int i = 0; i < this.n; i++)
        {
            this.arr[i] = sc.nextInt() ; // int is the input type
        }
    }

    // mixes stuff like merge sort.
    Mixer mix(Mixer A)
    {
        Mixer m = new Mixer(this.n + A.n) ;

        // copy every thing to the m.arr first
        for(int i = 0; i < this.n; i++) m.arr[i] = this.arr[i] ;
        for(int i = this.n; i < m.n; i++) m.arr[i] = A.arr[i-this.n] ;

        // now sort the whole thing.
        for(int i = 1; i < m.n; ++i)
        {
            int key = m.arr[i] ;
            int j = i - 1 ;
            while(j >= 0 && m.arr[j] > key)
            {
                m.arr[j+1] = m.arr[j] ;
                --j ;
            }
            m.arr[j+1] = key ;
        }
    }
}
```

```

    return m ;
}

// print the whole beautiful *sigh* array
// I had to write the same thing 10 times in a row
// now I am tired. god save my soul.
void display()
{
    for(int i = 0; i < this.n; i++)
        System.out.print(this.arr[i]+" ") ;
    System.out.println() ;
}
}

```

---

```

import java.util.Scanner ;
public class Mixer_main
{
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        int n1 = 0; // two different elements
        int n2 = 0;

        System.out.print("Number Of Elements: ") ;

        do{ n1 = sc.nextInt() ;}while(n1 <= 0) ; // inputs of both
        do{ n2 = sc.nextInt() ;}while(n2 <= 0) ;

        Mixer m1 = new Mixer(n1) ; // initializing 2 objs
        Mixer m2 = new Mixer(n2) ;

        m1.accept() ; // accepts input in mixer
        m2.accept() ;

        Mixer m3 = m1.mix(m2) ; // mixes the stuff

        System.out.println("Output: ") ; // prints the stuff out
        m3.display() ;
    }
}

```

---

## Variable Listing:

Name	Function	Type	Scope
n1	number of elements	int	main
n2	number of elements	int	main
m1	object to be filled	Mixer	main
m2	object to be filled	Mixer	main
m3	output of the mixers	Mixer	main
arr	to store elements of an array	int[]	Mixer
n	to store size of arr	int	Mixer
nn	temporary input var	int	Mixer()
sc	input of all the numbers	Scanner	accept, main
A	mix object to be used to mix stuff	Mixer	mix
m	output of the mix method	Mixer	mix
i,j	loop control variables	int	mix
key	key of insertion sort	int	mix



# Assignment 7

Write a program which takes n integers as input(max 50 integers) and stores them in an array data from index 0 to n-1. Now we want to rearrange the integers in the following way:- find the minimum value and put it in position (n/2) [for odd number of elements] and position (n/2-1) [for even number number elements] ; find the second smallest value and put it to its right; then the third small and place it to its left and so on altering right and left until all the integers are done.

Initial array:- (size: 7)

7	3	1	6	4	2	
---	---	---	---	---	---	--

Initial array:- (size: 6)

7	3	1	6	4	2	5
---	---	---	---	---	---	---

After re-arrangement of the first array becomes

6	3	1	2	4	7	
---	---	---	---	---	---	--

After re-arrangement the second array becomes

7	5	3	1	2	4	6
---	---	---	---	---	---	---

## Algorithm:

### Class Alternate\_main:

#### Method Main:

- Step 1: create a input handle from the console
- Step 2: create variables to hold array and sizes
- Step 3: take input from user if the input is bad reprompt
- Step 4: call fill method of the Alternate class.
- Step 5: print the nx buff.

### Class Alternate:

#### Method fill:

- Step 1: create a variable called pos.
- Step 2: check if input is array length is even
- Step 3: if the check passes then set pos to arr.length/2 - 1
- Step 3: else set pos to arr.length/2
- Step 4: loop from 0 to arr.length using i
- Step 5: loop from 0 to arr.length - 1 using j
- Step 6: swap arr[j] and arr[j+1] if arr[j] > arr[j+1]
- Step 7: after loop start new loop from 0 to nx.length using i
- Step 8: set pos = pos - i \* (1 if i is even else -1)
- Step 9: set nx[pos] = arr[i]
- Step 10: complete loop.

## Source code:

---

```
public class Alternate
{
    // fills the whole array
    void fill(int arr[], int nx[])
    {
        int pos = arr.length % 2 == 0 ? arr.length/2 - 1 : arr.length/2 ;
        int dn = 1 ;

        // sorting the whole thing using insertion sort.
        for(int i = 0; i < arr.length; i++)
        {
```

```

    for(int j = 0; j < arr.length - 1; j++)
    {
        if(arr[j] > arr[j+1])
        {
            int tmp = arr[j] ;
            arr[j] = arr[j+1] ;
            arr[j+1] = tmp ;
        }
    }
}

// goes up 2 times because other wise things might result
// in SIGSEGV which is what i dont't like.
for(int i = 0; i < nx.length; i++)
{
    pos -= i * (int)Math.pow(-1, i) ;
    nx[pos] = arr[i] ;
}
}
}

```

---

```

import java.util.Scanner ;
public class Alternate_main
{
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        int n = 0 ;
        int arr[] = null ;
        int nx[] = null ;

        do{ n = sc.nextInt() ; }while(n <= 0) ;
        arr = new int[n] ;
        nx = new int[n] ;

        for(int i = 0; i < n; i++)
            arr[i] = sc.nextInt() ;

        // arr will be sorted after this but who cares
        new Alternate().fill(arr, nx) ;

        // printing i guess
        System.out.println() ;
        for(int i = 0; i < n; i++)
            System.out.print(nx[i]+" ") ;
        System.out.println() ;
    }
}
}

```

---

## Variable Listing:

Name	Function	Type	Scope
arr	the input array which gets sorted	int[]	fill,main
nx	the buffer that is to be filled	int[]	fill,main
pos	the starting position of the filler	int	fill
i, j	loop control variable of the sorter	int	fill, main
tmp	temporary variable for swapping	int	fill
n	number of elements in the array	int	main

# Assignment 8

Two matrices are said to be equal if they have the same dimension and their corresponding elements are equal.

For examples, the two matrix A and B given below are equal:

Matrix A			Matrix B		
1	2	3	1	2	3
2	4	5	2	4	5
3	5	6	3	5	6

Design of class EqMat to check if two matrices are equal or not. Assume that the two matrices have the same dimension. some of the members of the class are given below:

**Class name**

**EqMat**

**Data members/instance**

**Members:**

a[][]	to store integer elements
m	to store number of rows
n	to store number of columns

**Members functions methods:**

Define the class Eq-

EqMat(int mm, int nn)	parameterized constructor initialize the data members m = mm and n = nn ;
void readarray()	to enter elements in the array
int check(EqMat p, EqMat q)	checks if the parameterized objects p and q are equal and returns 1 if true otherwise returns 0.
void print()	displays the arrays elements.

Mat giving details of constructor(), void readarray(), int check(EqMat, EqMat) and void print(). Define the main() function to create objects and call the functions accordingly to enable the task.

## Algorithm:

**Class EqMat\_main:**

**Method main:**

- Step 1: take input from the user about the row and cols.
- Step 2: check if the input is greater than 0 and retake input if not.
- Step 3: create a EqMat object and call readarray for input array.
- Step 4: repeat the last three steps again for a new object.
- Step 5: call print function of the first object.
- Step 6: call print function of the second object.
- Step 7: check if a.check(b) is equal to 1
- Step 8: if the check passes print array are equal
- Step 9: if the check fails print array are not equal

**Class EqMat:**

**Method Eqmat:**

- Step 1: initialize all object variables
- Step 2: create a new object for object a variable

**Method check:**

- Step 1: check if the matrix are even same dimensional.

Step 2: if the check fails return 0 ;  
Step 3: loop from 0 to p.m using i as variable  
Step 4: loop from 0 to q.n using j as variable  
Step 5: check if p.a[i][j] is not equal to q.a[i][j].  
Step 6: if the check fails return 0 ;  
Step 7: return if the control makes it out of the loops.

#### Method print:

Step 1: loop from 0 through the number of rows using i as var.  
Step 2: loop from 0 through the number of cols using j as var.  
Step 3: print a[i][j] with a space at the end.  
Step 4: print a new line at the end of j var.

#### Method readarray:

Step 1: create a input stream handle.  
Step 2: take input in the buffer created in a.

## Source code:

---

```
import java.util.Scanner ;
public class EqMat
{
    int a[][] ; // integer matrix storer
    int m ; // number of rows
    int n ; // number of cols

    // init function of java called the costructor
    EqMat(int mm, int nn)
    {
        this.m = mm ;
        this.n = nn ;
        this.a = new int[mm][nn] ;
    }

    // check if the whole thing works. it returns 1 if ok else 0
    int check(EqMat p, EqMat q)
    {
        if(p.m != q.m || p.n != q.n) return 0 ;
        for(int i = 0; i < p.m; i++)
        {
            for(int j = 0; j < q.n; j++)
            {
                // if one is not equal and thus it does not waste time
                if(p.a[i][j] != q.a[i][j])
                    return 0 ;
            }
        }
        return 1 ;
    }
}
```

```

}

// print the whole thing
void print()
{
    // loops through all the elements and prints the whole thing.
    for(int i = 0; i < this.m; i++)
    {
        for(int j = 0; j < this.n; j++)
        {
            System.out.print(this.a[i][j]+" ") ;
        }
        System.out.println() ;
    }
}

// reads matrix input from the start.
void readarray()
{
    Scanner sc = new Scanner(System.in) ;
    for(int i = 0; i < m; i++)
    {
        for(int j = 0; j < n; j++)
        {
            a[i][j] = sc.nextInt() ;
        }
    }
}
}

}

```

---

```

import java.util.Scanner ;
public class EqMat_main
{
    // entry point
    public static void main(String args[])
    {
        int m = 0;
        int n = 0;
        Scanner sc = new Scanner(System.in);

        // first input
        do
        {
            System.out.print("Enter the value of m and n respectively: ") ;
            m = sc.nextInt() ;
            n = sc.nextInt() ;
        }while(m <= 0 || n <= 0) ;

        EqMat a = new EqMat(m, n) ;
        System.out.println("Enter array elements: ") ;
        a.readarray() ;
    }
}

```

```

// reusing the variable because I have no shame
do
{
    System.out.print("Enter the value of m and n respectively: ") ;
    m = sc.nextInt() ;
    n = sc.nextInt() ;
}while(m <= 0 || n <= 0) ;

EqMat b = new EqMat(m, n) ;
System.out.println("Enter array elements: ") ;
b.readarray() ;

System.out.println("A: ") ;
a.print() ;

System.out.println("B: ") ;
b.print() ;

// prints relevant message if required.
if(a.check(a, b) == 1)
    System.out.println("The arrays are equal") ;
else
    System.out.println("The arrays are not equal") ;
}
}

```

---

## Variable Listing:

Name	Function	Type	Scope
a[][]	integer matrix storer	int[][]	EqMat:object
m	number of rows	int	EqMat:object, main
n	number of cols	int	EqMat:object, main
mm	a temporary variable for m	int	EqMat
nn	a temporary variable for n	int	EqMat
p	input for check function	EqMat	check
q	input for check function	EqMat	check
i	loop control variable	int	print
j	loop control variable	int	print
sc	Input handle variable	Scanner	readarray, main
a,b	object for testing	main	main

## Assignment 9

Write a program to declare a square matrix  $A[][]$  of order (M x M) where 'M' is the number of rows and the number of columns such that M must be greater than 2 and less than 20. Allow the user to input integers into this matrix. Display appropriate error message for an invalid input. Perform the following tasks:

- a) Display the input matrix.
- b) Create a mirror image matrix.
- c) Display the mirror image matrix

Test your program with the sample data and some random data:

### Example 1:

INPUT : M = 3

```
4  16  12
8   2  14
4   1   3
```

OUTPUT :

ORIGINAL MATRIX

```
4  16  12
8   2  14
4   1   3
```

MIRROR IMAGE MATRIX

```
12  16   4
14   2   8
 3   1   4
```

### Algorithm:

#### Class Mirror\_main:

##### Method Main:

- Step 1: create a input handle using scanner
- Step 2: input the number of chracters
- Step 3: create a 2d-array and fill it with data.
- Step 4: check and reprompt if the size if greater than 22 or lesser than 2.
- Step 5: create matrix object.
- Step 6: display the matrices.

#### Class Mirror:

##### Method display\_original:

- Step 1: loop from 0 to M using i



Step 2: loop from 0 to M using j  
Step 3: print A[i][j]  
Step 4: after second loop print new line

#### Method display\_mirror:

Step 1: loop from 0 to M using i  
Step 2: loop from 0 to M using j  
Step 3: print A[i][M-1-j]  
Step 4: after second loop print new line

#### Method Mirror:

Step 1: take M and A[][] as a input.  
Step 2: initialize object a new buffer called A with the size M x M.  
Step 3: fill the index of object's  $A[i/M][i\%M] = A[i/M][i\%M]$   
Step 4: initialize object's M to be M

## Source code:

---

```
public class Mirror
{
    int A[][] ; // the matrix storage.
    int M ; // the size of the matrix.

    // Did i really have to give a comment here
    // is the function name not at all descriptive
    // :( Sorry but it hurts me.

    Mirror(int M, int A[][])
    {
        this.A = new int[M][M] ;

        // this deep copies the array and
        // does not store the array reference
        // and thus it does not change the
        // value of the input array.
        for(int i = 0; i < M*M; i++)
            this.A[i/M][i%M] = A[i/M][i%M] ;

        this.M = M ;
    }

    // prints the original matrix
    void display_original()
    {
        for(int i = 0; i < M; i++)
        {
            for(int j = 0; j < M; j++)
            {
```

```

        System.out.print(A[i][j]+" ") ;
    }
    System.out.println() ;
}
}

// mirrors the matrix prints the elements
void display_mirror()
{
    for(int i = 0; i < M; i++)
    {
        for(int j = 0; j < M; j++)
        {
            // reverses the order of the output counting
            // thus mirroring the matrix effectively
            System.out.print(A[i][M-1-j]+" ") ;
        }
        System.out.println() ;
    }
}
}

```

---

```

import java.util.Scanner ;
public class Mirror_main
{
    // main entry point.
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        System.out.println("M= ") ;
        int M = sc.nextInt() ;
        int A[][] = new int[M][M] ;

        // as the input is asked :D
        if(M < 2 || M > 22)
        {
            System.out.println("SIZE OUT OF RANGE");
        }

        // input of the array as well
        for(int i = 0; i < M*M; i++)
            A[i/M][i%M] = sc.nextInt() ;

        Mirror mr = new Mirror(M, A) ;
        System.out.println("ORIGINAL MATRIX") ;
        mr.display_original() ;
        System.out.println("MIRROR MATRIX") ;
        mr.display_mirror() ;
    }
}

```

---

## Variable Listing:

Name	Function	Type	Scope
A	the matrix storage	int[][]	Mirror:object, Mirror, main
M	the size of the matrix	int[][]	Mirror:object, Mirror, main
i,j	index value of the for loops	display_original, display_mirror	
sc	input handler	Scanner	main
mr	input Mirror object	Mirror	main

# Assignment 10

A company manufactures packingg cartons in four sizes, i.e. cartons to accommodate 6 boxes, 12 boxes, 24 boxes and 48 boxes. Desiggn a program to accept the number of boxes to be packed (N) by the user (maximum up to 1000 boxes) and display the break-up of the cartons used in descending order of capacity (i.e. preference should be given to the highest capacity available, adn if boxes left are less than 6, an extra carton of capacity 6 should be used.)

Test your program with the following data and some random data:

## Example 1:

**INPUT:** N = 726

**OUTPUT:** 48 x 15 = 720

6 x 1 = 6

Remaining boxes = 0

Total number of boxes = 726

Toatl number of cartons = 16

## Example 2:

**INPUT:** N = 726

**OUTPUT:** 48 x 15 = 720

6 x 1 = 6

Remaining boxes = 0

Total number of boxes = 726

Toatl number of cartons = 16

## Algorithm:

### Class Company\_main:

#### Method Main:

Step 1: create a input handle using Scanner class

Step 2: take input the number of boxes.

Step 3: check if the input is sane. if the input is not sane print INVALID INPUT.

Step 4: create a compmany object using the N as intput.

Step 5: call calculate using company object.

Step 6: call pretty\_print using company object.

### Class Company:

#### Method calculate:

Step 1: create a copy of N locally.

Step 2: loop from 0 to this.cartons.length using the variable i

Step 3: execute the statement num\_cartons[i] = N / cartons[i]

Step 4: execute the statement num\_carton++

Step 5: execute the statement N %= cartons[i]

Step 6: set remainder to N

### Method pretty\_print:

Step 1: loop from 0 to this.num\_cartons.lengths using the variable i

Step 2: execute print statement only if num\_cartons[i] not equals 0

Step 3: print the output in a fancy format.

### Method Company:

Step 1: initialize cartons with [48 24 12 6] for carton listings.

Step 2: initialize num\_cartons with a new buffer of number of type of cartons

Step 4: initialize N with input N.

Step 5: initialize num\_carton to zero

## Source code:

---

```
public class Company
{
    int N ; // the number of boxes
    int cartons[] ; // the varid capacity boxes list
    int num_cartons[] ; // the magnitude of each boxes
    int num_carton ; // this is the total number of cartons that are required
    int remainder ; // the remaining boxes after filling

    // creates the boxes and stuff
    Company(int N)
    {
        this.cartons = new int[]{48, 24, 12, 6} ;
        this.num_cartons = new int[this.cartons.length] ;
        this.N = N ;
        this.num_carton = 0 ;
    }

    void calculate()
    {
        // saves a local copy to calculate data
        int N = this.N ;

        // rolls through all the cartons and calculates their magnitude.
        for(int i = 0; i < this.cartons.length; i++)
        {
            // gets how many can be acomodated in number of cartons
            this.num_cartons[i] = N / this.cartons[i] ;
            this.num_carton++ ;
            // then cheks how many remained.
            N %= this.cartons[i] ;
        }

        // checks if there are any remainders.
        this.remainder = N ;
    }
}
```

```

// this function prints the whole thing in a fancy manner. i like it :)
void pretty_print()
{
    // the print statements are tweaked many times to get the correct
    ↪ result.
    for(int i = 0; i < this.num_cartons.length; i++)
    {
        if(this.num_cartons[i] != 0)
            System.out.println("\t\t\t"+this.cartons[i]+" x "+this.num_cartons[
                ↪ i]+\t= "+
                (this.cartons[i]*this.num_cartons[i])) ;
    }
    System.out.println("Remaining boxes \t"+((this.remainder != 0)?this.
        ↪ remainder+" x 1\t= ":"\t= "+this.remainder) ;
    System.out.println("Total Number of boxes \t\t= "+this.N) ;
    System.out.println("Total Number of cartons \t= "+this.N) ;
}
}

import java.util.Scanner ;
public class Company_main
{
    // entry point of the program
    public static void main(String args[])
    {
        Scanner sc = new Scanner(System.in) ;
        System.out.print("N = ") ;
        int N = sc.nextInt() ;
        if(N < 0 || N > 1000)
        {
            System.out.println("INVALID INPUT") ;
            return ;
        }
        Company c = new Company(N) ;
        c.calculate() ;
        c.pretty_print() ;
    }
}

```

---

## Variable Listing:

Name	Function	Type	Scope
sc	input handler object that is used for input	Scanner	main
N	number of box	int	main,Company:obj,calculate
c	Company obbject createor	Company	main
i,j	iterator control variable	pretty_print	pretty_print, calculate
cartons	the varid capacity boxes list	int[]	Company:obj
num_cartons	the magnitude of each boxes	int[]	Company:obj
num_carton	this is the total number of cartons that are required	int	Company:obj
remainder	the remaining boxes after filling	int	Company:obj