

Computer Project

Aanjishnu Bhattacharyya

July 31, 2021

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 $sq \% 10^{\lceil len/2 \rceil}$ in $part1$ if len is odd.
- Step 4: store the value of $sq \% 10^{len/2}$ 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) +
        ↪ 1) ;
    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)
    {
        int avgl = 0 ; /* least avarage 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 handeling
        }
    }
}
```

```

        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
{
    /* entry 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:

Class Name:	Mixer
Data members/instance variables:	
int arr[]	: to store elements of an array
int n	: to store the size of the array
Member functions:	
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 of 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 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 avarage 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 avarage of the 5 subjects.

Step 5: check if the avarage 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:

```
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 ;
```