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Class / Division : TY – D

PRN No. : 122B1B255

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**Assignment No. 01**

**Problem Statement** : Write a program to compute squares of 20-digit large integer numbers and product of 2 large integers numbers using divide and conquer strategy ( Make it menu driven ).

**Code**

package daa;

import java.util.Scanner;

public class Aug20 {

public static void main(String[] args) {

// TODO Auto-generated method stub

Scanner sc = new Scanner(System.in);

int ch;

do {

System.out.println("1. Multiplication of two numbers.");

System.out.println("2.Square of a number : ");

System.out.println("3.Exit : ");

System.out.print("Enter your choice : ");

ch = sc.nextInt();

switch (ch) {

case 1: {

System.out.println("Enter the two Numbers : ");

System.out.print("1st Number : ");

String str1 = sc.next();

System.out.print("2nd Number : ");

String str2 = sc.next();

String ans = new Karatsuba(str1, str2).multiply();

System.out.println("The Answer is : " + ans);

break;

}

case 2 : {

System.out.println("Enter the Number : ");

System.out.print("1st Number : ");

String str1 = sc.next();

String ans = new Karatsuba(str1, str1).multiply();

System.out.println("The Answer is : " + ans);

break;

}

case 3 : {

System.out.println("Thank You !!!");

break;

}

default:

throw new IllegalArgumentException("Unexpected value: " + ch);

}

} while (ch != 3);

}

}

class Karatsuba {

String str1;

String str2;

public Karatsuba(String str1, String str2) {

super();

this.str1 = str1;

this.str2 = str2;

}

public String sumTwo() {

String ans = "";

if (str1.length() > str2.length()) {

String temp = str1;

str1 = str2;

str2 = temp;

}

int n1 = str1.length();

int n2 = str2.length();

str1 = new StringBuilder(str1).reverse().toString();

str2 = new StringBuilder(str2).reverse().toString();

int carry = 0;

for (int i = 0; i < n1; i++) {

int sum = (str1.charAt(i) - '0') + (str2.charAt(i) - '0') + carry;

ans += (char) (sum % 10 + '0');

carry = sum / 10;

}

for (int i = n1; i < n2; i++) {

int sum = ((str2.charAt(i) - '0') + carry);

ans += (char) (sum % 10 + '0');

carry = sum / 10;

}

if (carry != 0)

ans += (char) (carry + '0');

return new StringBuilder(ans).reverse().toString();

}

public String diffTwo() {

String ans = "";

if (str1.length() < str2.length()) {

String temp = str1;

str1 = str2;

str2 = temp;

}

int n1 = str1.length();

int n2 = str2.length();

str1 = new StringBuilder(str1).reverse().toString();

str2 = new StringBuilder(str2).reverse().toString();

int borrow = 0;

for (int i = 0; i < n2; i++) {

int diff = (str1.charAt(i) - '0') - (str2.charAt(i) - '0') - borrow;

if (diff < 0) {

diff = diff + 10;

borrow = 1;

} else {

borrow = 0;

}

ans += (char) (diff + '0');

}

for (int i = n2; i < n1; i++) {

int diff = ((str1.charAt(i) - '0') - borrow);

if (diff < 0) {

diff = diff + 10;

borrow = 1;

} else {

borrow = 0;

}

ans += (char) (diff + '0');

}

return new StringBuilder(ans).reverse().toString();

}

public String removeZeros(String str) {

int idx = 0;

while(str.charAt(idx) == '0') {

idx++;

if(idx == str.length()) {

idx = 0;

break;

}

}

int n = str.length();

str.substring(idx, n-1);

return str;

}

public String multiply() {

if (str1.length() > str2.length()) {

String temp = str1;

str1 = str2;

str2 = temp;

}

int n1 = str1.length();

int n2 = str2.length();

String ans = "";

while (n2 > n1) {

str1 = "0" + str1;

n1++;

}

if (n1 == 1) {

int ansInt = Integer.parseInt(str1) \* Integer.parseInt(str2);

return Integer.toString(ansInt);

}

if (n1 % 2 == 1) {

str1 = "0" + str1;

str2 = "0" + str2;

n1++;

}

String al = "", ar = "", bl = "", br = "";

for (int i = 0; i < n1 / 2; i++) {

al += str1.charAt(i);

bl += str2.charAt(i);

ar += str1.charAt(n2 / 2 + i);

br += str2.charAt(n2 / 2 + i);

}

String p = new Karatsuba(al, bl).multiply();

String q = new Karatsuba(ar, br).multiply();

String r = new Karatsuba(

new Karatsuba(new Karatsuba(al, ar).sumTwo(), new Karatsuba(bl, br).sumTwo()).multiply(),

new Karatsuba(p, q).sumTwo()).diffTwo();

for (int i = 0; i < n1; ++i)

p = p + "0";

// Multiply s by 10^(n/2)

for (int i = 0; i < n1 / 2; ++i)

r = r + "0";

ans = new Karatsuba(p, new Karatsuba(q, r).sumTwo()).sumTwo();

ans = removeZeros(ans);

return ans;

}

}

**Output**

1. Multiplication of two numbers.

2.Square of a number :

3.Exit :

Enter your choice : 1

Enter the two Numbers :

1st Number : 12345678923456789

2nd Number : 98765432113456789

The Answer is : 00000000018977455358086667816292407765025

1. Multiplication of two numbers.

2.Square of a number :

3.Exit :

Enter your choice : 2

Enter the Number :

1st Number : 12345678912345678955

The Answer is : 0000101494329294140746205082616944100229321

1. Multiplication of two numbers.

2.Square of a number :

3.Exit :

Enter your choice : 3

Thank You !!!