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NUMBERING SYSTEMS CONVERTER

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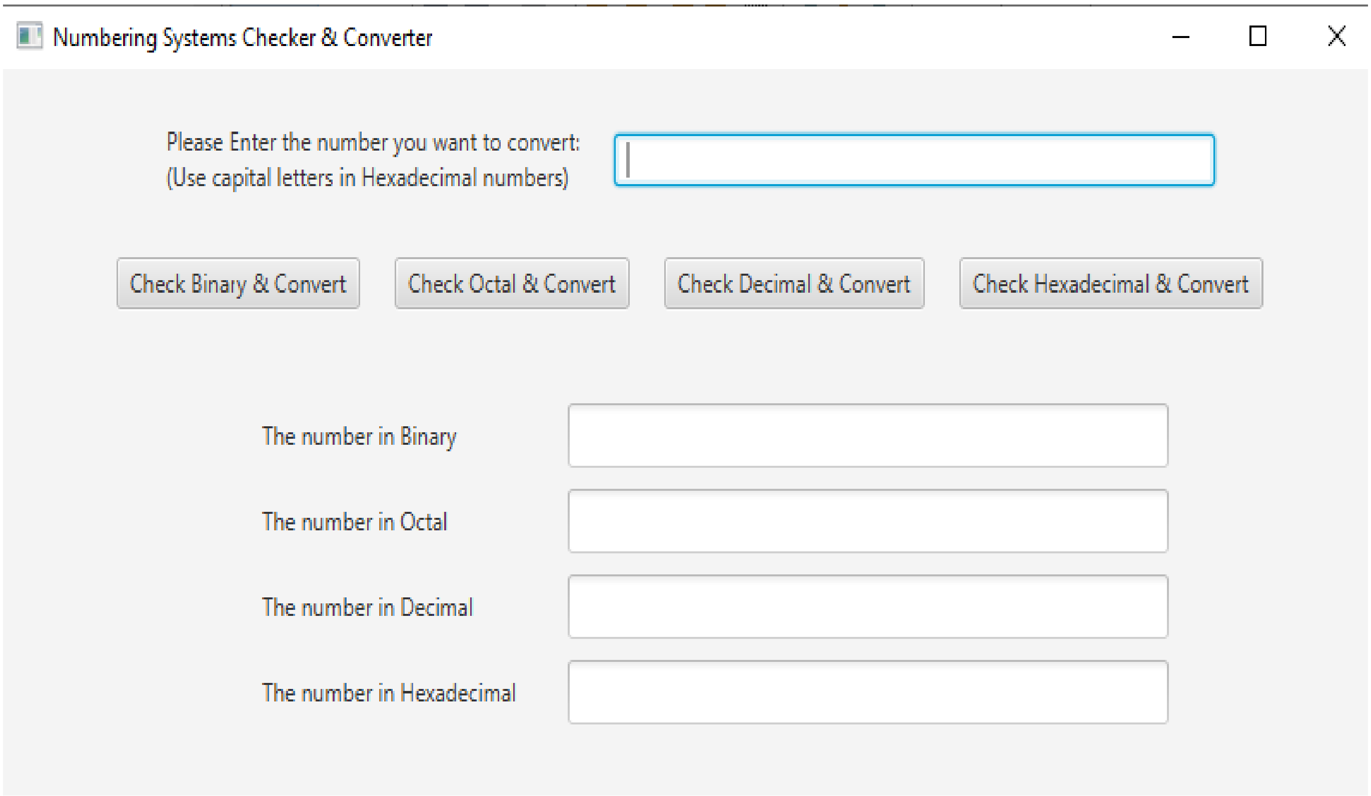
NUMBERING SYSTEMS CONVERTER

Introduction & Idea

NUMBERING SYSTEMS CONVERTER is a ***GUI*** application developed using ***JAVAFX***, it converts from / to Binary, Octal, Decimal, and Hexadecimal numbering systems. There is also a possibility to check if the input number is written correctly or the number is represented in that system wrongly. In this application There is an input text field and another four text fields for the output numbers represented in the main four numbering systems. To control checking and converting process, there are four buttons. Each button represents a system of the four systems. When you click any button. Firstly, the program will check each bit in the entered number. If the bit value is more than or equal the base of the system of the button, all output fields will display wrong message. And if the bit value is less than the base of the system, there will be many processes done to this number to get the output for the four output Text Fields.

GUI & Design



Numbering Systems Checker & Converter
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers)
Check Binary & Convert
Check Octal & Convert
Check Decimal & Convert
Check Hexadecimal & Convert
The number in Binary
The number in Octal
The number in Decimal
The number in Hexadecimal

As you can see there is an input text field with label:

`Please Enter the number you want to convert:`

`(Use capital letters in Hexadecimal numbers)`

It is used to receive the number to be converted.

There are four buttons which are responsible for checking and converting the entered number:

`Check Binary & Convert`

`Check Octal & Convert`

`Check Decimal & Convert`

```
Check Hexadecimal & Convert
```

Finally, there are also four text fields used to display the output of checking and converting processes and their labels are

```
The number in Binary
The number in Octal
The number in Decimal
The number in Hexadecimal
```

Implementation Steps

- ***Packages***

There is the main package for any program which has the same name of the program:

```
package numbering.systems.converter;
```

And I imported other packages:

These are the packages used to work with ***javafx*** as they create the application, its stage, and its scene.

```
import javafx.application.Application;
import javafx.stage.Stage;
import javafx.scene.Scene;
```

Here I imported labels, buttons, and text fields packages.

```
import javafx.scene.control.Label;
import javafx.scene.control.Button;
import javafx.scene.control.TextField;
```

To control the way of adding the nodes with each other, I imported these three packages.

```
import javafx.scene.layout.GridPane;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
```

This package is used to control the insets (distance from the edge of the region to the edge of the content area) of any node [1][2].

```
import javafx.geometry.Insets;
```

This package is used in modifying the alignment of nodes or panes on the scene.

```
import javafx.geometry.Pos;
```

And I imported this to control the horizontal alignment of the labels.

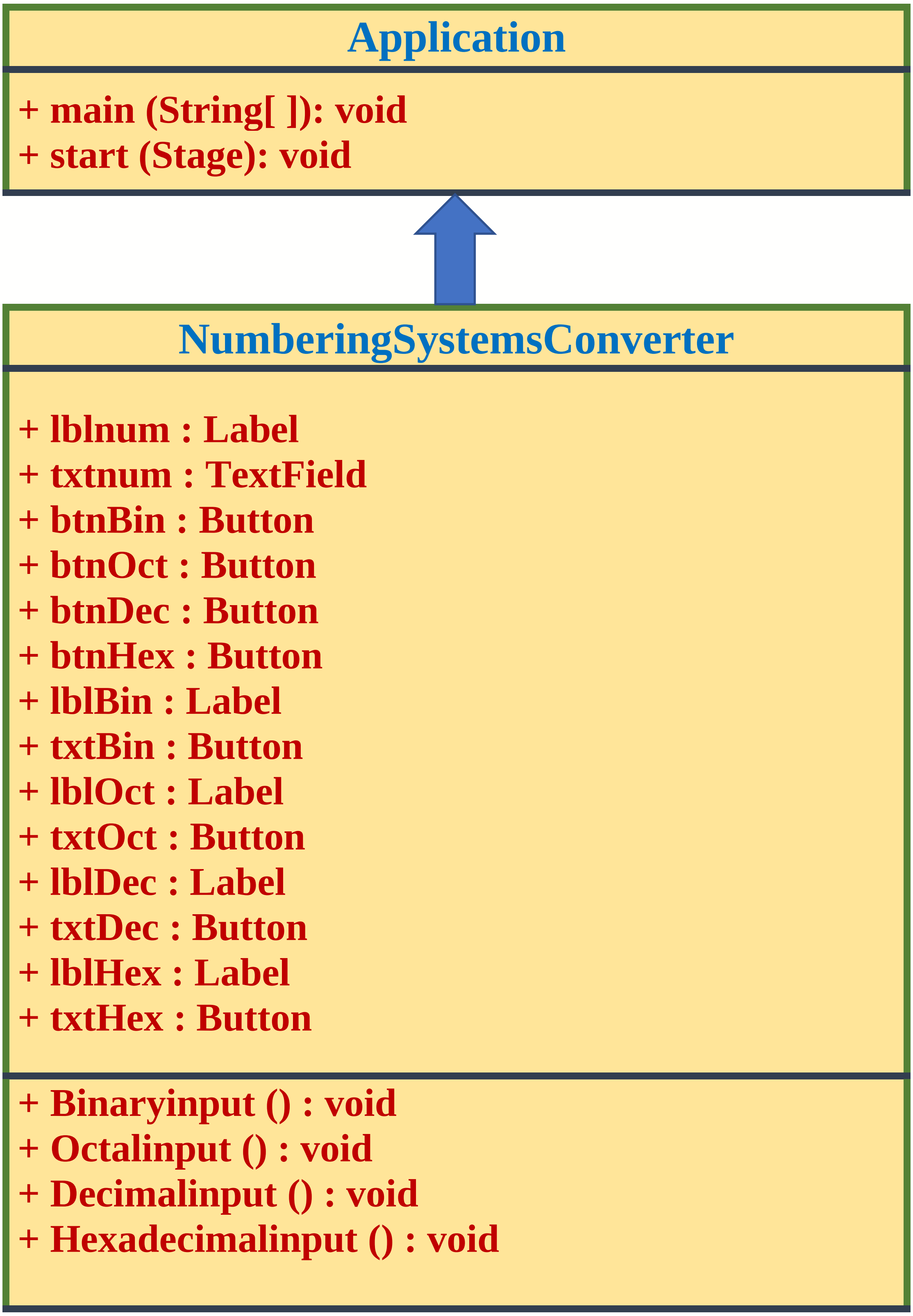
```
import javafx.geometry.HPos;
```

- ***Classes***

There is only the `"NumberingSystemsConverter"` class which inherits `"Application"` class.

- ***UML***

Helpful examples [3][4][5].



Application

+ main (String[ ]): void
+ start (Stage): void

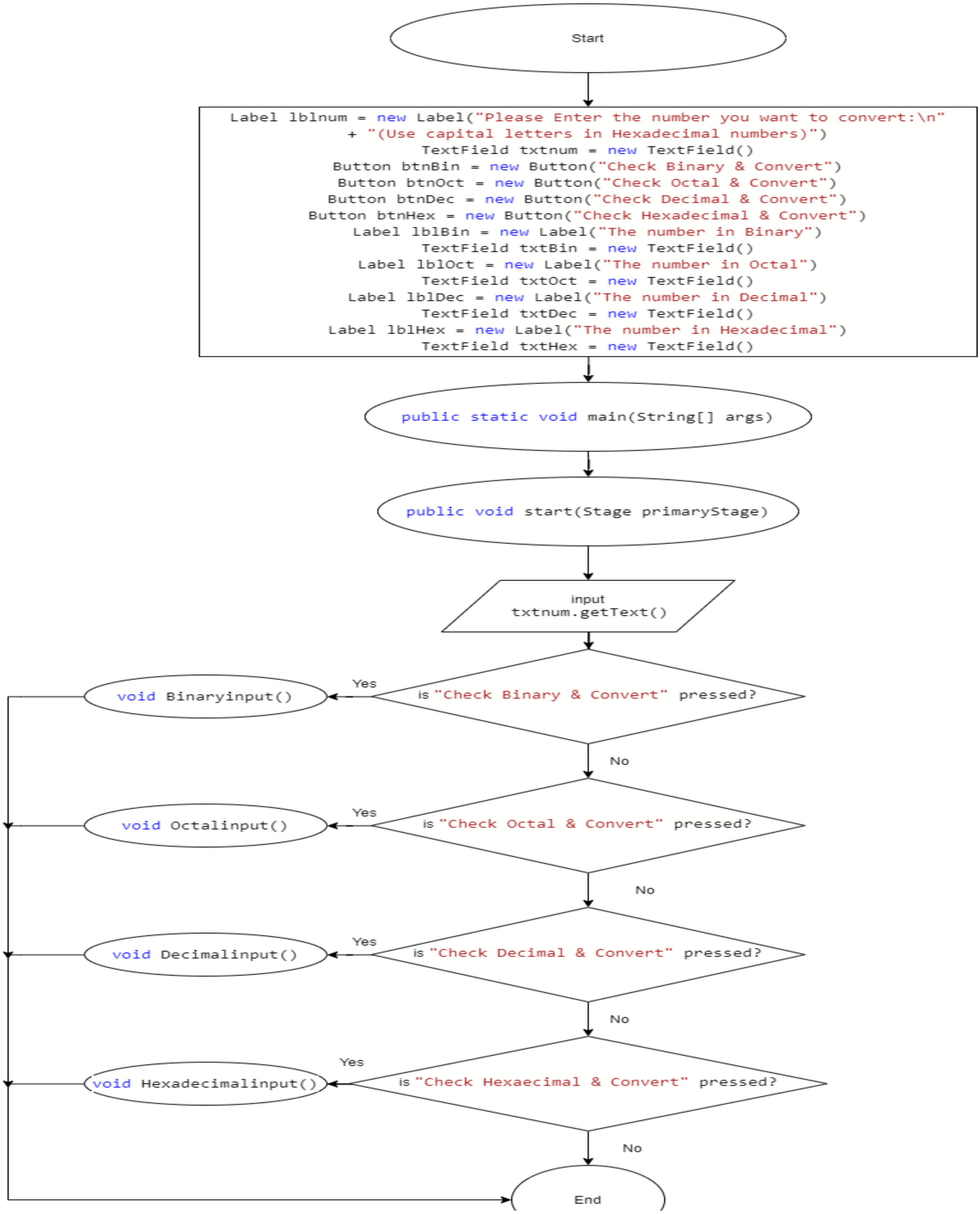
NumberingSystemsConverter

+ lblnum : Label
+ txtnum : TextField
+ btnBin : Button
+ btnOct : Button
+ btnDec : Button
+ btnHex : Button
+ lblBin : Label
+ txtBin : Button
+ lblOct : Label
+ txtOct : Button
+ lblDec : Label
+ txtDec : Button
+ lblHex : Label
+ txtHex : Button

+ Binaryinput () : void
+ Octalinput () : void
+ Decimalinput () : void
+ Hexadecimalinput () : void

Flow Chart

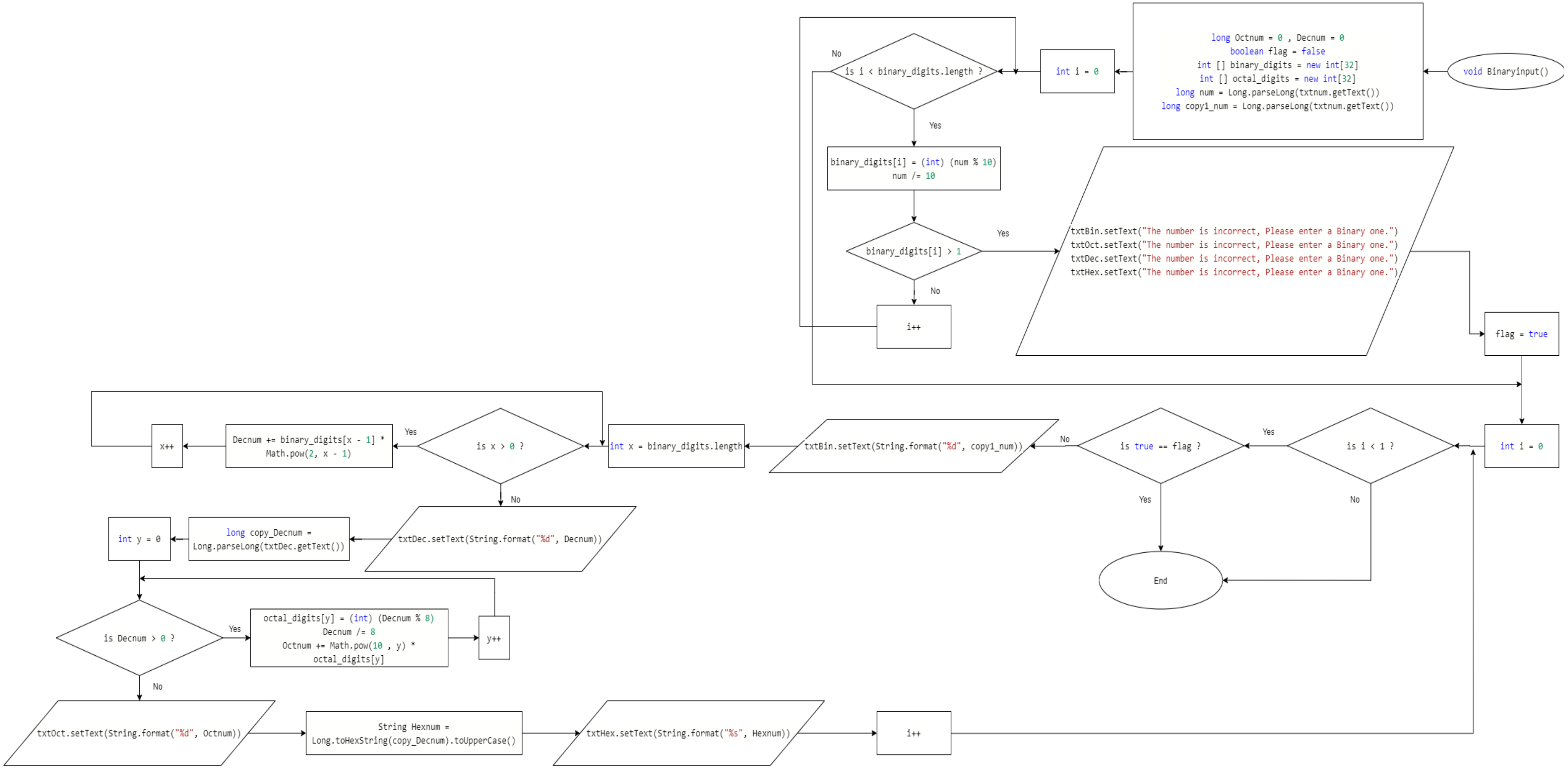
Helpful examples [6][7][8][9].



```
Label lblnum = new Label("Please Enter the number you want to convert:\n"
+ "(Use capital letters in Hexadecimal numbers)")
TextField txtnum = new TextField()
Button btnBin = new Button("Check Binary & Convert")
Button btnOct = new Button("Check Octal & Convert")
Button btnDec = new Button("Check Decimal & Convert")
Button btnHex = new Button("Check Hexadecimal & Convert")
Label lblBin = new Label("The number in Binary")
TextField txtBin = new TextField()
Label lblOct = new Label("The number in Octal")
TextField txtOct = new TextField()
Label lblDec = new Label("The number in Decimal")
TextField txtDec = new TextField()
Label lblHex = new Label("The number in Hexadecimal")
TextField txtHex = new TextField()
```

Start
public static void main(String[] args)
public void start(Stage primaryStage)
input
txtnum.getText()
is "Check Binary & Convert" pressed?
Yes
void Binaryinput()
No
is "Check Octal & Convert" pressed?
Yes
void Octalinput()
No
is "Check Decimal & Convert" pressed?
Yes
void Decimalinput()
No
is "Check Hexaecimal & Convert" pressed?
Yes
void Hexadecimalinput()
No
End

That was the flowchart for the whole program, and I will design another flow chart for one of the methods for example because they are all almost similar.


void Binaryinput()
long Octnum = 0 , Decnum = 0
boolean flag = false
int [] binary_digits = new int[32]
int [] octal_digits = new int[32]
long num = Long.parseLong(txtnum.getText())
long copy1_num = Long.parseLong(txtnum.getText())
int i = 0
is i < binary_digits.length ?
No
Yes
binary_digits[i] = (int) (num % 10)
num /= 10
binary_digits[i] > 1
Yes
No
txtBin.setText("The number is incorrect, Please enter a Binary one.")
txtOct.setText("The number is incorrect, Please enter a Binary one.")
txtDec.setText("The number is incorrect, Please enter a Binary one.")
txtHex.setText("The number is incorrect, Please enter a Binary one.")
i++
flag = true
int i = 0
is i < 1 ?
Yes
No
is true == flag ?
No
Yes
End
txtBin.setText(String.format("%d", copy1_num))
int x = binary_digits.length
is x > 0 ?
Yes
No
Decnum += binary_digits[x - 1] *
Math.pow(2, x - 1)
x++
txtDec.setText(String.format("%d", Decnum))
long copy_Decnum =
Long.parseLong(txtDec.getText())
int y = 0
is Decnum > 0 ?
Yes
No
octal_digits[y] = (int) (Decnum % 8)
Decnum /= 8
Octnum += Math.pow(10 , y) *
octal_digits[y]
y++
txtOct.setText(String.format("%d", Octnum))
String Hexnum =
Long.toHexString(copy_Decnum).toUpperCase()
txtHex.setText(String.format("%s", Hexnum))
i++

Source Code

▪ *Code*

```java
package numbering.systems.converter;

import javafx.application.Application;
import javafx.stage.Stage;
import javafx.scene.Scene;
import javafx.scene.control.Label;
import javafx.scene.control.Button;
import javafx.scene.control.TextField;
import javafx.scene.layout.GridPane;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
import javafx.geometry.Insets;
import javafx.geometry.Pos;
import javafx.geometry.HPos;

//Our class "NumberingSystemsConverter" inherits Application class.
public class NumberingSystemsConverter extends Application {
    /*Here I will declare some nodes. I will declare/create 5
textfields, one
    of them will receive the input and others for output. and also I
declared
    5 labels to describe them and finally I will create 4 buttons for
the main
    4 numbering systems.*/
    Label lblnum = new Label("Please Enter the number you want to
convert:\n"
            + "(Use capital letters in Hexadecimal numbers)");
    TextField txtnum = new TextField();

    Button btnBin = new Button("Check Binary & Convert");
    Button btnOct = new Button("Check Octal & Convert");
    Button btnDec = new Button("Check Decimal & Convert");
    Button btnHex = new Button("Check Hexadecimal & Convert");

    Label lblBin = new Label("The number in Binary");
    TextField txtBin = new TextField();

    Label lblOct = new Label("The number in Octal");
    TextField txtOct = new TextField();

    Label lblDec = new Label("The number in Decimal");
    TextField txtDec = new TextField();

    Label lblHex = new Label("The number in Hexadecimal");
    TextField txtHex = new TextField();

    /*This is the function which will be executed
    after clicking "Check Binary & Convert".*/
    void Binaryinput(){
        /*Two variables of long data type to
        hold the decimal and octal number after conversion.*/
        long Octnum = 0 , Decnum = 0;
        /*This flag is to determine if the number is represented
correctly
        or there is a mistake in the number bits.*/
        boolean flag = false;
        /*These two arrays hold the bits of the number in binary and
        octal representation.*/
        int [] binary_digits = new int[32];
        int [] octal_digits = new int[32];
        /*These two long variables get the binary number from input
textfield.
        the first one will be used to generate the binary bits
        and the second will be used to set the number in the binary
textfield.*/
        long num = Long.parseLong(txtnum.getText());
        long copy1_num = Long.parseLong(txtnum.getText());
        /*This for loop is used to check that the number is represented
in
        the binary form correctly. So, we will store the bits
(remainder of
        sequential division by 10) of the binary number in an array and
divide by
        10 sequentially also.*/
        for(int i = 0 ; i < binary_digits.length ; i++){
            binary_digits[i] = (int) (num % 10);
            num /= 10;
            /*If it is not represented correctly these messages will be
shown in
            the textfields. as this if condition checks if the binary
bit is
            more than one. and there is also a flag.*/
            if(binary_digits[i] > 1){
                txtBin.setText("The number is incorrect, Please enter a
Binary one.");
                txtOct.setText("The number is incorrect, Please enter a
Binary one.");
```

```
                txtDec.setText("The number is incorrect, Please enter a 
Binary one.");
                txtHex.setText("The number is incorrect, Please enter a 
Binary one.");
                flag = true;
                break;
            }
        }
        for(int i = 0 ; i < 1 ; i++){
            /*This if condition checks the value of the flag as if it 
is true
            there will be a break statement which will go to the end of 
the function.*/
            if(true == flag){
                break;
            }
            //Here, we will copy the content of the input textfield to 
the binary one.
            txtBin.setText(String.format("%d", copy1_num));
            /*This for loop is used to convert the binary bits to 
decimal number
            by multiplying the bit to 2 to the power x. As x is the 
order of the
            bit in array.*/
            for(int x = binary_digits.length ; x > 0 ; x--){
                Decnum += binary_digits[x - 1] * Math.pow(2, x - 1);
            }
            //Here, we will set the decimal textfield to the decimal 
number converted.
            txtDec.setText(String.format("%d", Decnum));
            /*Then we will get the decimal number from the decimal 
textfield to use
            it while generating the hexadecimal representation of the 
number as the
            Decnum variable will change after the next for loop.*/
            long copy_Decnum = Long.parseLong(txtDec.getText());
            /*This for loop will generate the octal number by the 
sequential division
            by 8 and this will generate the bits of the octal 
representation. and to
            display the whole number we will multiply each bit by 10 to 
the power of
            y. As y is the order of the bit in the array.*/
            for(int y = 0 ; Decnum > 0 ; y++){
                octal_digits[y] = (int) (Decnum % 8);
                Decnum /= 8;
                Octnum += Math.pow(10 , y) * octal_digits[y];
            }
            //Here, we will set the Octal textfield to the octal number 
converted.
            txtOct.setText(String.format("%d", Octnum));
            /*Here we will use the (toHexString()) to generate the 
hexadecimal number
            automatically (with uppercase letters) then we will set the 
result to
            the hexadecimal textfield.*/
            String Hexnum = 
Long.toHexString(copy_Decnum).toUpperCase();
            txtHex.setText(String.format("%s", Hexnum));
        }
    }

    /*This is the function which will be executed
    after clicking "Check Octal & Convert".*/
    void Octalinput(){
        /*Two variables of long data type to
        hold the decimal and binary number after conversion.*/
        long Binnum = 0 , Decnum = 0;
        /*This flag is to determine if the number is represented 
correctly
        or there is a mistake in the number bits.*/
        boolean flag = false;
        /*These two arrays hold the bits of the number in binary and
        octal representation.*/
        int [] binary_digits = new int[32];
        int [] octal_digits = new int[32];
        /*These two long variables get the octal number from input 
textfield.
        the first one will be used to generate the octal bits
        and the second will be used to set the number in the octal 
textfield.*/
        long num = Long.parseLong(txtnum.getText());
        long copy1_num = Long.parseLong(txtnum.getText());
        /*This for loop is used to check that the number is represented 
in
        the octal form correctly. So, we will store the bits (remainder 
of
        sequential division by 10) of the octal number in an array and 
divide by
        10 sequentially also.*/
        for(int i = 0 ; i < octal_digits.length ; i++){
            octal_digits[i] = (int) (num % 10);
            num /= 10;
            /*If it is not represented correctly these messages will be
shown in
            the textfields. as this if condition checks if the octal
bit is
            more than seven. and there is also a flag.*/
            if(octal_digits[i] > 7){
                txtBin.setText("The number is incorrect, Please enter
an Octal one.");
                txtOct.setText("The number is incorrect, Please enter
an Octal one.");
                txtDec.setText("The number is incorrect, Please enter
an Octal one.");
                txtHex.setText("The number is incorrect, Please enter
an Octal one.");
                flag = true;
                break;
            }
        }
        for(int i = 0 ; i < 1 ; i++){
            /*This if condition checks the value of the flag as if it
is true
            there will be a break statement which will go to the end of
the function.*/
            if(true == flag){
                break;
            }
            //Here, we will copy the content of the input textfield to
the octal one.
            txtOct.setText(String.format("%d", copy1_num));
            /*This for loop is used to convert the octal bits to
decimal number
            by multiplying the bit to 8 to the power x. As x is the
order of the
            bit in array.*/
            for(int x = octal_digits.length ; x > 0 ; x--){
                Decnum += octal_digits[x - 1] * Math.pow(8, x - 1);
            }
            //Here, we will set the decimal textfield to the decimal
number converted.
            txtDec.setText(String.format("%d", Decnum));
            /*Then we will get the decimal number from the decimal
textfield to use
            it while generating the hexadecimal representation of the
number as the
            Decnum variable will change after the next for loop.*/
            long copy_Decnum = Long.parseLong(txtDec.getText());
            /*This for loop will generate the binary number by the
sequential division
            by 2 and this will generate the bits of the binary
representation. and to
            display the whole number we will multiply each bit by 10 to
the power of
            y. As y is the order of the bit in the array.*/
            for(int y = 0 ; Decnum > 0 ; y++){
                binary_digits[y] = (int) (Decnum % 2);
                Decnum /= 2;
                Binnum += binary_digits[y] * Math.pow(10 , y);
            }
            //Here, we will set the Binary textfield to the binary
number converted.
            txtBin.setText(String.format("%d", Binnum));
            /*Here we will use the (toHexString()) to generate the
hexadecimal number
            automatically (with uppercase letters) then we will set the
result to
            the hexadecimal textfield.*/
            String Hexnum =
Long.toHexString(copy_Decnum).toUpperCase();
            txtHex.setText(String.format("%s", Hexnum));
        }
    }

    /*This is the function which will be executed
    after clicking "Check Decimal & Convert".*/
    void Decimalinput(){
        /*Two variables of long data type to
        hold the octal and binary number after conversion.*/
        long Binnum = 0 , Octnum = 0;
        /*This flag is to determine if the number is represented
correctly
        or there is a mistake in the number bits.*/
        boolean flag = false;
        /*These three arrays hold the bits of the number in binary,
decimal and
        octal representation.*/
        int [] binary_digits = new int[32];
        int [] octal_digits = new int[32];
        int [] decimal_digits = new int[32];
        /*These four long variables get the decimal number from input
textfield.
        the first one will be used to generate the decimal bits.
        the second will be used to set the number in the decimal
textfield and generate
```

```
        the binary bits.
        the third will be used to generate the octal bits.
        the fourth will be used to generate the hexadecimal bits.*/
        long num = Long.parseLong(txtnum.getText());
        long copy1_num = Long.parseLong(txtnum.getText());
        long copy2_num = Long.parseLong(txtnum.getText());
        long copy3_num = Long.parseLong(txtnum.getText());
        /*This for loop is used to check that the number is represented
in
        the decimal form correctly. So, we will store the bits
(remainder of
        sequential division by 10) of the decimal number in an array
and divide by
        10 sequentially also.*/
        for(int i = 0 ; i < decimal_digits.length ; i++){
            decimal_digits[i] = (int) (num % 10);
            num /= 10;
            /*If it is not represented correctly these messages will be
shown in
            the textfields. as this if condition checks if the decimal
bit is
            more than nine. and there is also a flag.*/
            if(decimal_digits[i] > 9){
                txtBin.setText("The number is incorrect, Please enter a
Decimal one.");
                txtOct.setText("The number is incorrect, Please enter a
Decimal one.");
                txtDec.setText("The number is incorrect, Please enter a
Decimal one.");
                txtHex.setText("The number is incorrect, Please enter a
Decimal one.");
                flag = true;
                break;
            }
        }
        for(int i = 0 ; i < 1 ; i++){
            /*This if condition checks the value of the flag as if it
is true
            there will be a break statement which will go to the end of
the function.*/
            if(true == flag){
                break;
            }
            //Here, we will copy the content of the input textfield to
the decimal one.
            txtDec.setText(String.format("%d", copy1_num));
            /*This for loop will generate the binary number by the 
sequential division
            by 2 and this will generate the bits of the binary 
representation. and to
            display the whole number we will multiply each bit by 10 to 
the power of
            x. As x is the order of the bit in the array.*/
            for(int x = 0 ; copy1_num > 0 ; x++){
                binary_digits[x] = (int) (copy1_num % 2);
                copy1_num /= 2;
                Binnum += binary_digits[x] * Math.pow(10 , x);
            }
            //Here, we will set the Binary textfield to the binary 
number converted.
            txtBin.setText(String.format("%d", Binnum));
            /*This for loop will generate the octal number by the 
sequential division
            by 8 and this will generate the bits of the octal 
representation. and to
            display the whole number we will multiply each bit by 10 to 
the power of
            y. As y is the order of the bit in the array.*/
            for(int y = 0 ; copy2_num > 0 ; y++){
                octal_digits[y] = (int) (copy2_num % 8);
                copy2_num /= 8;
                Octnum += octal_digits[y] * Math.pow(10 , y);
            }
            //Here, we will set the Octal textfield to the octal number 
converted.
            txtOct.setText(String.format("%d", Octnum));
            /*Here we will use the (toHexString()) to generate the 
hexadecimal number
            automatically (with uppercase letters) then we will set the 
result to
            the hexadecimal textfield.*/
            String Hexnum = Long.toHexString(copy3_num).toUpperCase();
            txtHex.setText(String.format("%s", Hexnum));
        }
    }

    /*This is the function which will be executed
    after clicking "Check Hexadecimal & Convert".*/
    void Hexadecimalinput(){
        /*Two variables of long data type to
        hold the octal and binary number after conversion.*/
        long Binnum = 0 , Octnum = 0;
        /*This flag is to determine if the number is represented 
correctly
        or there is a mistake in the number bits.*/
        int flag = 0;
        /*This array of characters will identify the allowed characters 
in
        the hexadecimal string entered in the input textfield.*/
        char [] hexadecimal_digits = 

{'0','1','2','3','4','5','6','7','8','9','A','B','C','D','E','F'};
        /*These two arrays hold the bits of the number in binary and
        octal representation.*/
        int [] binary_digits = new int[32];
        int [] octal_digits = new int[32];
        /*These two for loops will determine if the characters of the 
hexadecimal string
        are found in "hexadecimal_digits" array or not.*/
        for(int j = 0 ; j < txtnum.getText().length() ; j++){
            for(int i = 0 ; i < hexadecimal_digits.length ; i++){
                //if the character is found in the array the flag will 
increse.
                if(txtnum.getText().charAt(j) == 
hexadecimal_digits[i]){
                    flag++;
                    break;
                }
            }
        }
        /*if the value of the flag is less than the number of 
characters this means
        that there is a character which is not a hexadecimal character 
and these
        messages will be shown.*/
        if(txtnum.getText().length() > flag){
            txtBin.setText("The number is incorrect, Please enter a 
Hexadecimal one.");
            txtOct.setText("The number is incorrect, Please enter a 
Hexadecimal one.");
            txtDec.setText("The number is incorrect, Please enter a 
Hexadecimal one.");
            txtHex.setText("The number is incorrect, Please enter a 
Hexadecimal one.");
        }
        /*if the value of the flag is the same as the number of 
characters this means that
        the number is already a hexadecimal number.*/
        else if(txtnum.getText().length() == flag){
```

```
      //Here, we will copy the content of the input textfield to
the Hexadecimal one.
      txtHex.setText(String.format("%s", txtnum.getText()));
      /*Here, i will convert the entered hexadecimal value to a
decimal one
      then i will set it on the decimal textfield.*/
      long Decnum = Long.parseLong(txtnum.getText() , 16);
      txtDec.setText(String.format("%d", Decnum));
      //Here, i will take a copy of the decimal number.
      long copy1_Decnum = Long.parseLong(txtnum.getText() , 16);
      /*This for loop will generate the binary number by the
sequential division
      by 2 and this will generate the bits of the binary
representation. and to
      display the whole number we will multiply each bit by 10 to
the power of
      x. As x is the order of the bit in the array.*/
      for(int x = 0 ; copy1_Decnum > 0 ; x++){
        binary_digits[x] = (int) (copy1_Decnum % 2);
        copy1_Decnum /= 2;
        Binnum += binary_digits[x] * Math.pow(10 , x);
      }
      //Here, we will set the Binary textfield to the binary
number converted.
      txtBin.setText(String.format("%d", Binnum));
      //Here, i will take another copy of the decimal number.
      long copy2_Decnum = Long.parseLong(txtnum.getText() , 16);
      /*This for loop will generate the octal number by the
sequential division
      by 8 and this will generate the bits of the octal
representation. and to
      display the whole number we will multiply each bit by 10 to
the power of
      y. As y is the order of the bit in the array.*/
      for(int y = 0 ; copy2_Decnum > 0 ; y++){
        octal_digits[y] = (int) (copy2_Decnum % 8);
        copy2_Decnum /= 8;
        Octnum += octal_digits[y] * Math.pow(10 , y);
      }
      //Here, we will set the Octal textfield to the octal number
converted.
      txtOct.setText(String.format("%d", Octnum));
    }

  }
  //I will override "start" method.
  @Override
```

```
    public void start(Stage primaryStage) {
        /*I will create a grid pane and i will modify its insets, put
it
        in center and also adjust the horizontal and vertical gap
between nodes.*/
        GridPane G = new GridPane();
        G.setPadding(new Insets(5 , 10 , 10 , 10));
        G.setHgap(30);
        G.setVgap(10);
        G.setAlignment(Pos.CENTER);

        /*I will add four labels and adjust their alignment and four
textfields
        which i will modify their insets and their size on the
gridpane.*/
        G.add(lblBin , 1 , 1);
        G.setHalignment(lblBin , HPos.LEFT);

        G.add(txtBin , 2 , 1);
        txtBin.setPadding(new Insets(7 , 3 , 7 , 3));
        txtBin.setPrefSize(350, 25);

        G.add(lblOct , 1 , 2);
        G.setHalignment(lblOct , HPos.LEFT);

        G.add(txtOct , 2 , 2);
        txtOct.setPadding(new Insets(7 , 3 , 7 , 3));
        txtOct.setPrefSize(350, 25);

        G.add(lblDec , 1 , 3);
        G.setHalignment(lblDec , HPos.LEFT);

        G.add(txtDec , 2 , 3);
        txtDec.setPadding(new Insets(7 , 3 , 7 , 3));
        txtDec.setPrefSize(350, 25);

        G.add(lblHex , 1 , 4);
        G.setHalignment(lblHex , HPos.LEFT);

        G.add(txtHex , 2 , 4);
        txtHex.setPadding(new Insets(7 , 3 , 7 , 3));
        txtHex.setPrefSize(350, 25);

        /*Also, i will add 2 HBoxes for the buttons and the input
textfield
        and its label and i will adjust their position.*/
        HBox H1 = new HBox(20);
        H1.getChildren().addAll(lblnum , txtnum);
        txtnum.setPrefSize(350, 25);
        H1.setAlignment(Pos.CENTER);

        HBox H2 = new HBox(20);
        H2.getChildren().addAll(btnBin , btnOct , btnDec , btnHex);
        H2.setAlignment(Pos.CENTER);

        /*Here, I create VBox to add the two HBoxes and the gridpane on
it.
        and i will position it in the center.*/
        VBox V = new VBox(30);
        V.getChildren().addAll(H1 , H2 , G);
        V.setAlignment(Pos.CENTER);

        //Here, i will put the HBox on the scene.
        Scene S = new Scene(V, 800, 350);

        /*I will set the methods which will be executed when pressing
any of the
        four methods on action.*/
        btnBin.setOnAction(e -> Binaryinput());
        btnOct.setOnAction(e -> Octalinput());
        btnDec.setOnAction(e -> Decimalinput());
        btnHex.setOnAction(e -> Hexadecimalinput());

        /*Finally, I will set the title of the stage and set the scene
in the stage
        also and show it.*/
        primaryStage.setTitle("Numbering Systems Checker & Converter");
        primaryStage.setScene(S);
        primaryStage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

▪ *Summary*

● *Design*

This ***GUI*** Program is designed and coded with ***JavaFx*** packages so, the first step is to import the packages we have maintained above.

After importing the required packages I move to GUI design steps.

I got some nodes on the scene and I modified on values of their properties and the final step in the design is to use panes to organize nodes on the scene which is added to the stage.

In `"start"` method I set the four buttons on action using a method for each button by lambda expression. So, when the user enters the input number and clicks `"Check Binary & Convert"` for example. The `"Binaryinput()"` method will be executed and do the process of checking that the number is binary and converting it to the other three main numbering systems.

- ***Checking Process***

Checking process idea depends on knowing the value of each bit in the input number and comparing it with the base of the system or with the numbers in the system.

In binary, octal, and Decimal entered numbers I used a for loop to generate number of iterations equal the number of bits of the input.

Then I will do sequential division by 10 to get the last bit in each iteration (remainder) and store it in an array which will be used in the next step.

Using if condition I will compare each bit (array element) with the base of the system.

If the value of the bit is equal or larger than the base of the system. There will be messages shown in the output text fields tell the user to enter a correct number.

But if the bit value is less than the base of the input number I will move to the converting process.

In Hexadecimal inputs for checking process I did nearly the same steps such as the other three systems. But There are two differences.

The first one is that I did not use the sequential division by 10 to generate the bits of number as the input may be a hexadecimal string (A-F) and it cannot be divided by 10 to get the current bit. So, I used `"charAt()"` property where I found it in java script code in the source of this page [10] and I found this property in java also.

This property receives the index of character in string and return the character itself.

The second difference is that I created an array which contains the hexadecimal possible bits (0-F).

Then using two for loops I compared between each bit in the entered hexadecimal number and each element in the possible hexadecimal array and if I detected a character which is not in the array, There will be messages on the output text fields tell that the entered number is incorrect.

- ***Converting Process***

Converting process can be done using a set of for loops.

Our purpose is to get the decimal number as It is easy to deal with.

So, If the input number was binary or octal Firstly, I try to convert it to decimal number by multiplying each bit to the base of the system to the power equals its order in the array then assign the result in a variable which will act as a storage for the result of sequential multiplication[11].

Then display the output in the binary and octal text fields like examples in[4][3].

Now I have the decimal number which I could divide it sequentially by 8 to get octal bits and store the remainder in array then we take the sum of sequentially multiplication of the bit to 10 to the power of its order in the array and assign it in a variable which we set on the octal text[11].

To get the binary number we do something like this.

It will be explained well in comments illustrating the source code.

Finally I used `"toHexString()"` to generate the hexadecimal output directly.

In case the input was a decimal number we do a sequentially division by 8 to get the octal bits and by 2 to get the binary bits. And finally, we use `"toHexString()"` also to get hexadecimal.

If the input was a hexadecimal number I can convert it to decimal number using `"Long.parseLong(txtnum.getText() , 16)"` and convert the decimal to binary and octal easily like the other methods [12].

Results & Screenshots

This application has some limits as it could convert

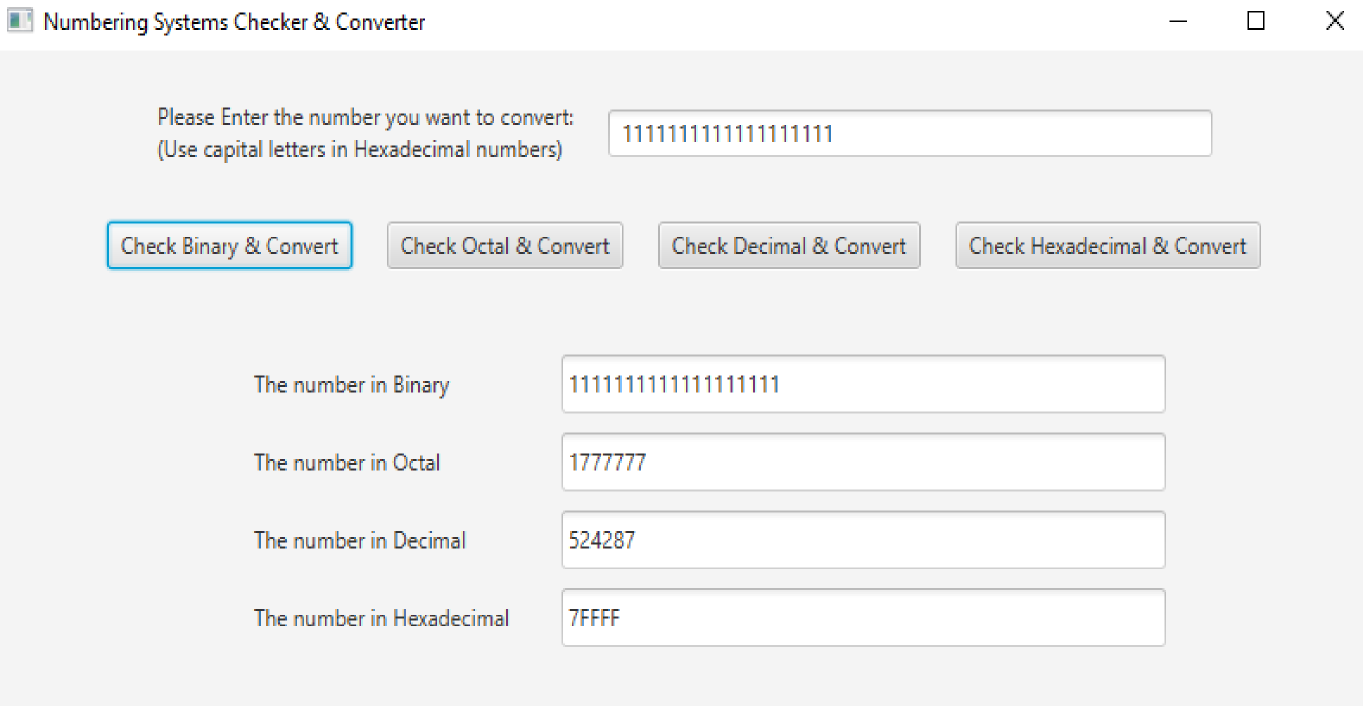
- Till 19 bits of ones as a binary input.
- Till 5 bits of sevens as an octal input.
- Till 4 bits of nines as a decimal input.
- Till 4 bits of F as a hexadecimal input.

I will check my results using [13].

<u>Note/</u> This site has a problem in detecting the incorrect numbers, but it is helpful in converting.

- ***Binary Input***

Test case 1



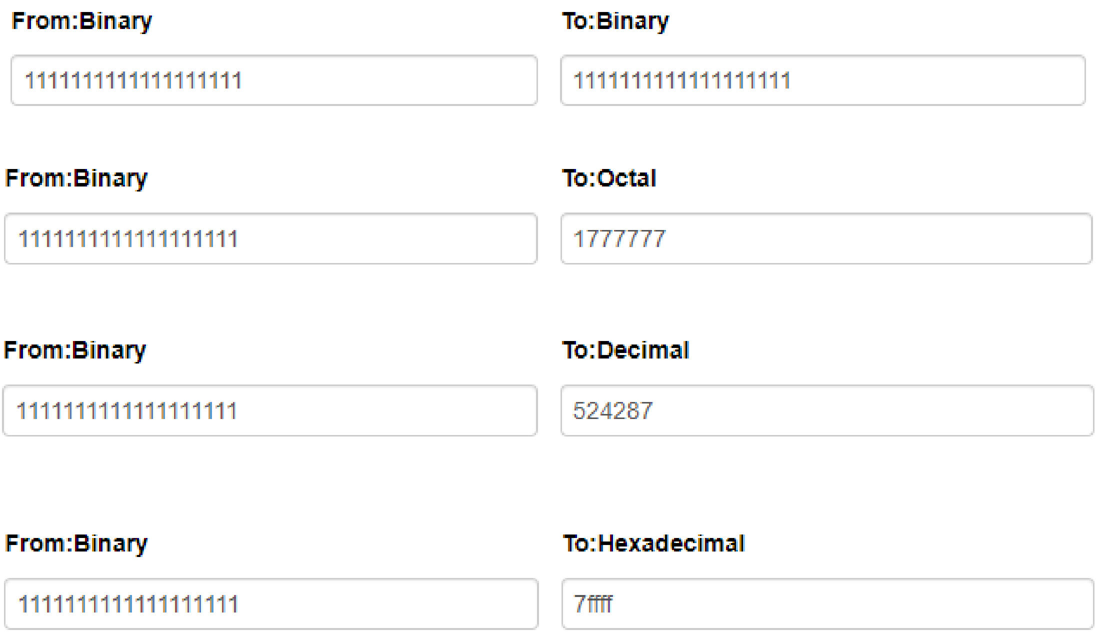
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 1111111111111111111

The number in Binary 1111111111111111111

The number in Octal 1777777

The number in Decimal 524287

The number in Hexadecimal 7FFFF



From:Binary
1111111111111111111

To:Binary
1111111111111111111

From:Binary
1111111111111111111

To:Octal
1777777

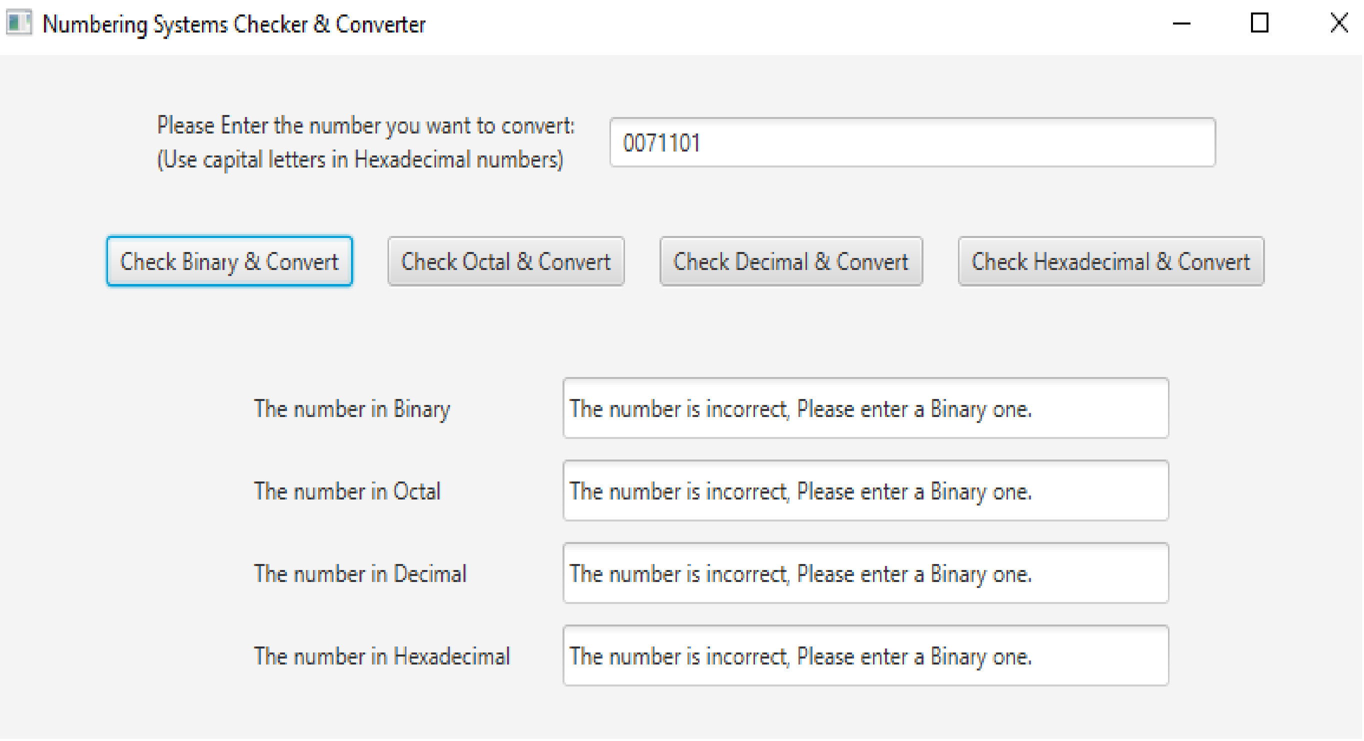
From:Binary
1111111111111111111

To:Decimal
524287

From:Binary
1111111111111111111

To:Hexadecimal
7ffff

Test case 2



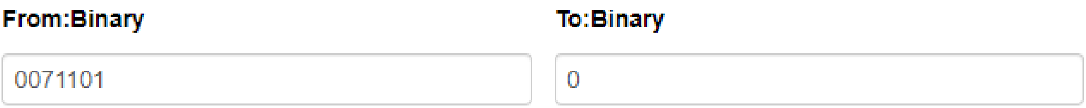
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers)
0071101

The number in Binary: The number is incorrect, Please enter a Binary one.

The number in Octal: The number is incorrect, Please enter a Binary one.

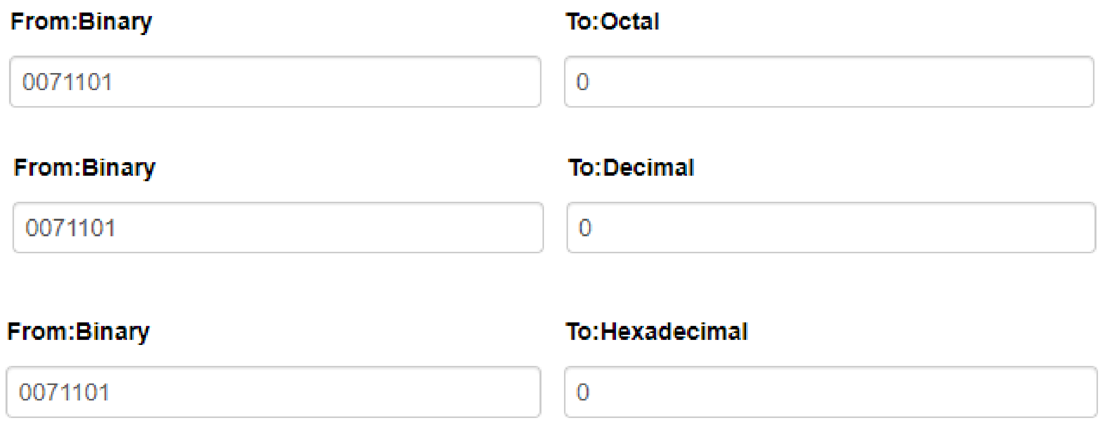
The number in Decimal: The number is incorrect, Please enter a Binary one.

The number in Hexadecimal: The number is incorrect, Please enter a Binary one.



From:Binary
0071101

To:Binary
0

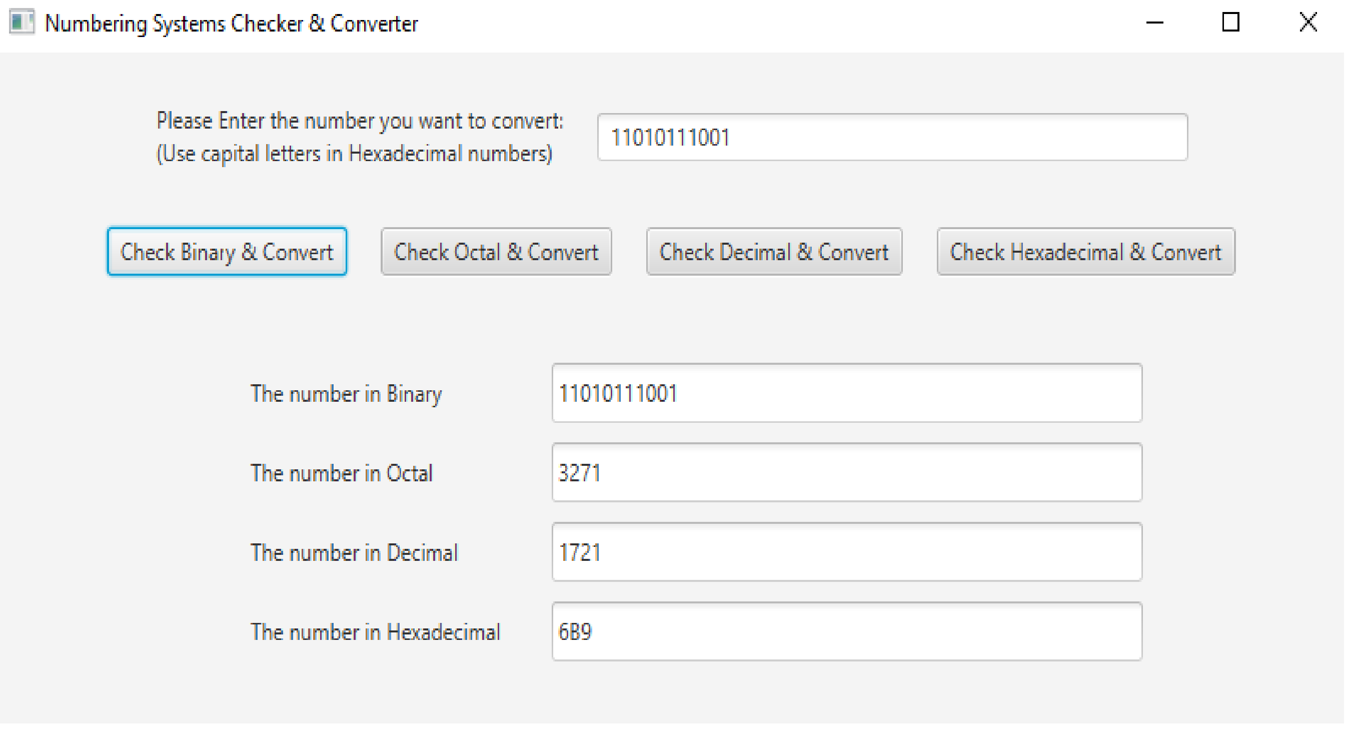


From:Binary: 0071101
To:Octal: 0

From:Binary: 0071101
To:Decimal: 0

From:Binary: 0071101
To:Hexadecimal: 0

Test case 3



Numbering Systems Checker & Converter

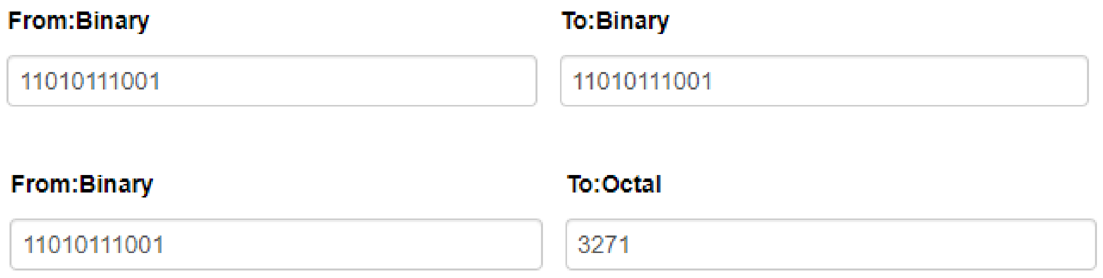
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers): 11010111001

The number in Binary: 11010111001

The number in Octal: 3271

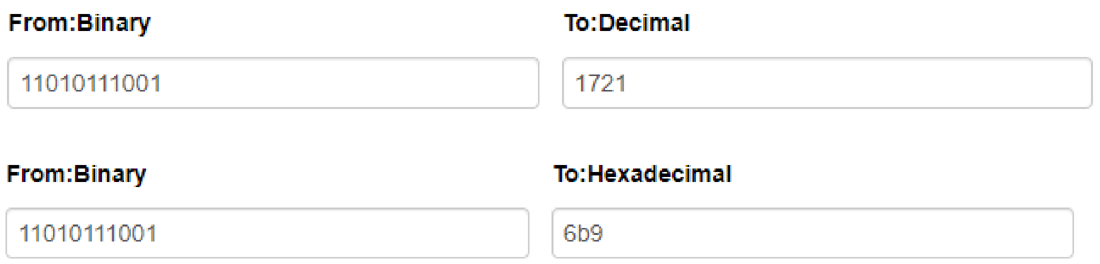
The number in Decimal: 1721

The number in Hexadecimal: 6B9



From:Binary: 11010111001
To:Binary: 11010111001

From:Binary: 11010111001
To:Octal: 3271



From:Binary 11010111001

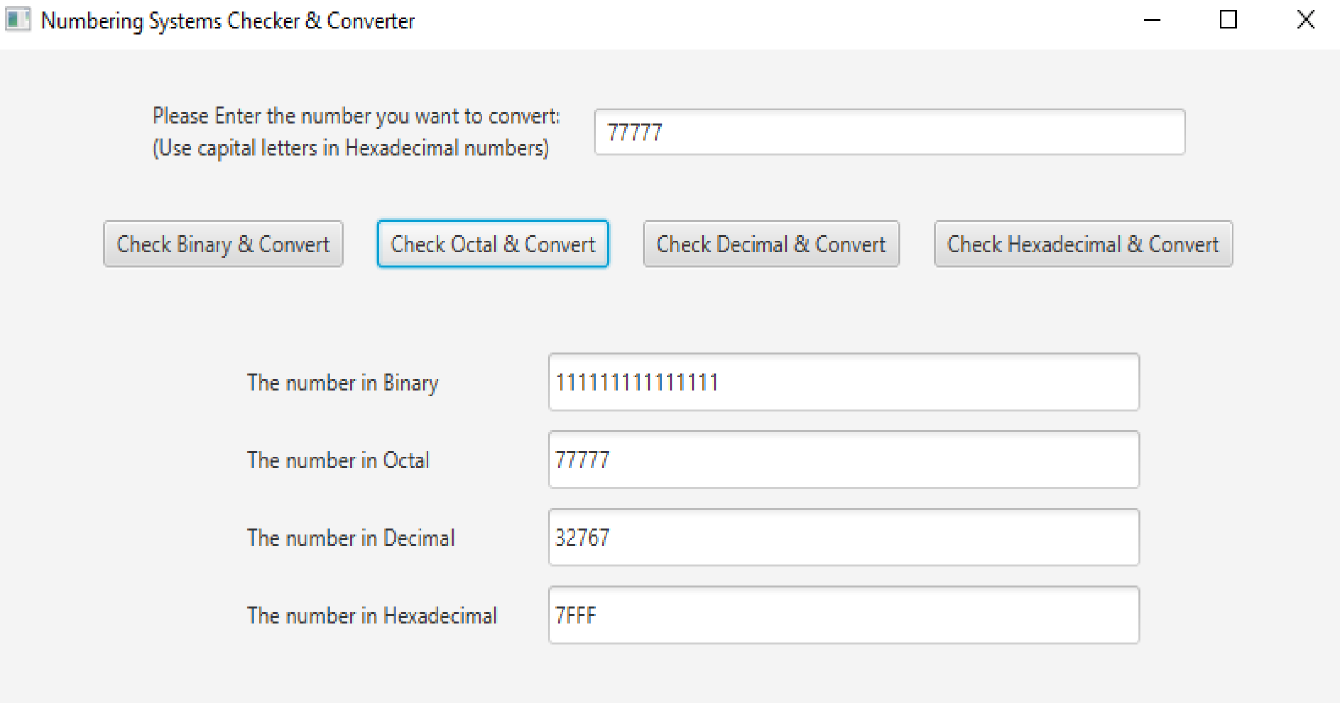
To:Decimal 1721

From:Binary 11010111001

To:Hexadecimal 6b9

- ***Octal Input***

Test case 1



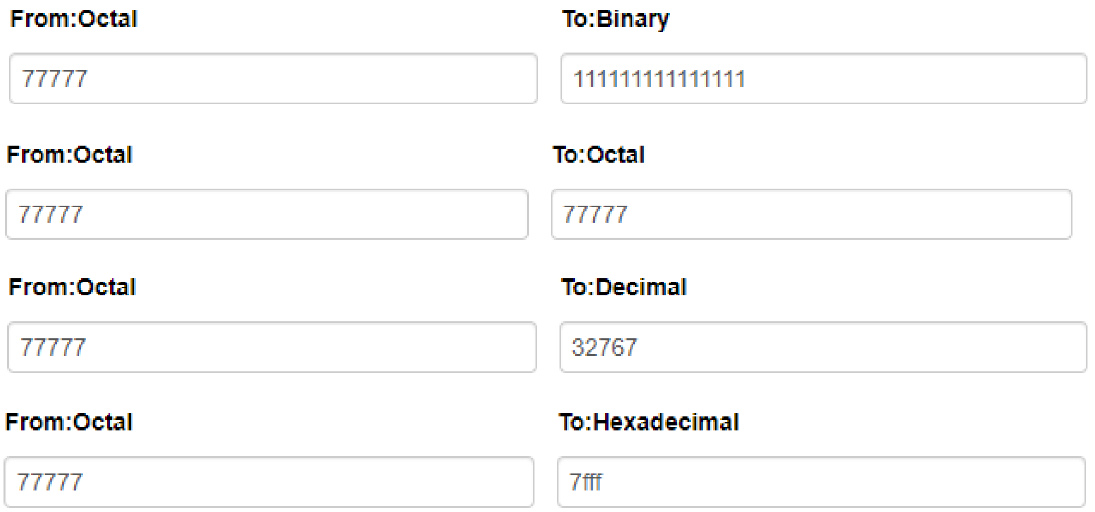
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 77777

The number in Binary 111111111111111

The number in Octal 77777

The number in Decimal 32767

The number in Hexadecimal 7FFF



From:Octal 77777

To:Binary 111111111111111

From:Octal 77777

To:Octal 77777

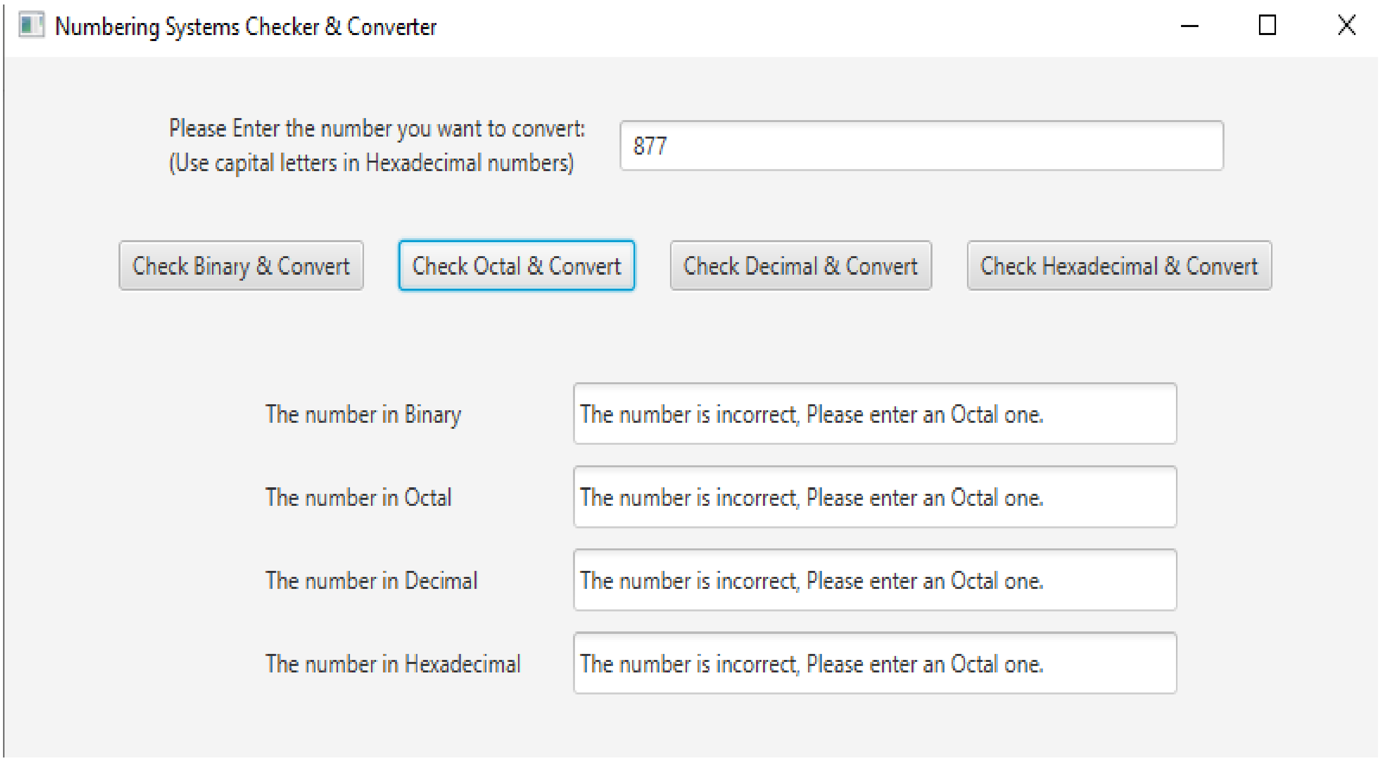
From:Octal 77777

To:Decimal 32767

From:Octal 77777

To:Hexadecimal 7fff

Test case 2



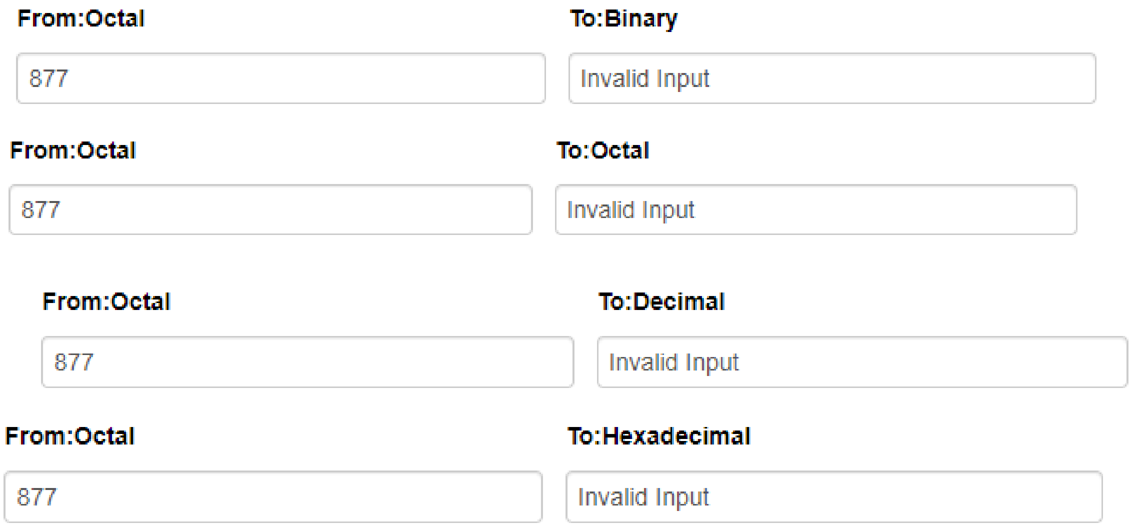
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 877

The number in Binary: The number is incorrect, Please enter an Octal one.

The number in Octal: The number is incorrect, Please enter an Octal one.

The number in Decimal: The number is incorrect, Please enter an Octal one.

The number in Hexadecimal: The number is incorrect, Please enter an Octal one.



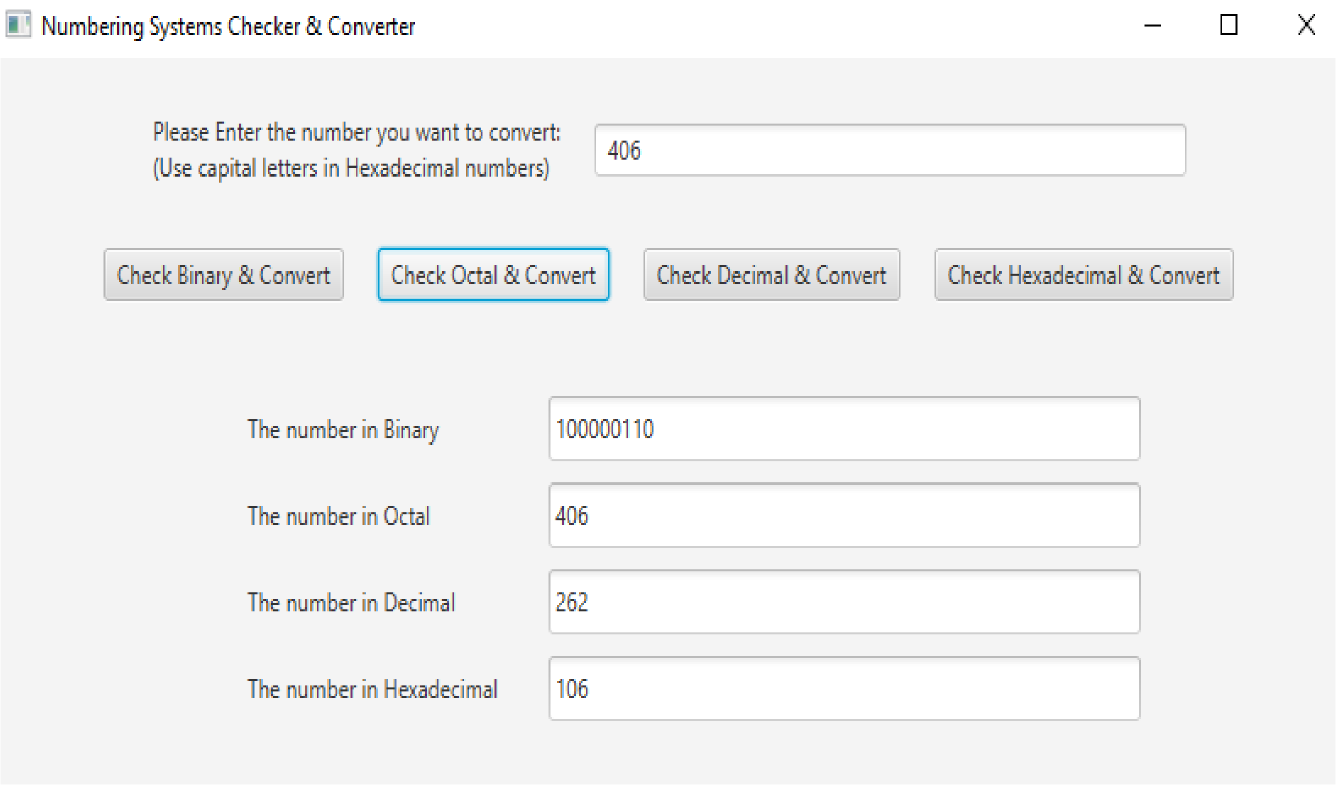
From:Octal 877 To:Binary Invalid Input

From:Octal 877 To:Octal Invalid Input

From:Octal 877 To:Decimal Invalid Input

From:Octal 877 To:Hexadecimal Invalid Input

Test case 3



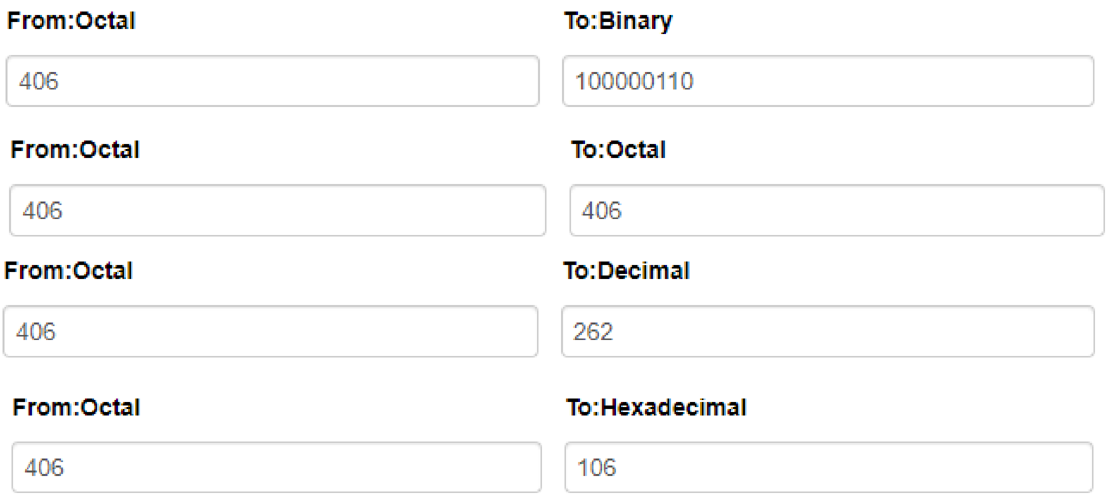
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 406

The number in Binary 100000110

The number in Octal 406

The number in Decimal 262

The number in Hexadecimal 106



From:Octal 406 To:Binary 100000110

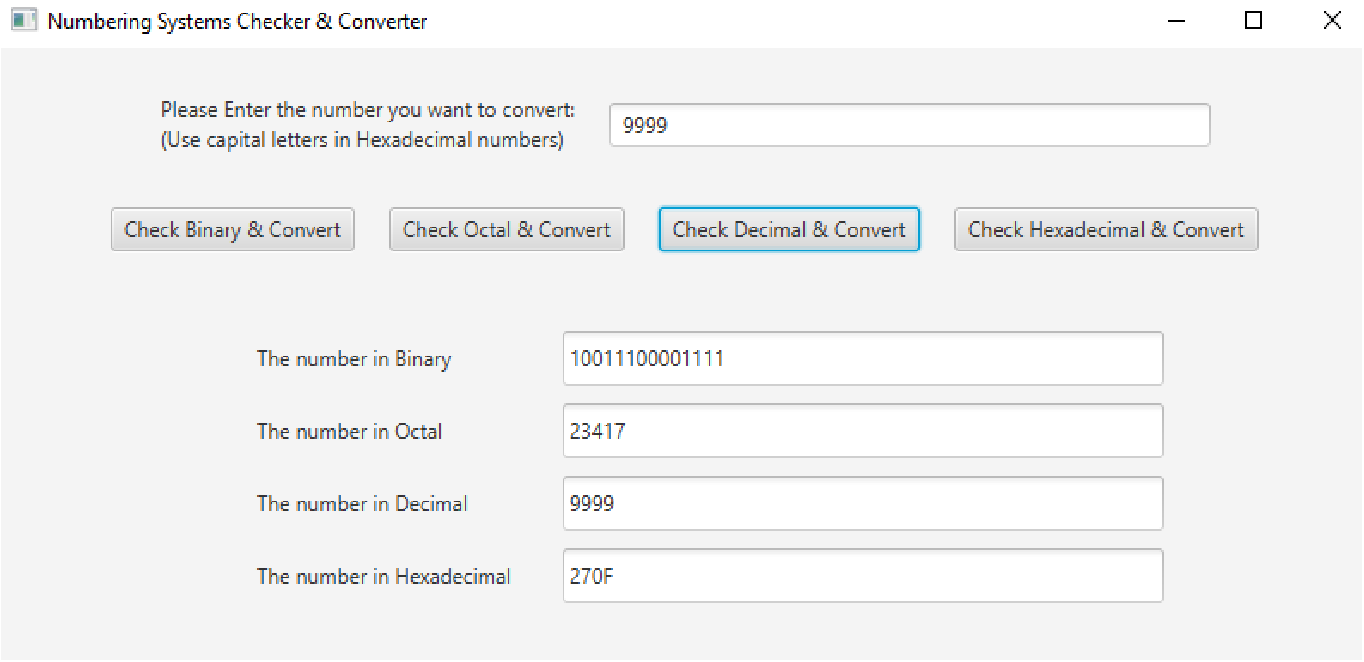
From:Octal 406 To:Octal 406

From:Octal 406 To:Decimal 262

From:Octal 406 To:Hexadecimal 106

- ***Decimal Input***

Test case 1



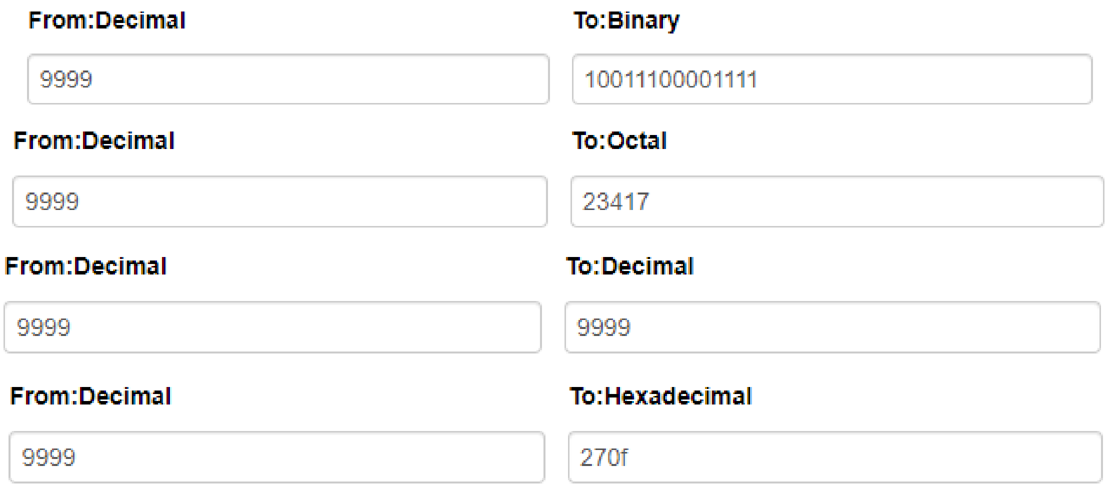
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 9999

The number in Binary 10011100001111

The number in Octal 23417

The number in Decimal 9999

The number in Hexadecimal 270F



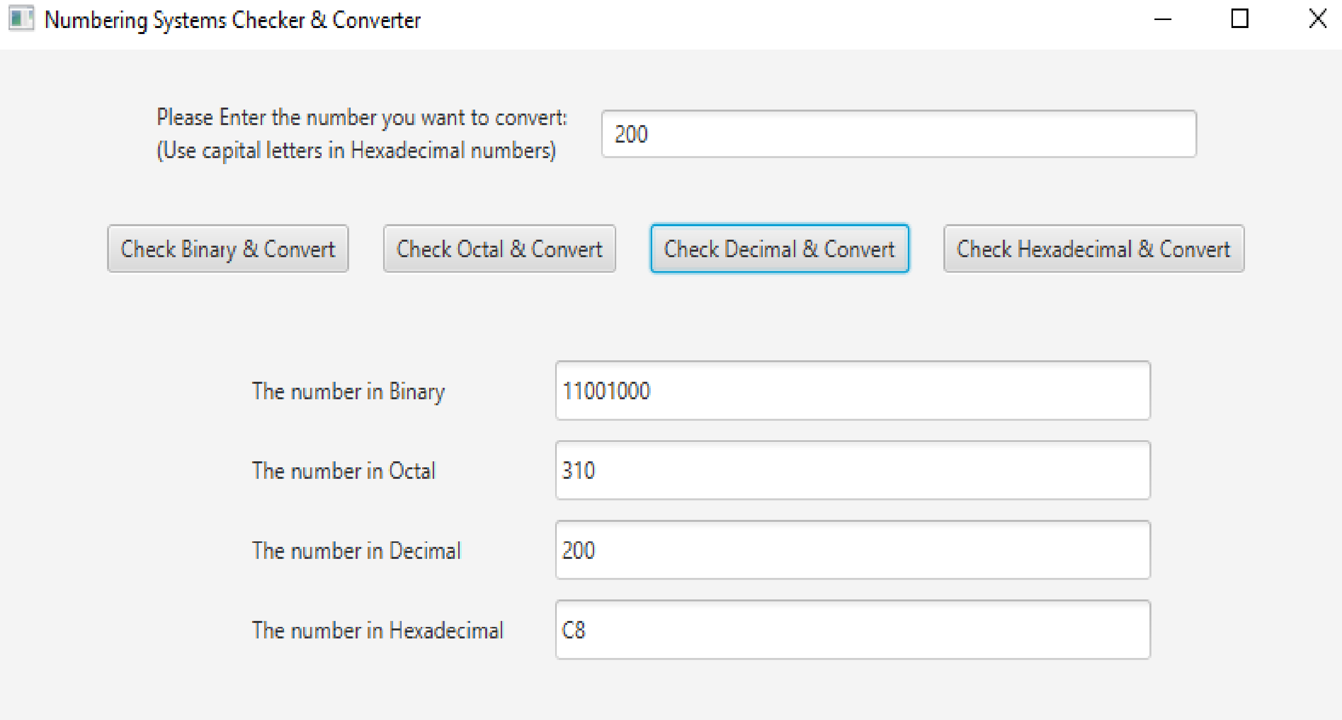
From:Decimal 9999 **To:Binary** 10011100001111

From:Decimal 9999 **To:Octal** 23417

From:Decimal 9999 **To:Decimal** 9999

From:Decimal 9999 **To:Hexadecimal** 270f

Test case 2



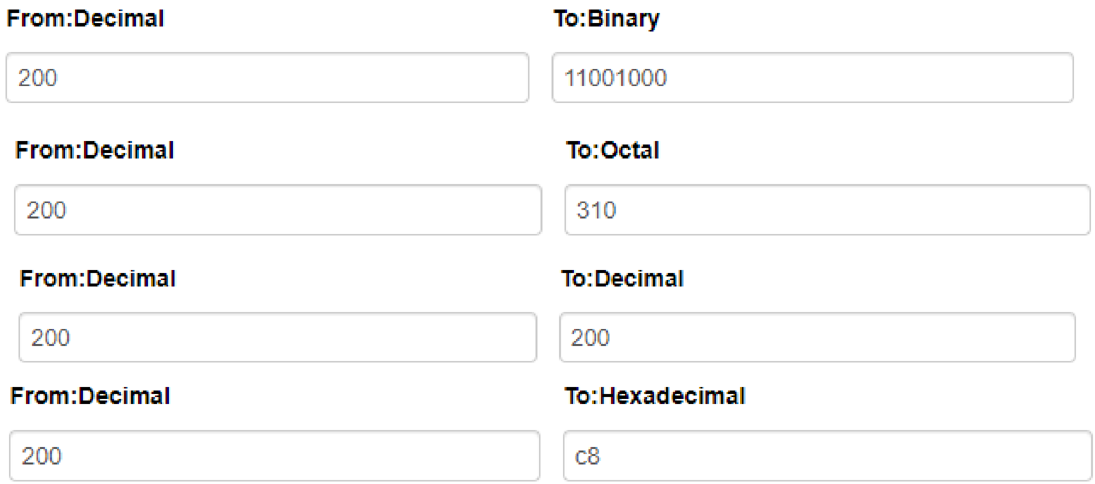
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 200

The number in Binary 11001000

The number in Octal 310

The number in Decimal 200

The number in Hexadecimal C8



From:Decimal 200 To:Binary 11001000

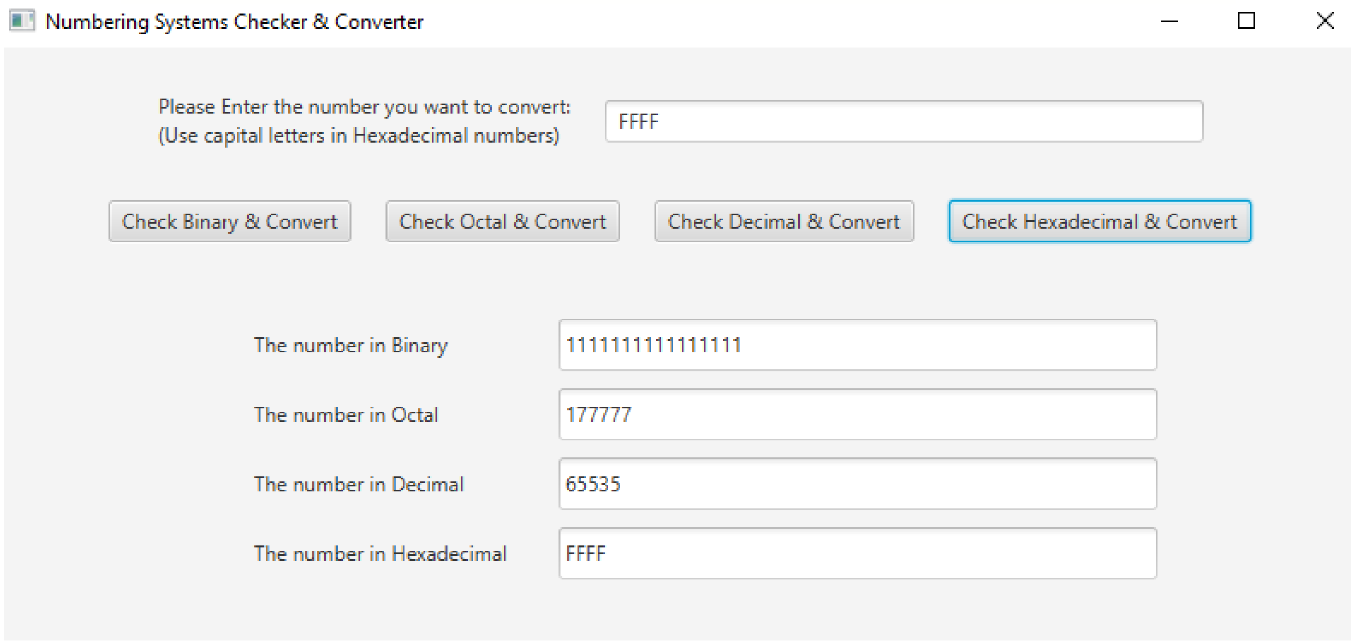
From:Decimal 200 To:Octal 310

From:Decimal 200 To:Decimal 200

From:Decimal 200 To:Hexadecimal c8

- ***Hexadecimal Input***

Test case 1



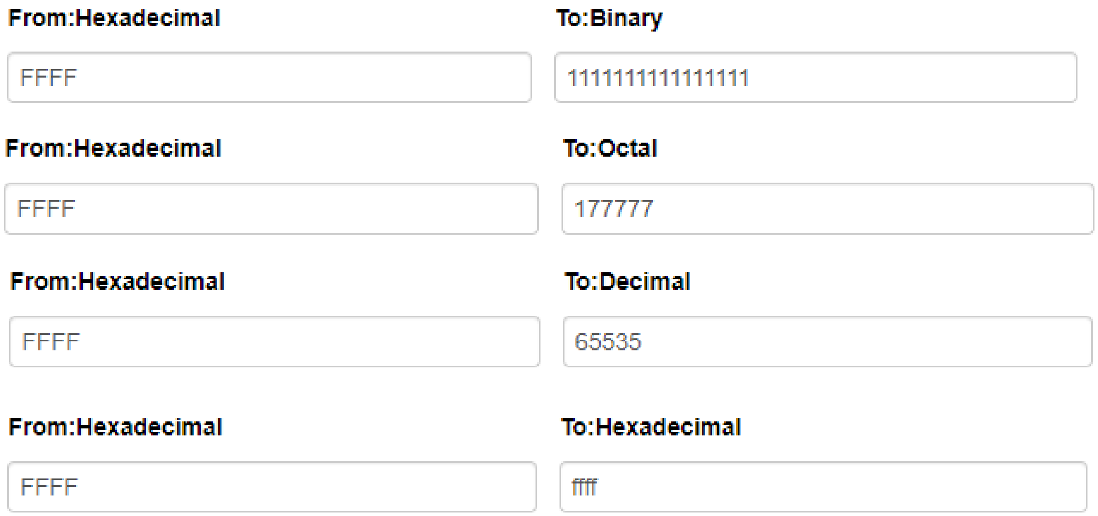
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) FFFF

The number in Binary 1111111111111111

The number in Octal 177777

The number in Decimal 65535

The number in Hexadecimal FFFF



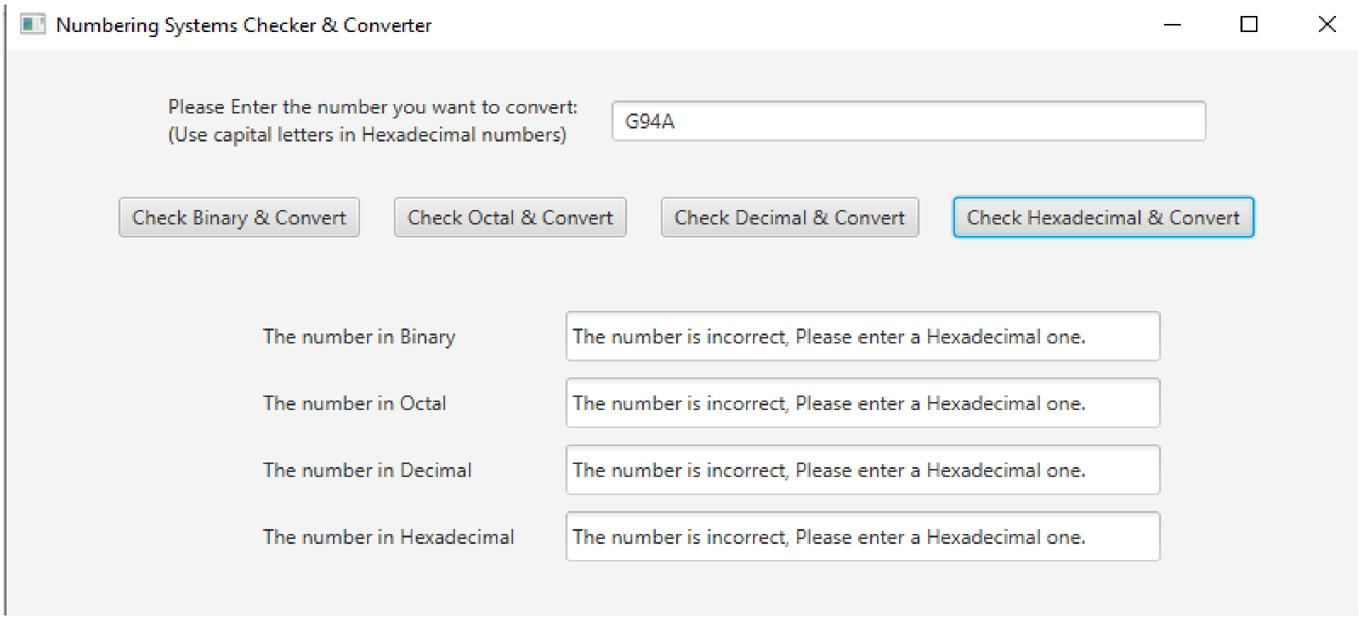
From:Hexadecimal FFFF **To:Binary** 1111111111111111

From:Hexadecimal FFFF **To:Octal** 177777

From:Hexadecimal FFFF **To:Decimal** 65535

From:Hexadecimal FFFF **To:Hexadecimal** ffff

Test case 2



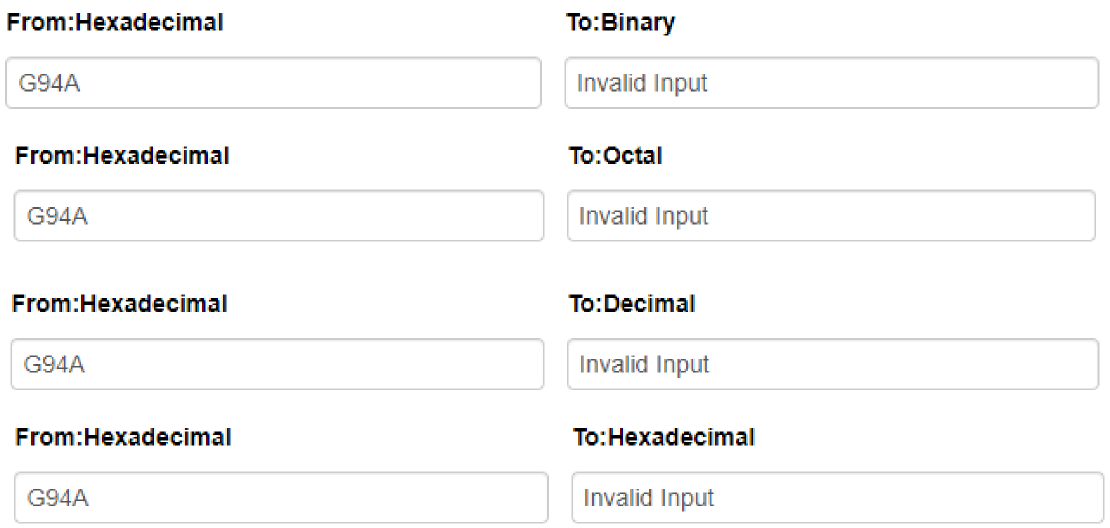
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) G94A

The number in Binary: The number is incorrect, Please enter a Hexadecimal one.

The number in Octal: The number is incorrect, Please enter a Hexadecimal one.

The number in Decimal: The number is incorrect, Please enter a Hexadecimal one.

The number in Hexadecimal: The number is incorrect, Please enter a Hexadecimal one.



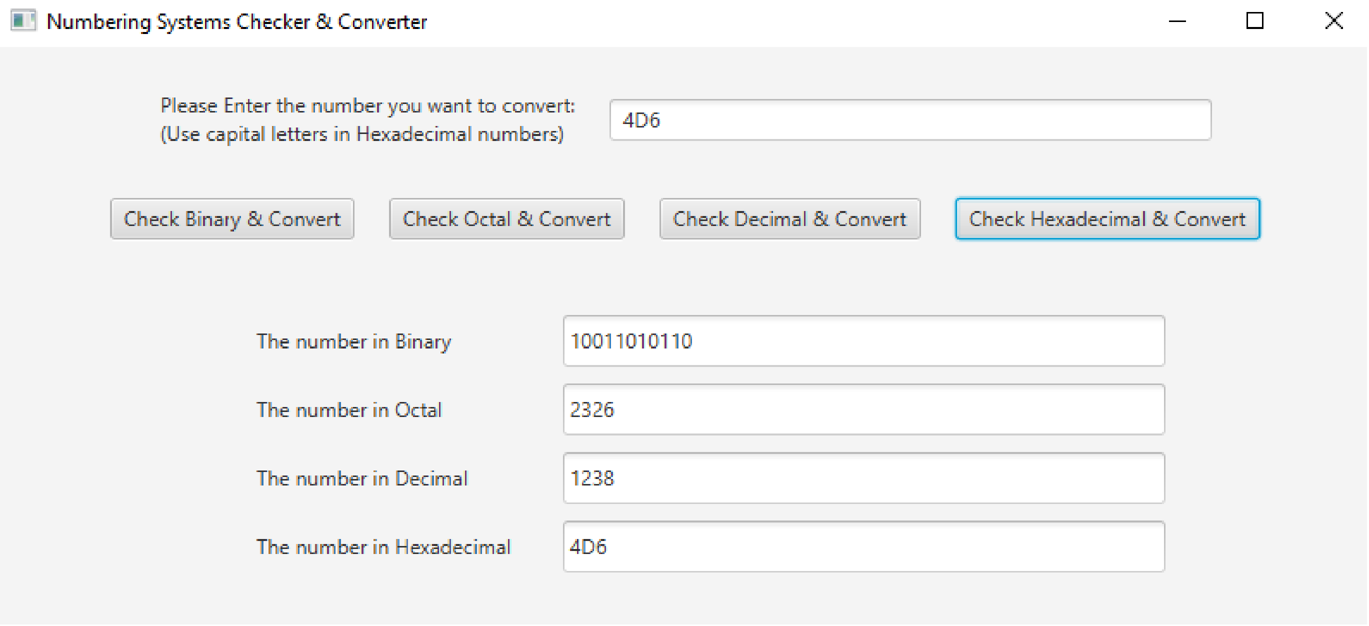
From:Hexadecimal: G94A To:Binary: Invalid Input

From:Hexadecimal: G94A To:Octal: Invalid Input

From:Hexadecimal: G94A To:Decimal: Invalid Input

From:Hexadecimal: G94A To:Hexadecimal: Invalid Input

Test case 3



Numbering Systems Checker & Converter

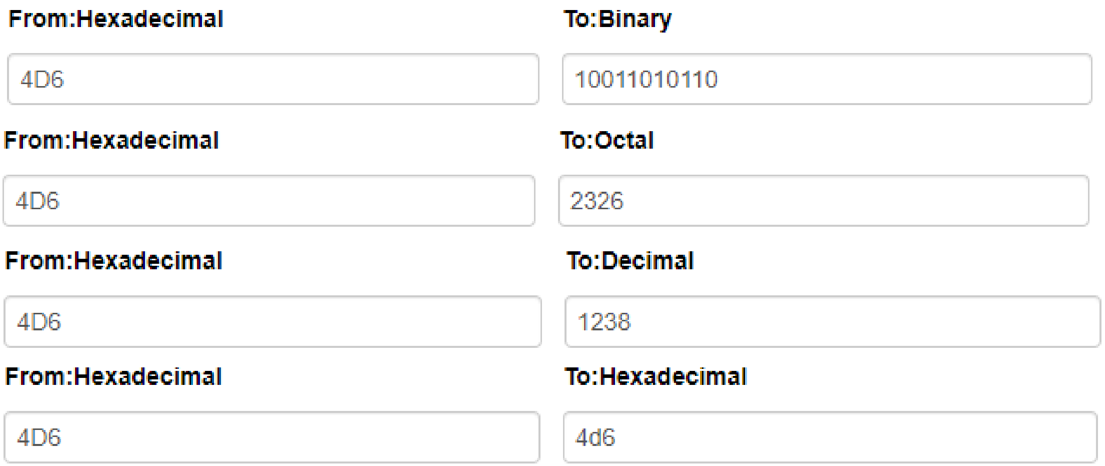
Please Enter the number you want to convert:
(Use capital letters in Hexadecimal numbers) 4D6

The number in Binary: 10011010110

The number in Octal: 2326

The number in Decimal: 1238

The number in Hexadecimal: 4D6



From:Hexadecimal	To:Binary
4D6	10011010110

From:Hexadecimal	To:Octal
4D6	2326

From:Hexadecimal	To:Decimal
4D6	1238

From:Hexadecimal	To:Hexadecimal
4D6	4d6

Difficulties

1- To make a multiline label in the label of the input text field I used "\n" and I could find this at [14].

2- I used "parseLong()" to get the number entered in the input text field like the example in page 135 in [3].

3- I used "toHexString()" to get the hexadecimal number directly without algorithm implementation and I find it at [15].

4- I used "toUpperCase()" to make the output hexadecimal bits from A to F in Capital. I found it at [16].

5- Knowing that there is a property like "charAt()" made me check the hexadecimal number in different way than the other three systems. And I found it in the source of this page [10].

6- When the input is a hexadecimal number. There is a difficulty to deal with as the hexadecimal bit could be a character So, I used "Long.parseLong(txtnum.getText() , 16)" to convert the hexadecimal string to decimal number directly [12].

7- The program has limits as it could convert

- Till 19 bits of ones as a binary input.
- Till 5 bits of sevens as an octal input.
- Till 4 bits of nines as a decimal input.
- Till 4 bits of F as a hexadecimal input.

And I cannot convert more bits than this because `long` data type has range ±9223372036854775807 and it cannot store more than that and long is the largest data type in **Java** unlike **C** which has **long long** [17].

Uncompleted tasks

1- I could not exceed the limits for the number of bits of the input number as `long` data type has a particular limit.

2- Wrong message `"The number is incorrect, Please enter a Decimal one."` will not be displayed as there is no number more than 9.

I tried to use the algorithm which I used in `"Hexadecimalinput()"` method but it did not work.

Recommendations

We can write this program’s methods in different way as we could use

parseLong(binaryString , 2) → to convert from binary to decimal directly [18].

parseLong(octalString , 8) → to convert from octal to decimal directly [19].

In addition to parseLong(hexadecimalString , 16) which we already used [12].

These lines would simplify this large code and, and I think they would increase the number of bits in the input number without having an error.

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