
VESSL
(KARNAUGH MAP)

SINHGAD INSTITUTE OF TECHNOLOGYLONAVALA

SAVITRIBAI PHULE PUNE UNIVERSITY

CERTIFICATE

This is certified that the Mini Project Entitled

VessL

(Karnaugh Map)

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SINHGAD INSTITUTE OF TECHNOLOGY LONAVALA

SAVITRIBAI PHULE PUNE UNIVERSITY

A

PROJECT REPORT

ON

VessL

(Karnaugh Map)

SUBMITTED IN FULFILLMENT FOR SUBMISSION

OF

Skill Development Lab

SUBMITTED BY

Jeevan Ingle [TEC-62]
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DEPARTMENT OF COMPUTER ENGINEERING

Sinhgad Institute of Technology, Kusgaon, Lonavala

Savitribai Phule Pune University

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Introduction

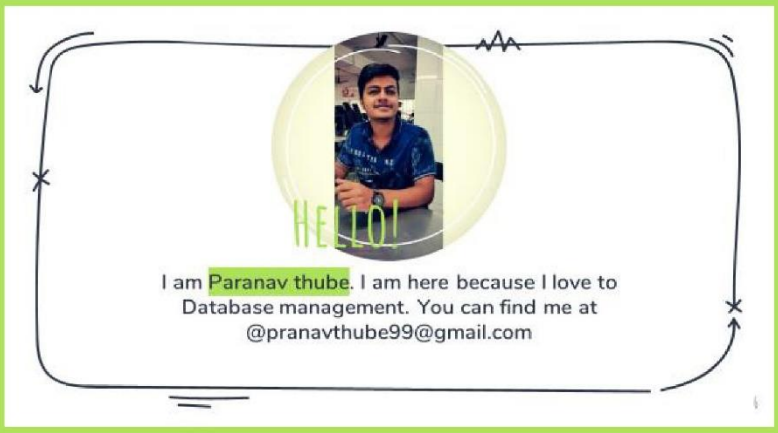
Acknowledgements.

This project has taken a considerable amount of time and resources and we would like to acknowledge the help of all of those who have made the project possible.

In particular I would like to thank my supervisor Prof.S. N. Lohar for his time, patience and guidance, and also for allowing the idea to be pursued originally. I would also like to thank Pushkaraj Chavan for his help, and my second marker Pranav Thube and my self Jeevan Ingle for, all of us time and advice.

We.....


HELLO!
I am Jeevan Ingle. I am here because I love to
Android development(Java) . You can find me at
@jeevaningle6057@gmail.com


HELLO!
I am Paranav thube. I am here because I love to
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HELLO!
I am Pushkaraj Chavan. I am here because I love to
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Introduction

Project Title : Vessl (Karnaugh Map) .

Software used : Android Studio.

Technology used : Java.

Main Features:

1. Clean and easy to use User Interface.
2. Straightforward usage without any complicated functions.
3. Gives 100% correct answer in both the format.
4. Does not depends on any other external resource for its proper functioning.

Objective

Vessl is designed to help individuals student who may lack in specific area of k-map. As we know k-map is complicate to solve and difficult to know the solved answer Is correct or not. Vessl provide you a platform on which you can tally your answer. With this platform, which gives you 100% correct answer in both format that is sum of product(SOP) and product of sum(POS). This platform is specifically design for the practice purpose to know whether the given solution is right or wrong.

Motivation

As a Engineering student I also go through all second year subject and the subject I most remember is digital electronics and in specifically the K-map topic. It's not just me but the other student also had the same issue regarding k-map, as no two student get correct answer in their first attempt. That's when it struck me there should be some kind of application which will give correct solution. As for the student and teacher its very hectic to tally your answer with all the student to know the correct answer. Many of friends also complained what to do in exam if we never knew which one is correct that's when an idea come in to create an application which will provide a better platform for practice. I thought that it will not just help us but the all the upcoming students and teachers who will be in chaos after every example of k-map. That's where it all began.

Project Code

MainActivity.java

```
import androidx.appcompat.app.AppCompatActivity;

import android.content.Intent;
import android.net.Uri;
import android.os.Bundle;
import android.view.View;
import android.widget.ImageView;
import android.widget.RadioButton;

public class MainActivity extends AppCompatActivity {

    private RadioButton ab;
    private RadioButton abc;
    private RadioButton abcd;
    RadioButton help;
    private ImageView imageView;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        getSupportActionBar().setTitle("K-map");   //change name



        ab = findViewById(R.id.ab);
        abc = findViewById(R.id.abc);
        abcd = findViewById(R.id.abcd);
        imageView = findViewById(R.id.imageView);

        imageView.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(Intent.ACTION_VIEW,
Uri.parse("https://google.com")));
            }
        });
```

Project Code

```
ab.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                if (abc.isChecked()) {
                    abc.setChecked(false);
                } else if (abcd.isChecked()) {
                    abcd.setChecked(false);
                }

                ab.setChecked(false);
                startActivity(new Intent(getApplicationContext(),
TwoVar_Layout.class));
            }
        });

        abc.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                if (abcd.isChecked()) {
                    abcd.setChecked(false);
                } else if (ab.isChecked()) {
                    ab.setChecked(false);
                }

                abc.setChecked(false);
                startActivity(new Intent(getApplicationContext(),
ThreeVar_Layout.class));
            }
        });

        abcd.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                if (ab.isChecked()) {
                    ab.setChecked(false);
                } else if (abc.isChecked()) {
                    abc.setChecked(false);
                }

                abcd.setChecked(false);
                startActivity(new Intent(getApplicationContext(),
FourVar_Layout.class));
            }
        });
    }
}
```

Project Code

FourVar_Layout.Java

```
import android.content.Context;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import androidx.appcompat.app.AppCompatActivity;
public class FourVar_Layout extends AppCompatActivity implements
View.OnClickListener {
    private Button[] buttons;
    private EditText textpane;
    private Button reset;
    private Button solve;
    private Button b;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.fourvar_layout);
        buttons = new Button[]{findViewById(R.id.button0),
findViewById(R.id.button1), findViewById(R.id.button2),
findViewById(R.id.button3),
                findViewById(R.id.button4), findViewById(R.id.button5),
findViewById(R.id.button6), findViewById(R.id.button7),
                findViewById(R.id.button8), findViewById(R.id.button9),
findViewById(R.id.button10), findViewById(R.id.button11),
                findViewById(R.id.button12), findViewById(R.id.button13),
findViewById(R.id.button14), findViewById(R.id.button15)};
        for (int i = 0; i < buttons.length; i++) {
            buttons[i].setOnClickListener(this);
        }
        textpane = findViewById(R.id.textpane);
        reset = findViewById(R.id.reset);
        solve = findViewById(R.id.solve);

        reset.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                // resets two variable panel buttons
                for (Button fourvarlocal : buttons) {
                    fourvarlocal.setText("0");
                }
                textpane.setText(null);
            }
          });
          solve.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                int val[];
                String soln;
```

Project Code

```
// executes when two variable is selected
                val = new int[16];

                for (int i = 0; i < val.length; i++) {
                    // stores value from button text
                    if (buttons[i].getText().toString().matches("X")) {
                        val[i] = 2;
                    } else {
                        val[i] =
Integer.parseInt(buttons[i].getText().toString());
                    }
                }

                // creates instance of two variable solver
                FourVarSolver solver = new FourVarSolver(val);
                // solves and stores result
                soln = solver.solve();

                // sets the result to text pane
                if (soln.isEmpty()) {
                    textpane.setText(null);
                } else {
                    new ResultTypeOptimizer(getContext(), soln, textpane);
                }
            }
        });
    }

    @Override
    public void onClick(View v) {
        b = (Button) v;

        if (b.getText().toString().matches("0")) {
            b.setText("1");
        } else {
            b.setText("0");
        }
    }

    private Context getContext() {
        return this;
    }
}
```

Project Code

FourVarSolver.Java

```
class FourVarSolver {
    private String output = "";
    private final int A[][] = new int[4][4];
    private final int checked[][] = new int[4][4];

    public FourVarSolver(int val[]) {
        int count = 0;
        for (int i = 0; i < 4; i++) {
            for (int j = 0; j < 4; j++) {
                A[i][j] = val[count++];
                checked[i][j] = 0;
            }
        }
    }

    public String solve() {
        if (!check16()) {
            // reaches if all values are 1
            output = "1";
        } else {
            // reaches if smaller groups are to be found rather than 16
            for (int i = 0; i < 4; i++) {
                for (int j = 0; j < 4; j++) {
                    if (A[i][j] == 1 && checked[i][j] == 0) {
                        if (check8(i, j)) {
                            if (check4(i, j)) {
                                if (check2(i, j)) {
                                    nogrouping(i, j);
                                }
                            }
                        }
                    }
                }
            }
        }
        return output;
    }
```

Project Code

```
                local = "B";// check for 16
    private boolean check16() {
        boolean search_smaller_group = false;

        outer:
        for (int i = 0; i < 4; i++) {
            for (int j = 0; j < 4; j++) {
                if (A[i][j] == 1) {
                    search_smaller_group = false;
                } else {
                    // breaks outer loop and returns true to find smaller groups
                    search_smaller_group = true;
                    break outer;
                }
            }
        }
        return search_smaller_group;
    }

    // check for 8
    private boolean check8(int r, int c) {
        boolean search_smaller_group = true;
        String local = "";

        if (A[r][0] == 1 && A[r][1] == 1 && A[r][2] == 1 && A[r][3] == 1 && A[(r +
1) % 4][0] == 1 && A[(r + 1) % 4][1] == 1
                && A[(r + 1) % 4][2] == 1 && A[(r + 1) % 4][3] == 1) { // rows ++
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {

            }
            if (r == 2) {
                local = "A";
            }
            if (r == 3) {
                local = "B'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }
```

Project Code

```
            search_smaller_group = false;
            // make checked
            checked[r][0] = 1;
            checked[r][1] = 1;
            checked[r][2] = 1;
            checked[r][3] = 1;
            checked[(r + 1) % 4][0] = 1;
            checked[(r + 1) % 4][1] = 1;
            checked[(r + 1) % 4][2] = 1;
            checked[(r + 1) % 4][3] = 1;
        } else if (A[r][0] == 1 && A[r][1] == 1 && A[r][2] == 1 && A[r][3] == 1 &&
A[(4 + (r - 1)) % 4][0] == 1
                && A[(4 + (r - 1)) % 4][1] == 1 && A[(4 + (r - 1)) % 4][2] == 1 &&
A[(4 + (r - 1)) % 4][3] == 1) { // rows --
            if (r == 0) {
                local = "B'";
            }
            if (r == 1) {
                local = "A'";
            }
            if (r == 2) {
                local = "B";
            }
            if (r == 3) {
                local = "A";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
               output = output + " + " + local;

    }
          search_smaller_group = false;
            // make checked
            checked[r][0] = 1;
            checked[r][1] = 1;
            checked[r][2] = 1;
            checked[r][3] = 1;
            checked[(4 + (r - 1)) % 4][0] = 1;
            checked[(4 + (r - 1)) % 4][1] = 1;
            checked[(4 + (r - 1)) % 4][2] = 1;
            checked[(4 + (r - 1)) % 4][3] = 1;
        } else if (A[0][c] == 1 && A[1][c] == 1 && A[2][c] == 1 && A[3][c] == 1 &&
A[0][(c + 1) % 4] == 1 && A[1][(c + 1) % 4] == 1
                && A[2][(c + 1) % 4] == 1 && A[3][(c + 1) % 4] == 1) { // columns
++
```

Project Code

```
            if (c == 0) {
                local = "C'";
            }
            if (c == 1) {
                local = "D";
            }
            if (c == 2) {
                local = "C";
            }
            if (c == 3) {
                local = "D'";
            }
           if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }
            search_smaller_group = false;
            // make checked
            checked[0][c] = 1;
            checked[1][c] = 1;
            checked[2][c] = 1;
            checked[3][c] = 1;
            checked[0][(c + 1) % 4] = 1;
            checked[1][(c + 1) % 4] = 1;
            checked[2][(c + 1) % 4] = 1;
            checked[3][(c + 1) % 4] = 1;
        } else if (A[0][c] == 1 && A[1][c] == 1 && A[2][c] == 1 && A[3][c] == 1 &&
A[0][(4 + (c - 1)) % 4] == 1
                && A[1][(4 + (c - 1)) % 4] == 1 && A[2][(4 + (c - 1)) % 4] == 1 &&
A[3][(4 + (c - 1)) % 4] == 1) { // columns --
            if (c == 0) {
                local = "D'";
            }
            if (c == 1) {
                local = "C'";
            }
            if (c == 2) {
                local = "D";
            }
            if (c == 3) {
                local = "C";}
            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;}
```

Project Code

```
search_smaller_group = false;
            // make checked

            checked[0][c] = 1;
            checked[1][c] = 1;
            checked[2][c] = 1;
            checked[3][c] = 1;
            checked[0][(4 + (c - 1)) % 4] = 1;
            checked[1][(4 + (c - 1)) % 4] = 1;
            checked[2][(4 + (c - 1)) % 4] = 1;
            checked[3][(4 + (c - 1)) % 4] = 1;
        }
        return search_smaller_group;
    }

    // check for 4
    private boolean check4(int r, int c) {
        boolean search_smaller_group = true;
        String local = "";

        if (A[r][0] == 1 && A[r][1] == 1 && A[r][2] == 1 && A[r][3] == 1) { // row
fours
            if (r == 0) {
                local = "A'B'";
            }
            if (r == 1) {
                local = "A'B";
            }
            if (r == 2) {
                local = "AB";
            }
            if (r == 3) {
                local = "AB'";
            }
            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][0] = 1;
            checked[r][1] = 1;
            checked[r][2] = 1;
            checked[r][3] = 1;
        } else if (A[0][c] == 1 && A[1][c] == 1 && A[2][c] == 1 && A[3][c] == 1) {
// column fours
```

Project Code

```
            if (c == 0) {
                local = "C'D'";
            }
            if (c == 1) {
                local = "C'D";
            }
            if (c == 2) {
                local = "CD";
            }
            if (c == 3) {
                local = "CD'";
            }
            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }
            search_smaller_group = false;
            // make checked
            checked[0][c] = 1;
            checked[1][c] = 1;
            checked[2][c] = 1;
            checked[3][c] = 1;
        } else if (A[r][c] == 1 && A[r][(c + 1) % 4] == 1 && A[(r + 1) % 4][c] == 1 && A[(r
+ 1) % 4][(c + 1) % 4] == 1) {
            // rows ++ & columns ++
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {
                local = "B";
            }
            if (r == 2) {
                local = "A";
            }
            if (r == 3) {
                local = "B'";
            }
            if (c == 0) {
                local = local + "C'";
            }
            if (c == 1) {
                local = local + "D";
            }
            if (c == 2) {
                local = local + "C";
            }
            if (c == 3) {
                local = local + "D'";
            }
            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local; }
```

Project Code

```
search_smaller_group = false;
            // make checked
            checked[r][c] = 1;
            checked[r][(c + 1) % 4] = 1;
            checked[(r + 1) % 4][c] = 1;
            checked[(r + 1) % 4][(c + 1) % 4] = 1;
        } else if (A[r][(4 + (c - 1)) % 4] == 1 && A[r][c] == 1 && A[(r + 1) % 4][(4 + (c - 1)) % 4]
== 1 && A[(r + 1) % 4][c] == 1) {
            // rows ++ & columns --
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {
                local = "B";
            }
            if (r == 2) {
                local = "A";
            }
            if (r == 3) {
                local = "B'";
            }
            if (c == 0) {
                local = local + "D'";
            }
            if (c == 1) {
                local = local + "C'";
            }
            if (c == 2) {
                local = local + "D";
            }
            if (c == 3) {
                local = local + "C'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][(4 + (c - 1)) % 4] = 1;
            checked[r][c] = 1;
            checked[(r + 1) % 4][(4 + (c - 1)) % 4] = 1;
            checked[(r + 1) % 4][c] = 1;

        } else if (A[(4 + (r - 1)) % 4][(4 + (c - 1)) % 4] == 1 && A[(4 + (r - 1)) % 4][c] == 1 &&
A[r][(4 + (c - 1)) % 4] == 1 && A[r][c] == 1) {
            // rows -- & columns --
            if (r == 0) {
                local = "B'";
            }
            if (r == 1) {
                local = "A'";
            }
            if (r == 2) {
```

Project Code

```
local = "B";
            }
            if (r == 3) {
                local = "A";
            }
            if (c == 0) {
                local = local + "D'";
            }
            if (c == 1) {
                local = local + "C'";
            }
            if (c == 2) {
                local = local + "D";
            }
            if (c == 3) {
                local = local + "C'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }
            search_smaller_group = false;
            // make checked
            checked[(4 + (r - 1)) % 4][(4 + (c - 1)) % 4] = 1;
            checked[(4 + (r - 1)) % 4][c] = 1;
            checked[r][(4 + (c - 1)) % 4] = 1;
            checked[r][c] = 1;
        } else if (A[(4 + (r - 1)) % 4][c] == 1 && A[(4 + (r - 1)) % 4][(c + 1) % 4] == 1 && A[r][c]
== 1 && A[r][(c + 1) % 4] == 1) {
            // rows-- & columns++
            if (r == 0) {
                local = "B'";
            }
            if (r == 1) {
                local = "A'";
            }
            if (r == 2) {
                local = "B";
            }
            if (r == 3) {
                local = "A";
            }
            if (c == 0) {
                local = local + "C'";
            }
            if (c == 1) {
                local = local + "D";
            }
            if (c == 2) {
                local = local + "C";
            }
            if (c == 3) {
                local = local + "D'";
            }
```

Project Code

```
        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        search_smaller_group = false;
        // make checked
        checked[(4 + (r - 1)) % 4][c] = 1;
        checked[(4 + (r - 1)) % 4][(c + 1) % 4] = 1;
        checked[r][c] = 1;
        checked[r][(c + 1) % 4] = 1;
    }
    return search_smaller_group;
}

// check for 2
private boolean check2(int r, int c) {
    boolean search_smaller_group = true;
    String local = "";

    if (A[r][c] == 1 && A[r][(c + 1) % 4] == 1) { // columns ++
        if (r == 0) {
            local = "A'B'";
        }
        if (r == 1) {
            local = "A'B";
        }
        if (r == 2) {
            local = "AB";
        }
        if (r == 3) {
            local = "AB'";
        }
        if (c == 0) {
            local = local + "C'";
        }
        if (c == 1) {
            local = local + "D";
        }
        if (c == 2) {
            local = local + "C";
        }
        if (c == 3) {
            local = local + "D'";
        }
        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }
        search_smaller_group = false;
        // make checked
        checked[r][c] = 1;
        checked[r][(c + 1) % 4] = 1;
    } else if (A[r][(4 + (c - 1)) % 4] == 1 && A[r][c] == 1) { // columns --
        if (r == 0) {
```

Project Code

```
            local = "A'B'";
        }
        if (r == 1) {
            local = "A'B";
        }
        if (r == 2) {
            local = "AB";
        }
        if (r == 3) {
            local = "AB'";
        }
        if (c == 0) {
            local = local + "D'";
        }
        if (c == 1) {
            local = local + "C'";
        }
        if (c == 2) {
            local = local + "D";
        }
        if (c == 3) {
            local = local + "C";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        search_smaller_group = false;
        // make checked
        checked[r][(4 + (c - 1)) % 4] = 1;
        checked[r][c] = 1;
    } else if (A[r][c] == 1 && A[(r + 1) % 4][c] == 1) { // rows ++
        if (r == 0) {
            local = "A'";
        }
        if (r == 1) {
            local = "B";
        }
        if (r == 2) {
            local = "A";
        }
        if (r == 3) {
            local = "B'";
        }
        if (c == 0) {
            local = local + "C'D'";
        }
        if (c == 1) {
            local = local + "C'D";
        }
        if (c == 2) {
            local = local + "CD";
        }
        if (c == 3) {
            local = local + "CD'";
        }
```

Project Code

```
if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][c] = 1;
            checked[(r + 1) % 4][c] = 1;
        } else if (A[r][c] == 1 && A[(4 + (r - 1)) % 4][c] == 1) { // rows --
            if (r == 0) {
                local = "B'";
            }
            if (r == 1) {
                local = "A'";
            }
            if (r == 2) {
                local = "B";
            }
            if (r == 3) {
                local = "A";
            }
            if (c == 0) {
                local = local + "C'D'";
            }
            if (c == 1) {
                local = local + "C'D";
            }
            if (c == 2) {
                local = local + "CD";
            }
            if (c == 3) {
                local = local + "CD'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][c] = 1;
            checked[(4 + (r - 1)) % 4][c] = 1;
        }
        return search_smaller_group;
    }
```

Project Code

```
    // no grouping
    private void nogrouping(int r, int c) {
        String local = "";
        if (r == 0) {
            local = "A'B'";
        }
        if (r == 1) {
            local = "A'B";
        }
        if (r == 2) {
            local = "AB";
        }
        if (r == 3) {
            local = "AB'";
        }
        if (c == 0) {
            local = local + "C'D'";
        }
        if (c == 1) {
            local = local + "C'D";
        }
        if (c == 2) {
            local = local + "CD";
        }
        if (c == 3) {
            local = local + "CD'";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        checked[r][c] = 1;
    }
}
```

Project Code

ThreeVar_Layout.java

```
import androidx.appcompat.app.AppCompatActivity;

import android.content.Context;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;

public class ThreeVar_Layout extends AppCompatActivity implements
View.OnClickListener {

    private Button[] buttons;
    private EditText textpane;
    private Button reset;
    private Button solve;
    private Button b;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.threevar_layout);

        buttons = new Button[]{findViewById(R.id.button0),
findViewById(R.id.button1), findViewById(R.id.button2),
findViewById(R.id.button3),
                findViewById(R.id.button4), findViewById(R.id.button5),
findViewById(R.id.button6), findViewById(R.id.button7)};
        for (int i = 0; i < buttons.length; i++) {
            buttons[i].setOnClickListener(this);
        }

        textpane = findViewById(R.id.textpane);
        reset = findViewById(R.id.reset);
        solve = findViewById(R.id.solve);

        reset.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                // resets two variable panel buttons
                for (Button threevarlocal : buttons) {
                    threevarlocal.setText("0");
                }
                textpane.setText(null);
            }
        });
```

Project Code

```
        solve.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                int val[];
                String soln;

                // executes when two variable is selected
                val = new int[8];

                for (int i = 0; i < val.length; i++) {
                    // stores value from button text
                    if (buttons[i].getText().toString().matches("X")) {
                        val[i] = 2;
                    } else {
                        val[i] = Integer.parseInt(buttons[i].getText().toString());
                    }
                }

                // creates instance of two variable solver
                ThreeVarSolver solver = new ThreeVarSolver(val);
                // solves and stores result
                soln = solver.solve();

                // sets the result to text pane
                if (soln.isEmpty()) {
                    textpane.setText(null);
                } else {
                    new ResultTypeOptimizer(getContext(), soln, textpane);
                }
            }
        });
    }

    @Override
    public void onClick(View v) {
        b = (Button) v;

        if (b.getText().toString().matches("0")) {
            b.setText("1");
        } else {
            b.setText("0");
        }
    }

    private Context getContext() {
        return this;
    }
}
```

Project Code

ThreeVarSolver.java

```
class ThreeVarSolver {
    private String output = "";
    private final int A[][] = new int[2][4];
    private final int checked[][] = new int[2][4];

    public ThreeVarSolver(int[] val) {
        int count = 0;
        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 4; j++) {
                A[i][j] = val[count++];
                checked[i][j] = 0;
            }
        }
    }

    public String solve() {
        if (!check8()) {
            // reaches if all values are 1
            output = "1";
        } else {
            // reaches if smaller groups are to be found rather than 8
            for (int i = 0; i < 2; i++) {
                for (int j = 0; j < 4; j++) {
                    if (A[i][j] == 1 && checked[i][j] == 0) {
                        if (check4(i, j)) {
                            if (check2(i, j)) {
                                nogrouping(i, j);
                            }
                        }

                    }
                }
            }
        }
        return output;
    }

    // check for 8
    private boolean check8() {
        boolean search_smaller_group = false;

        outer:
        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 4; j++) {
                if (A[i][j] == 1) {
                    search_smaller_group = false;
                } else {
                    // breaks outer loop and returns true to find smaller groups
                    search_smaller_group = true;
                    break outer;
                }
            }
        }
        return search_smaller_group;
    }
```

Project Code

```
    // check for 4
    private boolean check4(int r, int c) {
        boolean search_smaller_group = true;
        String local = "";

        if (A[r][0] == 1 && A[r][1] == 1 && A[r][2] == 1 && A[r][3] == 1) { // row fours
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {
                local = "A";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][0] = 1;
            checked[r][1] = 1;
            checked[r][2] = 1;
            checked[r][3] = 1;
        } else if (A[0][c] == 1 && A[0][(c + 1) % 4] == 1 && A[1][c] == 1 && A[1][(c + 1) % 4] == 1) {
// columns ++
            if (c == 0) {
                local = "B'";
            }
            if (c == 1) {
                local = "C";
            }
            if (c == 2) {
                local = "B";
            }
            if (c == 3) {
                local = "C'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[0][c] = 1;
            checked[0][(c + 1) % 4] = 1;
            checked[1][c] = 1;
            checked[1][(c + 1) % 4] = 1;
        } else if (A[0][c] == 1 && A[0][(4 + (c - 1)) % 4] == 1 && A[1][c] == 1 && A[1][(4 + (c - 1))
% 4] == 1) { // columns --
            if (c == 0) {
                local = "C'";
```

Project Code

```
            }
            if (c == 1) {
                local = "B'";
            }
            if (c == 2) {
                local = "C";
            }
            if (c == 3) {
                local = "B";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }
            search_smaller_group = false;
            // make checked
            checked[0][c] = 1;
            checked[0][(4 + (c - 1)) % 4] = 1;
            checked[1][c] = 1;
            checked[1][(4 + (c - 1)) % 4] = 1;
        }
        return search_smaller_group;
    }

    // check for 2
    private boolean check2(int r, int c) {
        boolean search_smaller_group = true;
        String local = "";

        if (A[r][c] == 1 && A[r][(c + 1) % 4] == 1) { // columns ++
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {
                local = "A";
            }
            if (c == 0) {
                local = local + "B'";
            }
            if (c == 1) {
                local = local + "C";
            }
            if (c == 2) {
                local = local + "B";
            }
            if (c == 3) {
                local = local + "C'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
```

Project Code

```
            // make checked
            checked[r][c] = 1;
            checked[r][(c + 1) % 4] = 1;
        } else if (A[r][(4 + (c - 1)) % 4] == 1 && A[r][c] == 1) { // columns --
            if (r == 0) {
                local = "A'";
            }
            if (r == 1) {
                local = "A";
            }
            if (c == 0) {
                local = local + "C'";
            }
            if (c == 1) {
                local = local + "B'";
            }
            if (c == 2) {
                local = local + "C";
            }
            if (c == 3) {
                local = local + "B";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][(4 + (c - 1)) % 4] = 1;
            checked[r][c] = 1;
        } else if (A[r][c] == 1 && A[(r + 1) % 2][c] == 1) { // rows ++
            if (c == 0) {
                local = "B'C'";
            }
            if (c == 1) {
                local = "B'C";
            }
            if (c == 2) {
                local = "BC";
            }
            if (c == 3) {
                local = "BC'";
            }

            if (output.matches("")) {
                output = output + local;
            } else {
                output = output + " + " + local;
            }

            search_smaller_group = false;
            // make checked
            checked[r][c] = 1;
            checked[(r + 1) % 2][c] = 1;
        }
        return search_smaller_group;
    }
```

Project Code

```
// no grouping
    private void nogrouping(int r, int c) {
        String local = "";

        if (r == 0) {
            local = "A'";
        }
        if (r == 1) {
            local = "A";
        }
        if (c == 0) {
            local = local + "B'C'";
        }
        if (c == 1) {
            local = local + "B'C";
        }
        if (c == 2) {
            local = local + "BC";
        }
        if (c == 3) {
            local = local + "BC'";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        checked[r][c] = 1;
    }
}
```

Project Code

TwoVar_Layout.java

```
import androidx.appcompat.app.AppCompatActivity;

import android.content.Context;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;

public class TwoVar_Layout extends AppCompatActivity implements View.OnClickListener {

    private Button[] buttons;
    private EditText textpane;
    private Button reset;
    private Button solve;
    private Button b;


    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.twovar_layout);

        buttons = new Button[]{findViewById(R.id.button0), findViewById(R.id.button1),
findViewById(R.id.button2), findViewById(R.id.button3)};
        for (int i = 0; i < buttons.length; i++) {
            buttons[i].setOnClickListener(this);
        }

        textpane = findViewById(R.id.textpane);
        reset = findViewById(R.id.reset);
        solve = findViewById(R.id.solve);

        reset.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                // resets two variable panel buttons
                for (Button twovarlocal : buttons) {
                    twovarlocal.setText("0");
                }
                textpane.setText(null);
            }
        });

        solve.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                int val[];
                String soln;

                // executes when two variable is selected
                val = new int[4];
```

Project Code

```
                for (int i = 0; i < val.length; i++) {
                    // stores value from button text
                    if (buttons[i].getText().toString().matches("X")) {
                        val[i] = 2;
                    } else {
                        val[i] =
Integer.parseInt(buttons[i].getText().toString());
                    }
                }

                // creates instance of two variable solver
                TwoVarSolver solver = new TwoVarSolver(val);
                // solves and stores result
                soln = solver.solve();

                // sets the result to text pane
                if (soln.isEmpty()) {
                    textpane.setText(null);
                } else {
                    new ResultTypeOptimizer(getContext(), soln, textpane);
                }
            }
        });
    }

    @Override
    public void onClick(View v) {
        b = (Button) v;

        if (b.getText().toString().matches("0")) {
            b.setText("1");
        } else {
            b.setText("0");
        }
    }

    private Context getContext() {
        return this;
    }
}
```

Project Code

TwoVarSolver.java

```
class TwoVarSolver {
    private String output = "";
    private final int A[][] = new int[2][2];
    private final int checked[][] = new int[2][2];

    public TwoVarSolver(int[] val) {
        int count = 0;
        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 2; j++) {
                A[i][j] = val[count++];
                checked[i][j] = 0;
            }
        }
    }

    public String solve() {
        if (!check4()) {
            // reaches if all values are 1
            output = "1";
        } else {
            // reaches if smaller groups are to be found rather than 4
            for (int i = 0; i < 2; i++) {
                for (int j = 0; j < 2; j++) {
                    if (A[i][j] == 1 && checked[i][j] == 0) {
                        if (check2(i, j)) {
                            nogrouping(i, j);
                        }

                    }
                }
            }
        }
        return output;
    }
    // check for 4
    private boolean check4() {
        boolean search_smaller_group = false;

        outer:
        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 2; j++) {
                if (A[i][j] == 1) {
                    search_smaller_group = false;
                } else {                        // breaks outer loop and returns true to
find smaller groups
                    search_smaller_group = true;
                    break outer;
                }
            }
        }
        return search_smaller_group;
    }
```

Project Code

```
// check for 2
private boolean check2(int r, int c) {
    boolean search_smaller_group = true;
    String local = "";

    if (A[r][c] == 1 && A[r][(c + 1) % 2] == 1) { // columns ++
        if (r == 0) {
            local = "A'";
        }
        if (r == 1) {
            local = "A";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        search_smaller_group = false;
        // make checked
        checked[r][c] = 1;
        checked[r][(c + 1) % 2] = 1;
    } else if (A[r][c] == 1 && A[(r + 1) % 2][c] == 1) { // rows ++
        if (c == 0) {
            local = "B'";
        }
        if (c == 1) {
            local = "B";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        search_smaller_group = false;
        // make checked
        checked[r][c] = 1;
        checked[(r + 1) % 2][c] = 1;
    }
    return search_smaller_group;
}
```

Project Code

```
// no grouping
    private void nogrouping(int r, int c) {
        String local = "";

        if (r == 0) {
            local = "A'";
        }
        if (r == 1) {
            local = "A";
        }
        if (c == 0) {
            local = local + "B'";
        }
        if (c == 1) {
            local = local + "B";
        }

        if (output.matches("")) {
            output = output + local;
        } else {
            output = output + " + " + local;
        }

        checked[r][c] = 1;
    }
}
```

Project Code

activity_main.XML

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/back"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#AEE25A"
    tools:context=".MainActivity">
    <ImageView
        android:id="@+id/imageView"
        android:layout_width="389dp"
        android:layout_height="417dp"
        android:layout_marginStart="4dp"
        android:contentDescription="@string/logo"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:srcCompat="@drawable/logo" />
    <RadioButton
        android:id="@+id/abcd"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:fontFamily="casual"
        android:text="A, B, C, D"
        android:textSize="18sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toEndOf="@+id/abc"
        app:layout_constraintTop_toBottomOf="@+id/imageView" />
    <RadioButton
        android:id="@+id/abc"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:fontFamily="casual"
        android:text="A, B, C"
        android:textSize="18sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/imageView" />
    <RadioButton
        android:id="@+id/ab"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:fontFamily="casual"
        android:text="A, B"
        android:textSize="18sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toStartOf="@+id/abc"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/imageView"/>
</androidx.constraintlayout.widget.ConstraintLayout>
```

Project Code

Fourvar_layout.XML

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#AEE25A"
    tools:context=".FourVar_Layout">

    <LinearLayout
        android:id="@+id/linearLayout0"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent">

        <Button
            android:id="@+id/button0"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button1"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button2"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
```

Project Code

```
        <Button
            android:id="@+id/button3"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

    </LinearLayout>

    <LinearLayout
        android:id="@+id/linearLayout1"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/linearLayout0">

        <Button
            android:id="@+id/button4"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button5"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button6"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
```

Project Code

```
    <Button
        android:id="@+id/button7"
        android:layout_width="wrap_content"
        android:layout_height="120dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />
</LinearLayout>
 <LinearLayout
    android:id="@+id/linearLayout2"
    android:layout_width="0dp"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/linearLayout1">

    <Button
        android:id="@+id/button8"
        android:layout_width="wrap_content"
        android:layout_height="120dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />

    <Button
        android:id="@+id/button9"
        android:layout_width="wrap_content"
        android:layout_height="120dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />

    <Button
        android:id="@+id/button10"
        android:layout_width="wrap_content"
        android:layout_height="120dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />
```

Project Code

```
        <Button
            android:id="@+id/button11"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
    </LinearLayout>

    <LinearLayout
        android:id="@+id/linearLayout3"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/linearLayout2">

        <Button
            android:id="@+id/button12"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button13"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button14"
            android:layout_width="wrap_content"
            android:layout_height="120dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
```

Project Code

```
     <Button
         android:id="@+id/button15"
         android:layout_width="wrap_content"
         android:layout_height="120dp"
         android:layout_weight="1"
         android:backgroundTint="#FFFFFF"
         android:fontFamily="casual"
         android:text="@string/zero"
         android:textSize="30sp" />
</LinearLayout>

<LinearLayout
    android:id="@+id/linearLayout4"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    app:layout_constraintBottom_toBottomOf="parent">

    <Button
        android:id="@+id/reset"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/reset"
        android:textSize="18sp" />

    <Button
        android:id="@+id/solve"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:scrollbarSize="8dp"
        android:text="@string/solve"
        android:textSize="18sp" />
</LinearLayout>
```

Project Code

```
<EditText
        android:id="@+id/textpane"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:clickable="false"
        android:cursorVisible="false"
        android:editable="false"
        android:ems="10"
        android:focusable="false"
        android:focusableInTouchMode="false"
        android:fontFamily="casual"
        android:gravity="start|top"
        android:inputType="textMultiLine"
        android:textSize="24sp"
        app:layout_constraintBottom_toTopOf="@+id/linearLayout4"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent" />
</androidx.constraintlayout.widget.ConstraintLayout>
```

Project Code

threevar_layout.XML

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#AEE25A"
    tools:context=".ThreeVar_Layout">
    <LinearLayout
        android:id="@+id/linearLayout0"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent">
        <Button
            android:id="@+id/button0"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
        <Button
            android:id="@+id/button1"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
        <Button
            android:id="@+id/button2"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
        <Button
            android:id="@+id/button3"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

    </LinearLayout>
```

Project Code

```
<LinearLayout
        android:id="@+id/linearLayout1"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/linearLayout0">

        <Button
            android:id="@+id/button4"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button5"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button6"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button7"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />
    </LinearLayout>
```

Project Code

```
<LinearLayout
        android:id="@+id/linearLayout2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintBottom_toBottomOf="parent">

        <Button
            android:id="@+id/reset"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/reset"
            android:textSize="18sp" />

        <Button
            android:id="@+id/solve"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/solve"
            android:textSize="18sp" />
    </LinearLayout>

    <EditText
        android:id="@+id/textpane"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:clickable="false"
        android:cursorVisible="false"
        android:ems="10"
        android:focusable="false"
        android:focusableInTouchMode="false"
        android:fontFamily="casual"
        android:gravity="start|top"
        android:inputType="textMultiLine"
        android:textSize="24sp"
        app:layout_constraintBottom_toTopOf="@+id/linearLayout2"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent" />
</androidx.constraintlayout.widget.ConstraintLayout>
```

Project Code

Twovar_layout.XML

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#AEE25A"
    android:orientation="vertical">

    <LinearLayout
        android:id="@+id/linearLayout2"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:orientation="horizontal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent">

        <Button
            android:id="@+id/button0"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

        <Button
            android:id="@+id/button1"
            android:layout_width="wrap_content"
            android:layout_height="150dp"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/zero"
            android:textSize="30sp" />

    </LinearLayout>
```

Project Code

```
<LinearLayout
    android:id="@+id/linearLayout3"
    android:layout_width="0dp"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/linearLayout2">

    <Button
        android:id="@+id/button2"
        android:layout_width="wrap_content"
        android:layout_height="150dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />

    <Button
        android:id="@+id/button3"
        android:layout_width="wrap_content"
        android:layout_height="150dp"
        android:layout_weight="1"
        android:backgroundTint="#FFFFFF"
        android:fontFamily="casual"
        android:text="@string/zero"
        android:textSize="30sp" />
</LinearLayout>

<LinearLayout
    android:id="@+id/linearLayout"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    app:layout_constraintBottom_toBottomOf="parent">
```

Project Code

```
<Button
            android:id="@+id/reset"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/reset"
            android:textSize="18sp" />

        <Button
            android:id="@+id/solve"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_weight="1"
            android:backgroundTint="#FFFFFF"
            android:fontFamily="casual"
            android:text="@string/solve"
            android:textSize="18sp" />
    </LinearLayout>

<EditText
        android:id="@+id/textpane"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:clickable="false"
        android:cursorVisible="false"
        android:ems="10"
        android:focusable="false"
        android:focusableInTouchMode="false"
        android:fontFamily="casual"
        android:gravity="start|top"
        android:inputType="textMultiLine"
        android:textSize="24sp"
        app:layout_constraintBottom_toTopOf="@+id/linearLayout"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent" />

</androidx.constraintlayout.widget.ConstraintLayout>
```

Project Code

AndroidMainfest.xml

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.emranffl.k_mapsolver">

    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:theme="@style/AppTheme">
        <activity android:name=".FourVar_Layout"></activity>
        <activity android:name=".ThreeVar_Layout" />
        <activity android:name=".TwoVar_Layout" />
        <activity android:name=".MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>

        <meta-data
            android:name="preloaded_fonts"
            android:resource="@array/preloaded_fonts" />
    </application>

</manifest>
```

Steps To Run The Project

1.Install Vessal .

2.Select the function in which you want to solve the respective k-map.

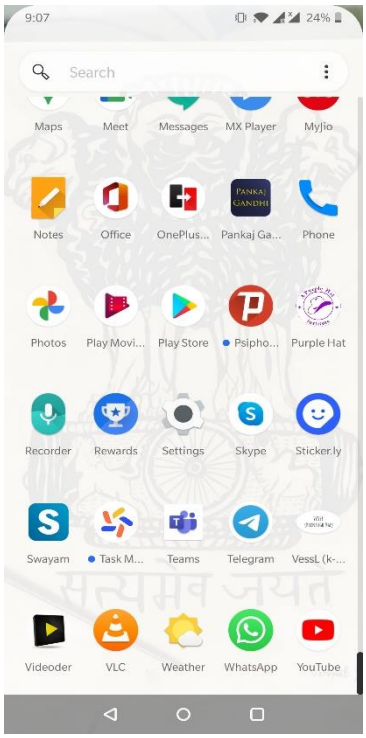
3.Enter the the correct location of 1's in the selected format.

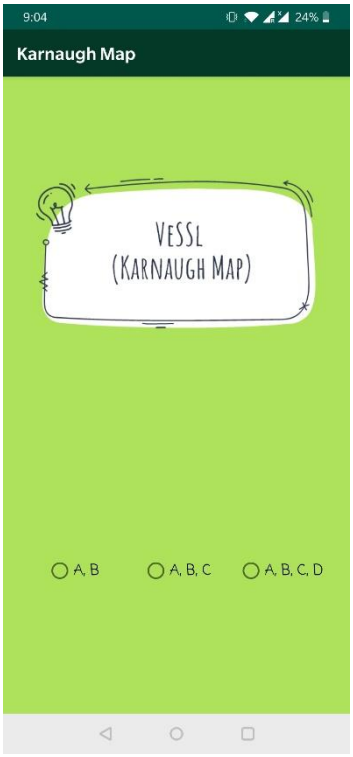
4.Click on solve select the option in between SOP or POS.

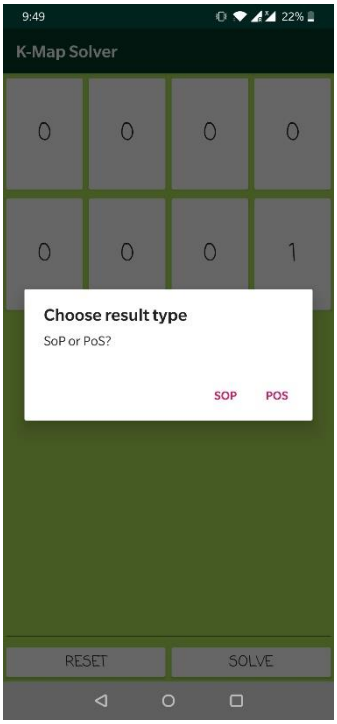
5.To re-enter the values click on reset.

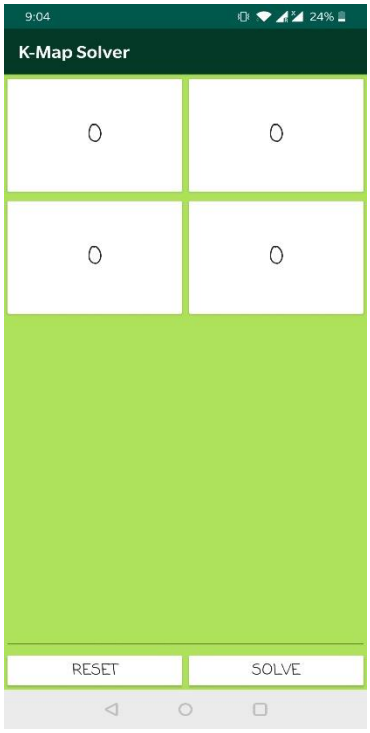
6.To exit click on back button.

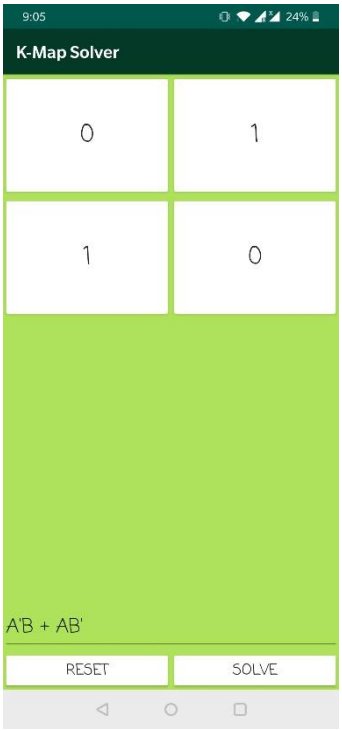
Screenshots

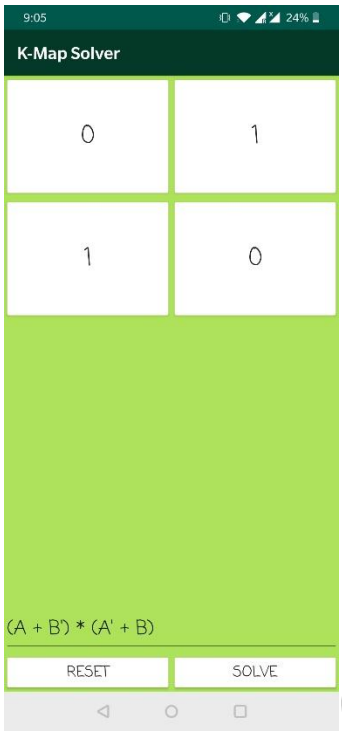




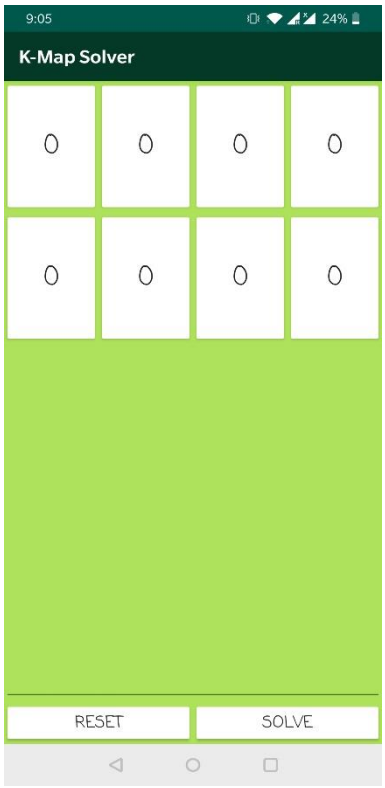


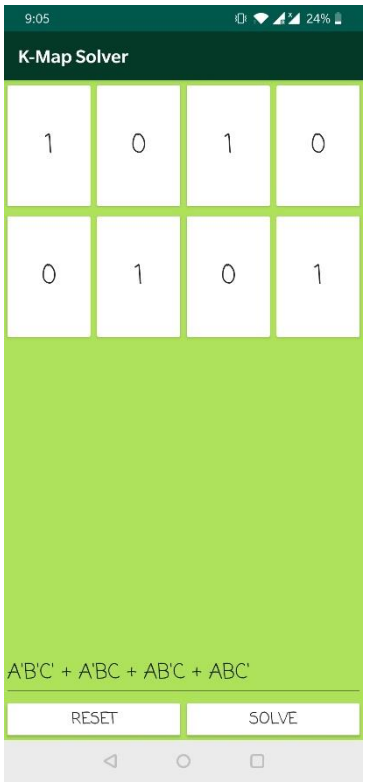


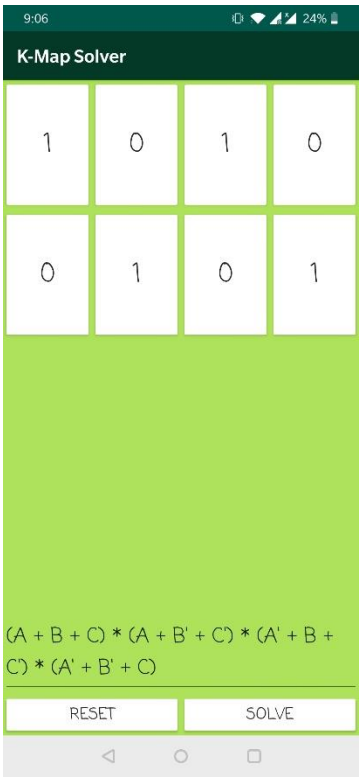


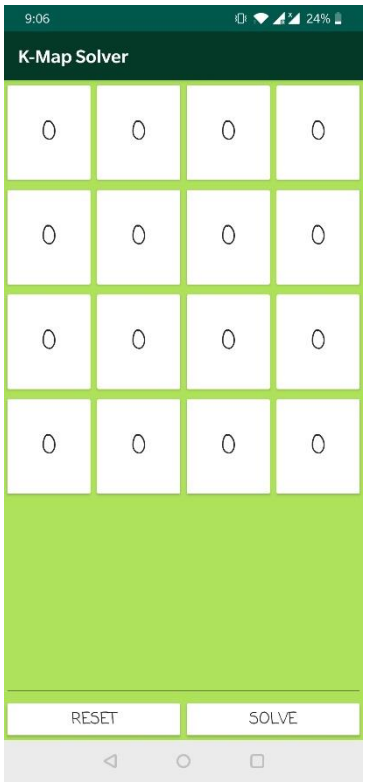


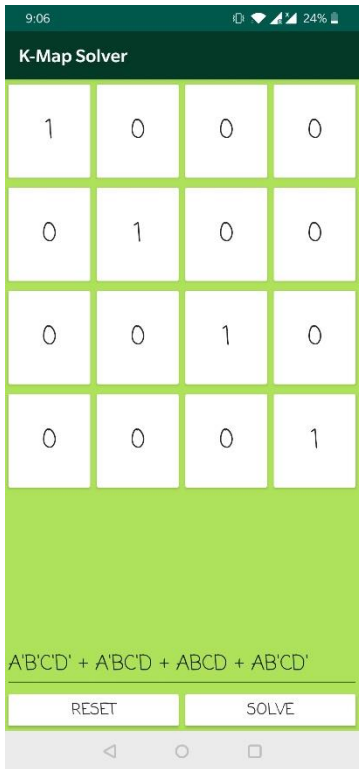
Screenshots

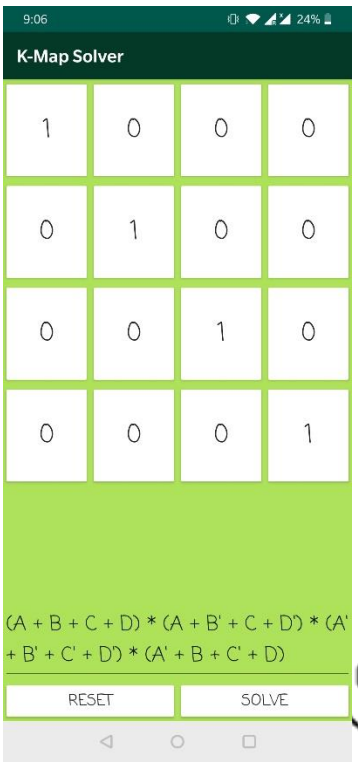












Advantages and disadvantages

ADVANTAGES:

1. Don't need to tired yourself in search of correct answer.
2. Good platform for the practice.
3. Gives 100% correct answers.
4. Have multiple formats for answers.
5. All example of k-map can be solved.

DISADVANTAGES:

1. _There are no disadvantages for this application as long as you do your honest work.
2. Can be used for the cheating purposes.

Make you lazy has you can get answers directly without following any certain method.

Conclusion

It provide's you better platform for practice, all the solutions are verified no need for hectic methods and long solutions.