

## 《移动应用软件开发》实验报告

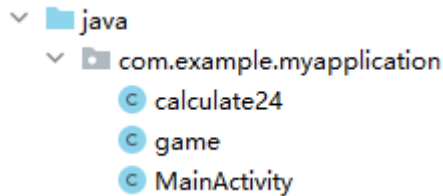
年级、专业、班级	2021 级计算机科学与技术 3 班	姓名	刘成	学号	20215005
实验题目	扑克牌计算 24 点 APP				
实验时间	2023. 10. 22	实验地点	DS1401		
学年学期	2023-2024(1)	实验性质	<input type="checkbox"/> 验证性 <input checked="" type="checkbox"/> 设计性 <input type="checkbox"/> 综合性		
<b>一、实验目的</b> 1. 本次实验的目的是掌握开发工具的基本操作，了解所开发 APP 项目的基本结构。掌握常用组件和布局的使用。开发平台 HarmonyOS, Android, iOS, 原生开发, 三选一。 2. 设计完成一个 APP 开发：扑克牌计算 24 点。 3. 抄袭计 0 分。					
<b>二、实验项目内容</b> <p>已知一副扑克牌有 54 张，去除大王和小王，剩余 52 张。在其中抽取 4 张牌，利用加减乘除进行计算得到 24，除法必须能够除尽。编写程序从一副扑克牌，选择 4 张，进行计算是否能得到 24。如果可以，排序列出可能的计算表达式，可能有多种计算形式。</p> <p>评分点：（1）在界面上显示出 52 张扑克牌。（2）通过点击的方式选出 4 张扑克牌并放置在界面某一个地方，位置自己确定。（3）如果可以计算出 24，排序列出可能的计算方式，并显示在界面上，如果不能算出，请提示。（4）APP 界面自行设计，至少包含两个界面。（5）界面美观度，功能完整度，扩展性功能，程序稳定性。</p> <p>提交：（1）本实验报告，（2）源代码压缩文件 zip，（3）软件演示的 MP4 视频，视频大小不超过 20M，视频请在<b>搜狗浏览器</b>测试能否正常播放。注意源代码加注释。注意文件名称的规范性。文件名：组号-学号姓名 1.doc，组号-学号姓名 1.zip，组号-学号姓名 1.mp4。三个文件分别提交。</p>					
<b>三、实验过程或算法（写明设计思想、程序的结构、功能关系图、类的说明和类之间的关系图、程序主要执行流程图，最后是核心源代码，截图等）</b> <b>1. 设计思想</b> 在界面设计上，设计了 24 点游戏的主界面和游戏界面。主页面用于游戏介绍和进入游戏界面，设计了开始游戏按钮。在游戏界面种，将 52 张扑克牌按照 4 种花色，通过 RelativeLayout 布局横向排列，分布在中上方。并设计 4 张待选卡牌，用于保存用户选择的卡牌。同时设计了“重试”和“计					

算”按钮，辅助用户的点击操作。

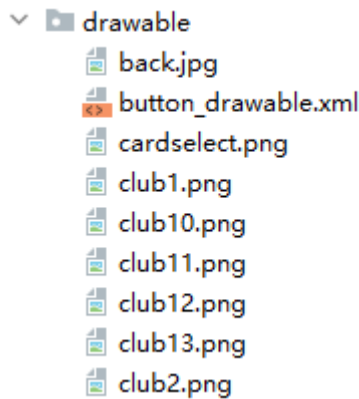
在逻辑设计上，创建 `calculate24` 类，使用了穷举搜索和回溯的算法计算给定 4 个数字 24 点表达式，返回所有的表达式列表。在 `MainActivity` 类中定义了“开始游戏按按钮”的点击事件。在 `game` 类中，分别定义了 52 张卡牌、4 个待选位置以及 2 个操作按钮的点击事件。

## 2. 程序结构

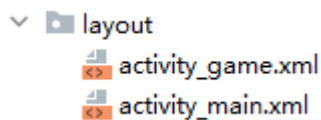
`myApplication` 中包含了 `calculate24`, `game`, `MainActivity` 三个 java 类



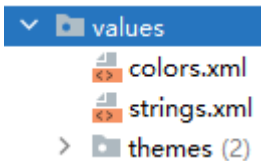
`drawable` 中包含了 52 张卡牌图片以及其他设计图片和设计文件



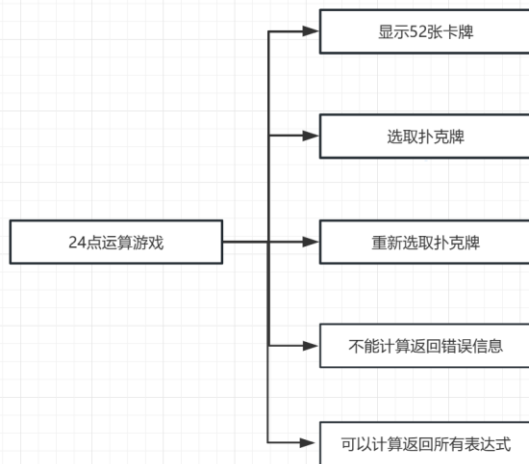
`layout` 中包含了 `activity_game.xml` 和 `activity_main.xml` 两个设计界面



`values` 中包含了 `colors.xml` 和 `strings.xml` 以及 themes 信息



## 3. 功能关系图



#### 4. 类的说明

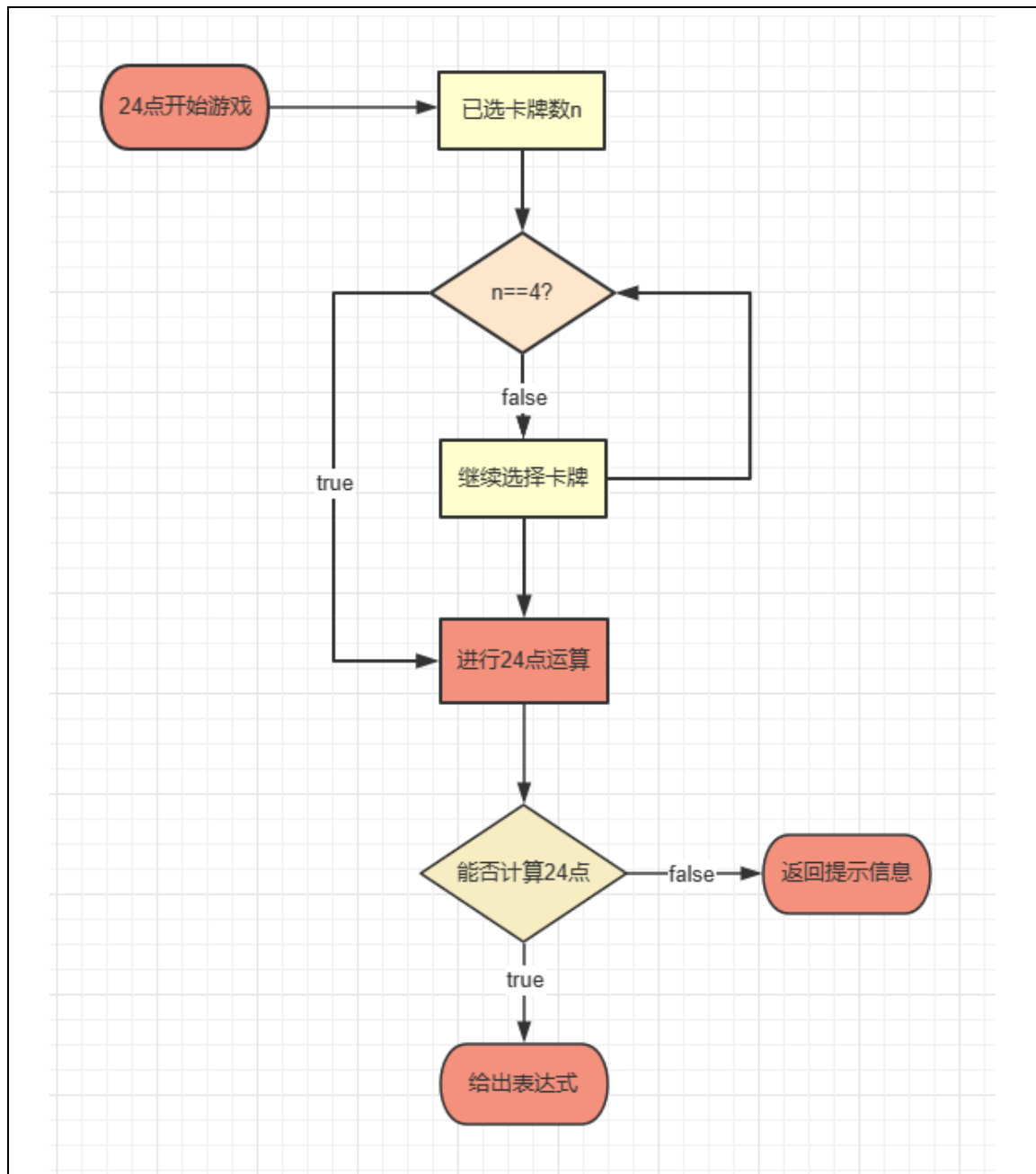
calculate24: 用于对给定的 4 个数字计算 24 点，采用穷举和回溯算法

MainActivity: 定义了“开始游戏”按钮的点击事件，跳转到游戏界面

game: 定义了 4 个待选位置的数值和 24 张卡牌的点击事件，根据待选位置的数量，在点击卡牌时判断是否改变待选位置的数值和对应的图片资源；定义了“重试”按钮的点击事件，用于清空当前待选位置并还原图片资源；定义了“计算”按钮的点击事件，调用 calculate24 类计算 24 点表达式，并通过弹窗给出对应结果。

程序的 uml 图如下所示。

#### 5. 程序主要执行流程图



## 6. 核心源代码

-calculate24.java

```
package com.example.myapplication;
```

```
import java.util.ArrayList;
```

```
import java.util.LinkedHashSet;
```

```
import java.util.List;
```

```
public class calculate24 {
```

```
    static final int TARGET = 24;
```

```
    static final double EPSILON = 1e-6;
```

```
    static final int ADD = 0, MUL = 1, SUB = 2, DIV = 3;
```

```
    private List<String> equations = new ArrayList<>();
```

```
public List<String> find24Expressions(int[] cards) {
    equations.clear();

    List<Double> numbers = new ArrayList<>(); // 存储操作数
    List<String> numStr = new ArrayList<>(); // 存储表达式

    for (int num : cards) {
        numbers.add((double) num);
        numStr.add(Integer.toString(num));
    }

    solve24(numbers, numStr);

    // 表达式去重
    equations = new ArrayList<>(new LinkedHashSet<>(equations));
    return equations;
}

private void solve24(List<Double> numbers, List<String> numStr) {
    if (numbers.size() == 0) {
        return;
    }

    if (numbers.size() == 1) {
        if (Math.abs(numbers.get(0) - TARGET) < EPSILON) {
            String equation = numStr.get(0);
            equations.add(equation.substring(1, equation.length() - 1) +
"=24");
        }
        return;
    }

    int n = numbers.size();
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            if (i != j) {
                List<Double> newNumbers = new ArrayList<>();
                List<String> newNumStr = new ArrayList<>();

                for (int z = 0; z < n; z++) {
                    if (z != i && z != j) {
                        newNumbers.add(numbers.get(z));
                        newNumStr.add(numStr.get(z));
                    }
                }
            }
        }
    }
}
```



```
import android.app.AlertDialog;
import android.content.DialogInterface;
import android.os.Bundle;
import android.view.View;
import android.widget.ImageButton;
import android.widget.ImageView;
import android.widget.Toast;

import java.util.List;

public class game extends AppCompatActivity {
    // 定义四个位置的数字
    private int position1 = -1;
    private int position2 = -1;
    private int position3 = -1;
    private int position4 = -1;
    // 定义待选择位置
    private ImageButton cardSelect1;
    private ImageButton cardSelect2;
    private ImageButton cardSelect3;
    private ImageButton cardSelect4;
    private int countCard = 0; // 统计已经选择的卡牌数量
    private StringBuilder result = new StringBuilder(); // 24 点计算结果

    private void showAlertDialog() {
        AlertDialog.Builder builder = new AlertDialog.Builder(this);

        // 设置对话框标题和消息
        builder.setTitle("运算结果");
        builder.setMessage(result);

        // 设置确定按钮
        builder.setPositiveButton("确定", new DialogInterface.OnClickListener()
        {
            @Override
            public void onClick(DialogInterface dialog, int which) {
                // 在用户点击确定按钮时执行的操作
                // 可以在这里添加你的逻辑
                countCard = 0; // 已选择卡牌数量归零
                // 四个位置的图片还原
                cardSelect1.setImageResource(R.drawable.cardselect);
                cardSelect2.setImageResource(R.drawable.cardselect);
                cardSelect3.setImageResource(R.drawable.cardselect);
            }
        });
    }
}
```

```
        cardSelect4.setImageResource(R.drawable.cardselect);
    }
});

// 创建并显示对话框
AlertDialog dialog = builder.create();
dialog.show();
}

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

    cardSelect1 = findViewById(R.id.cardselect1);
    cardSelect2 = findViewById(R.id.cardselect2);
    cardSelect3 = findViewById(R.id.cardselect3);
    cardSelect4 = findViewById(R.id.cardselect4);

    // 分别遍历不同花色的卡牌，对每个卡牌的点击赋予点击事件
    for (int i = 1; i <= 13; i++) {
        final int cardPosition = i;
        final int drawableResource = getResources().getIdentifier("club" + i,
"drawable", getPackageName());

        ImageButton cardButton =
findViewById(getResources().getIdentifier("club" + i, "id", getPackageName()));
        cardButton.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                if (countCard < 4) {
                    countCard++;    // 已选择卡牌数量增加
                    switch (countCard) {
                        case 1:
                            position1 = cardPosition;    // 位置 1 对应的值变
为卡牌值
cardSelect1.setImageResource(drawableResource);    // 待选位置 1 图片变为卡牌图
片
                            break;
                        case 2:
                            position2 = cardPosition;
cardSelect2.setImageResource(drawableResource);
```



```
                break;
            case 3:
                position3 = cardPosition;

cardSelect3.setImageResource(drawableResource);

                break;
            case 4:
                position4 = cardPosition;

cardSelect4.setImageResource(drawableResource);

                break;
        }
    }
}

});
}

for (int i = 1; i <= 13; i++) {
    final int cardPosition = i;
    final int drawableResource = getResources().getIdentifier("diamond"
+ i, "drawable", getPackageName());

    ImageButton cardButton =
findViewById(getResources().getIdentifier("diamond" + i, "id",
getPackageName()));
    cardButton.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {
            if (countCard < 4) {
                countCard++;
                switch (countCard) {
                    case 1:
                        position1 = cardPosition;

cardSelect1.setImageResource(drawableResource);

                        break;
                    case 2:
                        position2 = cardPosition;

cardSelect2.setImageResource(drawableResource);

                        break;
                    case 3:
                        position3 = cardPosition;
```

```
cardSelect3.setImageResource(drawableResource);
                break;
            case 4:
                position4 = cardPosition;

cardSelect4.setImageResource(drawableResource);
                break;
        }
    }
}

});
}

for (int i = 1; i <= 13; i++) {
    final int cardPosition = i;
    final int drawableResource = getResources().getIdentifier("heart" +
i, "drawable", getPackageName());

    ImageButton cardButton =
findViewById(getResources().getIdentifier("heart" + i, "id", getPackageName()));
    cardButton.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {
            if (countCard < 4) {
                countCard++;
                switch (countCard) {
                    case 1:
                        position1 = cardPosition;

cardSelect1.setImageResource(drawableResource);
                            break;
                    case 2:
                        position2 = cardPosition;

cardSelect2.setImageResource(drawableResource);
                            break;
                    case 3:
                        position3 = cardPosition;

cardSelect3.setImageResource(drawableResource);
                            break;
                    case 4:
                        position4 = cardPosition;
```

```
cardSelect4.setImageResource(drawableResource);
                break;
            }
        }
    }
});
}

for (int i = 1; i <= 13; i++) {
    final int cardPosition = i;
    final int drawableResource = getResources().getIdentifier("spade" +
i, "drawable", getPackageName());

    ImageButton cardButton =
findViewById(getResources().getIdentifier("spade" + i, "id", getPackageName()));
    cardButton.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {
            if (countCard < 4) {
                countCard++;
                switch (countCard) {
                    case 1:
                        position1 = cardPosition;

cardSelect1.setImageResource(drawableResource);
                            break;
                        case 2:
                            position2 = cardPosition;

cardSelect2.setImageResource(drawableResource);
                            break;
                        case 3:
                            position3 = cardPosition;

cardSelect3.setImageResource(drawableResource);
                            break;
                        case 4:
                            position4 = cardPosition;

cardSelect4.setImageResource(drawableResource);
                            break;
                    }
                }
            }
        }
    });
}
```

```
    });  
}  
  
// 绑定重试事件  
ImageButton retry = findViewById(R.id.retry);  
retry.setOnClickListener(new View.OnClickListener() {  
    @Override  
    public void onClick(View view) {  
        countCard = 0;        // 已选择卡牌数量归零  
        // 四个位置的图片还原  
        cardSelect1.setImageResource(R.drawable.cardselect);  
        cardSelect2.setImageResource(R.drawable.cardselect);  
        cardSelect3.setImageResource(R.drawable.cardselect);  
        cardSelect4.setImageResource(R.drawable.cardselect);  
    }  
});  
  
// 绑定成功事件  
ImageButton success = findViewById(R.id.success);  
success.setOnClickListener(new View.OnClickListener() {  
    @Override  
    public void onClick(View view) {  
        if (countCard == 4) {  
            calculate24 cal = new calculate24();  
            int nums[] = {position1, position2, position3, position4};  
            List<String> res = cal.find24Expressions(nums);  
            if(res.isEmpty()){  
                result = new StringBuilder(R.string.fail_tip);  
            }else{  
                int cnt = res.size();  
                for(int i = 0; i<cnt; i++){  
                    result.append(i+1).append("、  
").append(res.get(i)).append("\n");  
                }  
                result.append("一共有 "+cnt+" 种方法计算 24 点。");  
            }  
            showAlertDialog();  
            result = new StringBuilder();  
        } else {  
            Toast.makeText(game.this, R.string.success_tip,  
Toast.LENGTH_SHORT).show();  
        }  
    }  
});
```

```
    }  
}  
  
-MainActivity.java  
package com.example.myapplication;  
  
import androidx.appcompat.app.AppCompatActivity;  
  
import android.content.Intent;  
import android.os.Bundle;  
import android.view.View;  
import android.widget.Button;  
  
public class MainActivity extends AppCompatActivity {  
  
    private Button StartButton;    // 定义首页中开始游戏按钮  
  
    @Override  
    protected void onCreate(Bundle savedInstanceState) {  
        super.onCreate(savedInstanceState);  
        setContentView(R.layout.activity_main);  
  
        StartButton = findViewById(R.id.startButton);    // 绑定界面中开始游戏按钮  
        StartButton.setOnClickListener(new View.OnClickListener() {    // 为开始按钮绑定点击事件  
            @Override  
            public void onClick(View view) {  
                // 跳转到游戏界面  
                Intent intent = new Intent(MainActivity.this, game.class);  
                startActivity(intent);  
            }  
        });  
  
    }  
}  
  
-activity_game.xml  
<?xml version="1.0" encoding="utf-8"?>  
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"  
    android:layout_width="match_parent"  
    android:layout_height="match_parent"
```

```
android:background="@drawable/back"
android:padding="15dp">

<ImageButton
    android:id="@+id/club1"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club1" />

<ImageButton
    android:id="@+id/club2"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club1"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club2" />

<ImageButton
    android:id="@+id/club3"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club2"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club3" />

<ImageButton
    android:id="@+id/club4"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club3"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club4" />

<ImageButton
    android:id="@+id/club5"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club4"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
```

```
        android:src="@drawable/club5" />

<ImageButton
    android:id="@+id/club6"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club5"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club6" />

<ImageButton
    android:id="@+id/club7"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club6"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club7" />

<ImageButton
    android:id="@+id/club8"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club7"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club8" />

<ImageButton
    android:id="@+id/club9"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club8"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club9" />

<ImageButton
    android:id="@+id/club10"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club9"
    android:layout_marginEnd="-104sp"
```

```
        android:scaleType="centerCrop"
        android:src="@drawable/club10" />
```

```
<ImageButton
    android:id="@+id/club11"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club10"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club11" />
```

```
<ImageButton
    android:id="@+id/club12"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club11"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club12" />
```

```
<ImageButton
    android:id="@+id/club13"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/club12"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/club13" />
```

```
<ImageButton
    android:id="@+id/diamond1"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/club1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/diamond1" />
```

```
<ImageButton
    android:id="@+id/diamond2"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_marginEnd="-104dp"
```



```
android:layout_toStartOf="@id/diamond1"  
android:scaleType="centerCrop"  
android:layout_below="@id/club1"  
android:layout_marginTop="5dp"  
android:src="@drawable/diamond2" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond3"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond2"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond3" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond4"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond3"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond4" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond5"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond4"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond5" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond6"  
    android:layout_width="80sp"
```

```
android:layout_height="110sp"
android:layout_toStartOf="@id/diamond5"
android:layout_marginEnd="-104sp"
android:scaleType="centerCrop"
android:src="@drawable/diamond6" />
```

```
<ImageButton
    android:layout_below="@id/club1"
    android:layout_marginTop="5dp"
    android:id="@+id/diamond7"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond6"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/diamond7" />
```

```
<ImageButton
    android:layout_below="@id/club1"
    android:layout_marginTop="5dp"
    android:id="@+id/diamond8"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond7"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/diamond8" />
```

```
<ImageButton
    android:layout_below="@id/club1"
    android:layout_marginTop="5dp"
    android:id="@+id/diamond9"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond8"
    android:layout_marginEnd="-104sp"
    android:scaleType="centerCrop"
    android:src="@drawable/diamond9" />
```

```
<ImageButton
    android:layout_below="@id/club1"
    android:layout_marginTop="5dp"
    android:id="@+id/diamond10"
    android:layout_width="80sp"
```

```
android:layout_height="110sp"  
android:layout_toStartOf="@id/diamond9"  
android:layout_marginEnd="-104sp"  
android:scaleType="centerCrop"  
android:src="@drawable/diamond10" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond11"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond10"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond11" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond12"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond11"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond12" />
```

```
<ImageButton  
    android:layout_below="@id/club1"  
    android:layout_marginTop="5dp"  
    android:id="@+id/diamond13"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond12"  
    android:layout_marginEnd="-104sp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/diamond13" />
```

```
<ImageButton  
    android:id="@+id/spade1"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_below="@id/diamond1"
```

```
android:layout_marginTop="5dp"
android:scaleType="centerCrop"
android:src="@drawable/spade1" />
```

```
<ImageButton
    android:id="@+id/spade2"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond1"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade2" />
```

```
<ImageButton
    android:id="@+id/spade3"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond2"
    android:layout_marginEnd="-104sp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade3" />
```

```
<ImageButton
    android:id="@+id/spade4"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond3"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade4" />
```

```
<ImageButton
    android:id="@+id/spade5"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond4"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
```

```
android:layout_marginTop="5dp"
android:scaleType="centerCrop"
android:src="@drawable/spade5" />
```

```
<ImageButton
    android:id="@+id/spade6"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond5"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade6" />
```

```
<ImageButton
    android:id="@+id/spade7"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond6"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade7" />
```

```
<ImageButton
    android:id="@+id/spade8"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond7"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/spade8" />
```

```
<ImageButton
    android:id="@+id/spade9"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/diamond8"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/diamond1"
```

```
android:layout_marginTop="5dp"  
android:scaleType="centerCrop"  
android:src="@drawable/spade9" />
```

```
<ImageButton  
    android:id="@+id/spade10"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond9"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/diamond1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/spade10" />
```

```
<ImageButton  
    android:id="@+id/spade11"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond10"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/diamond1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/spade11" />
```

```
<ImageButton  
    android:id="@+id/spade12"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond11"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/diamond1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/spade12" />
```

```
<ImageButton  
    android:id="@+id/spade13"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/diamond12"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/diamond1"
```

```
        android:layout_marginTop="5dp"
        android:scaleType="centerCrop"
        android:src="@drawable/spade13" />

<ImageButton
    android:id="@+id/heart1"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart1" />

<ImageButton
    android:id="@+id/heart2"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart1"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart2" />

<ImageButton
    android:id="@+id/heart3"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart2"
    android:layout_marginEnd="-104sp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart3" />

<ImageButton
    android:id="@+id/heart4"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart3"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
```

```
android:src="@drawable/heart4" />
```

```
<ImageButton
```

```
    android:id="@+id/heart5"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart4"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart5" />
```

```
<ImageButton
```

```
    android:id="@+id/heart6"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart5"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart6" />
```

```
<ImageButton
```

```
    android:id="@+id/heart7"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart6"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart7" />
```

```
<ImageButton
```

```
    android:id="@+id/heart8"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart7"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spade1"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
```



```
android:src="@drawable/heart8" />
```

```
<ImageButton
```

```
    android:id="@+id/heart9"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/heart8"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/spade1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/heart9" />
```

```
<ImageButton
```

```
    android:id="@+id/heart10"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/heart9"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/spade1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/heart10" />
```

```
<ImageButton
```

```
    android:id="@+id/heart11"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/heart10"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/spade1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"  
    android:src="@drawable/heart11" />
```

```
<ImageButton
```

```
    android:id="@+id/heart12"  
    android:layout_width="80sp"  
    android:layout_height="110sp"  
    android:layout_toStartOf="@id/heart11"  
    android:layout_marginEnd="-104dp"  
    android:layout_below="@id/spade1"  
    android:layout_marginTop="5dp"  
    android:scaleType="centerCrop"
```

```
        android:src="@drawable/heart12" />

<ImageButton
    android:id="@+id/heart13"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_toStartOf="@id/heart12"
    android:layout_marginEnd="-104dp"
    android:layout_below="@id/spadel"
    android:layout_marginTop="5dp"
    android:scaleType="centerCrop"
    android:src="@drawable/heart13" />

<ImageButton
    android:id="@+id/cardselect1"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/heart1"
    android:layout_marginTop="15dp"
    android:scaleType="centerCrop"
    android:background="@android:color/transparent"
    android:src="@drawable/cardselect" />

<ImageButton
    android:id="@+id/cardselect2"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/heart1"
    android:layout_marginStart="15dp"
    android:layout_marginTop="15dp"
    android:layout_toEndOf="@id/cardselect1"
    android:background="@android:color/transparent"
    android:scaleType="centerCrop"
    android:src="@drawable/cardselect" />

<ImageButton
    android:id="@+id/cardselect3"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/heart1"
    android:layout_marginStart="15dp"
    android:layout_marginTop="15dp"
    android:layout_toEndOf="@id/cardselect2"
    android:background="@android:color/transparent"
```

```
        android:scaleType="centerCrop"
        android:src="@drawable/cardselect" />

<ImageButton
    android:id="@+id/cardselect4"
    android:layout_width="80sp"
    android:layout_height="110sp"
    android:layout_below="@id/heart1"
    android:layout_marginStart="15dp"
    android:layout_marginTop="15dp"
    android:layout_toEndOf="@id/cardselect3"
    android:background="@android:color/transparent"
    android:scaleType="centerCrop"
    android:src="@drawable/cardselect" />

<ImageButton
    android:id="@+id/retry"
    android:layout_width="40sp"
    android:layout_height="40sp"
    android:layout_below="@id/cardselect1"
    android:layout_marginTop="32dp"
    android:background="@android:color/transparent"
    android:scaleType="centerCrop"
    android:layout_marginStart="240dp"
    android:src="@drawable/retry" />

<ImageButton
    android:id="@+id/success"
    android:layout_width="40sp"
    android:layout_height="40sp"
    android:layout_below="@id/cardselect1"
    android:layout_marginStart="40dp"
    android:layout_marginTop="32dp"
    android:layout_toEndOf="@id/retry"
    android:background="@android:color/transparent"
    android:scaleType="centerCrop"
    android:src="@drawable/success" />

</RelativeLayout>

-activity_main.xml
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout 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="@drawable/points"  
android:padding="16dp"  
tools:context=".MainActivity">
```

```
<Button
```

```
    android:id="@+id/startButton"  
    android:background="@drawable/button_drawable"  
    android:layout_width="130sp"  
    android:layout_height="wrap_content"  
    android:layout_centerHorizontal="true"  
    android:layout_marginTop="589dp"  
    android:text="@string/startButton"  
    android:textColor="@android:color/white"  
    android:textSize="24sp" />
```

```
</RelativeLayout>
```

## 7. 程序运行截图





#### 四、实验结果及分析和（或）源程序调试过程（界面截图和文字）、实验总结与体会

##### 1. 实验结果分析

本次实验完成了 24 点卡牌游戏的运行过程，达到了预期的实验目标。

##### 2. 实验总结与体会

通过开发扑克牌计算 24 点的 Android 应用，学习了 Android Studio 开发的基本原理和应用程序的生命周期。进程创建时，系统会自动为其创建一个 Activity，并调用 onCreate() 方法，用于初始化操作，例如加载 XML 资源文件、创建布局、设置监听器等。onCreate() 在每个进程创建时都会执行。我还学习了 Android 中的基本组件，如 id，它在 XML 文件中是唯一标识符，用于寻找和绑定控件；layout\_width 和 layout\_height，用于设置视图的宽度和高度等等。我掌握了 Android 中不同的布局方式，包括 FrameLayout（帧布局）、LinearLayout（线性布局）、AbsoluteLayout（绝对布局）、RelativeLayout（相对布局）等等。这些布局方式可以以不同的方式排列和定位视图元素。

同时，还继续深入学习了 java 程序设计的编程技术，学习了通过穷举和回溯算法对给定的 4 个数计算 24 点的方法。并完成了前后端之间的交互，实现了通过 java 后端来修改前端界面的元素属性。同时也实现了通过 java 对界面中控件绑定点击等事件，从而实现页面跳转和图片资源的转换。

总之，通过这次实验，我基本掌握了 android studio 的基础开发模式，深入了解了应用程序的生命周期、布局、组件以及了 java 编程技巧。

实验报告填写说明：

- 1、第一、二部分由老师提供；
- 2、第三部分填写源程序或者算法，清单文件，资源文件等。源程序要符合程序编写风格（缩进、注释等）；
- 3、第四部分主要填写程序调试运行过程、结果（截图）、解决问题的方法、总结和体会等；
- 4、报告规范：包含报告页眉、报告的排版、内容是否填写，命名是否规范等。