

7611ICT Computer Systems and Network

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1.0 Circuit Function

1.1 Part A – Rock vs Scissors vs Paper

The following circuit diagram shows either win/lose or ties. The first two sub-circuits that are connected to S1, S2, S3 and S4 represent the inputs for Player P and Player Q. Once Player P has chosen 'Rock' ($S1 = 0$, $S2 = 0$) and Player Q has chosen 'Scissors' ($S3 = 0$, $S4 = 1$), the selector would determine Player P to win and then LED that is connected to the corresponding would light on to represent Player P wins the game. When Player P and Player Q have the same signal, there would have no one to win or lose the game, and the middle LED would light on.

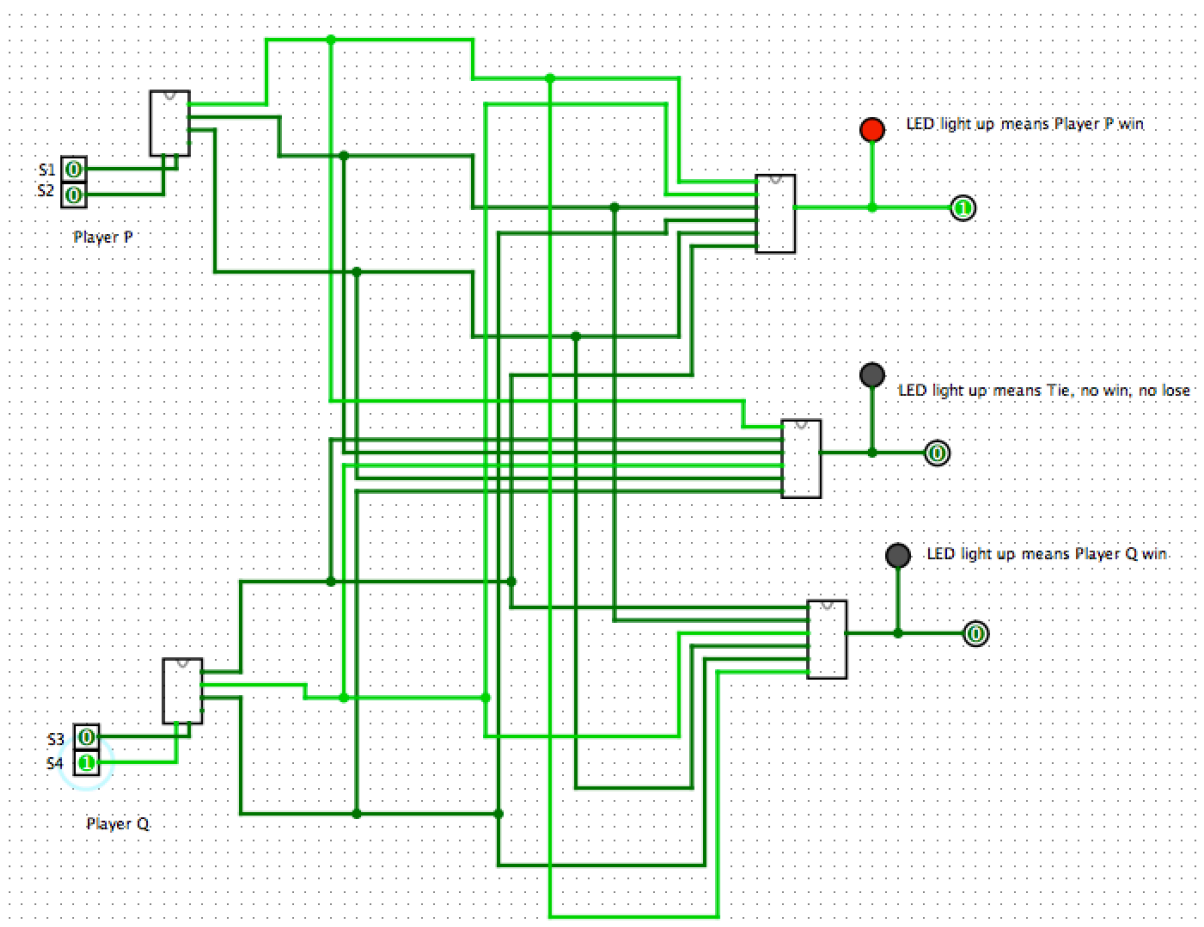


Figure 1 Part A Circuit overview

1.2 Part B – Counter and Comparator

The following circuit is to decide at least how many games are needed to win the game. When one of the players win a game, the corresponding counter would have increment by 1. When a player wins 4 games in total, the corresponding LED would light on.

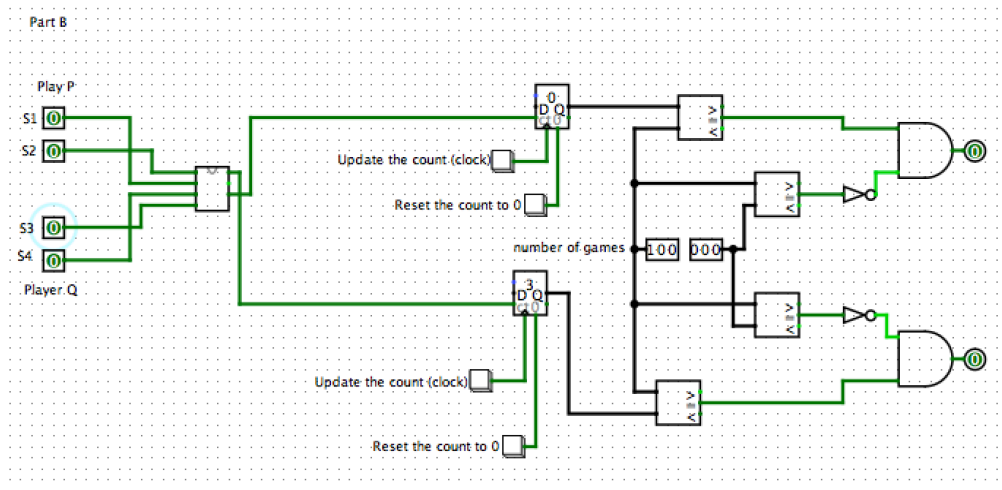


Figure 2 Part B Circuit Overview – Tie State: Rock versus Rock – no win

Figure 3 shows the ultimate Player – Player Q. When Player P won 4 games, the LED lights on. To enhance accuracy, two three-bit pins (000) to has been added to make the number of games is equal to four to win the game.

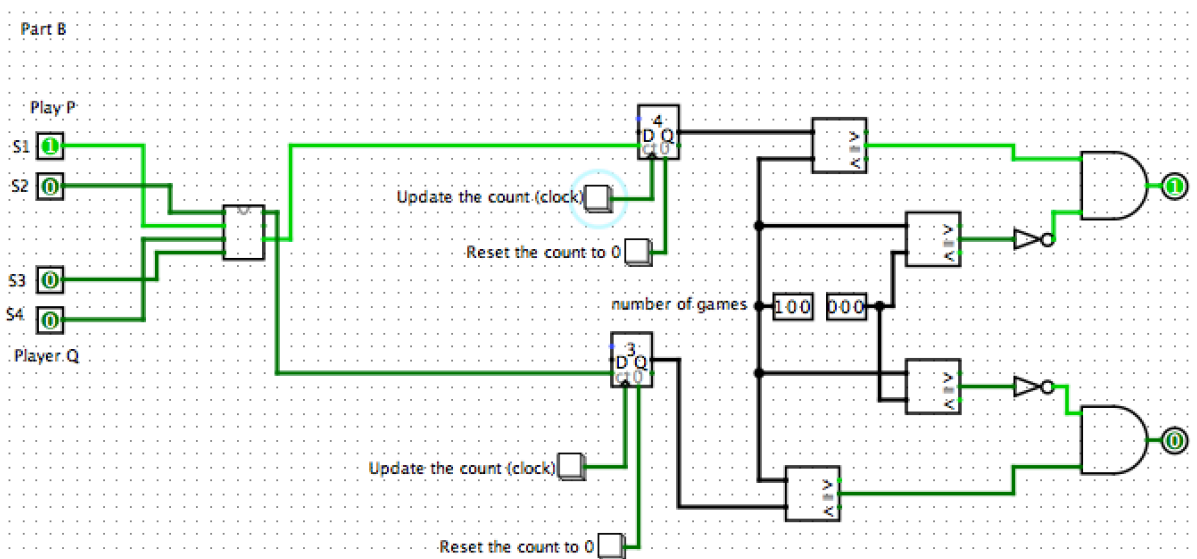


Figure 3 Part B Circuit - Player P won

1.3 Templates/Sub-circuits

1.3.1 Decoder

The following two-to-four decoder diagram shows the representation of Rock, Scissors and Paper. When the designated inputs are entered, it will show the corresponding signal. For example, according to the Table 1, when S1/S3 is '1' and S2/S4 is '0', line of 'Paper' is selected, representing 'Paper'. In the part A, there would have two decoders as shown in the following whereas one represents Player P but the other one represents Player Q.

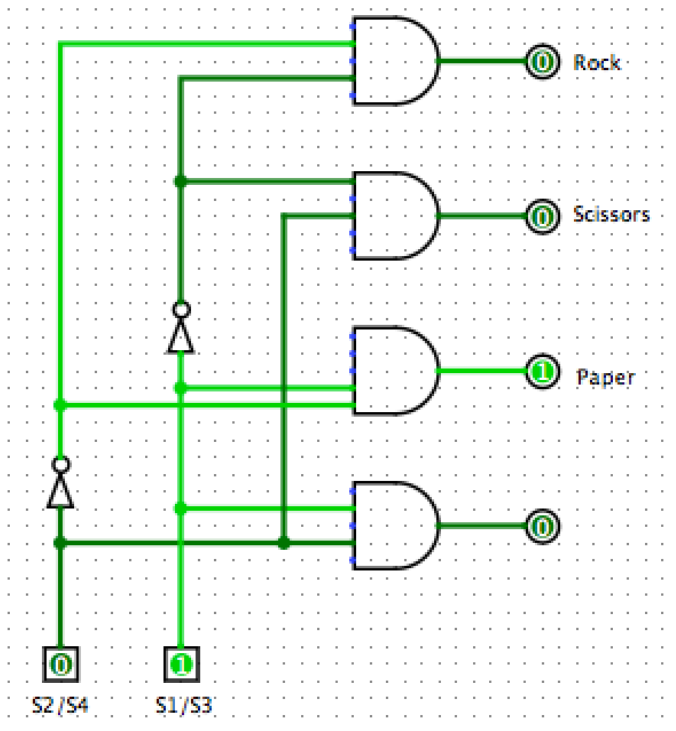


Figure 4 Decoder for the Players

1.3.2 Selector & Ties

In this sub-circuit, there would conduct comparison between all combination and the output in regard to win or lose. There would be two sub-circuits as shown below to decide who win or lose the game. In other words, there would be six combinations for comparison for win/lose for Player P and Play Q: Rock vs Scissors, Scissors vs Paper, Paper vs Rock etc. AND gate is used because it requires a combination is selected. The ultimate result would show the win side. It also the sub-circuit for ties, which means when Rock vs Rock, there would be no win and no lose.

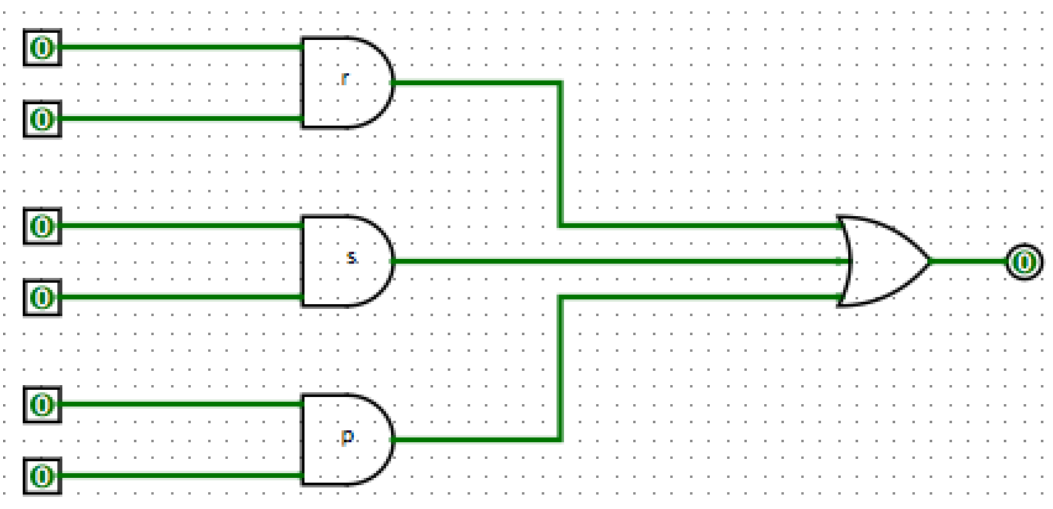


Figure 5 Selector/Ties Selector

2.0 Truth Table

Below table illustrates the inputs for Player P (S1, S2) and Player Q (S3, S4).

| Hand sign | S1/S3 | S2/S4 |
|---------------|-------|-------|
| Rock | 0 | 0 |
| Scissors | 0 | 1 |
| Paper | 1 | 0 |
| Initial state | 1 | 1 |

Table 1 Signal Representation

Table 2 is the outcome of all possible inputs including ties (Rock vs Rock, Scissors vs Scissors, Paper vs Paper).

| Player P | | Player Q | | Win(1)/Lose(0) | |
|----------|----|----------|----|----------------|----------|
| S1 | S2 | S3 | S4 | Player P | Player Q |
| 0 | 0 | 0 | 0 | T | T |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| | | | | | |
| 0 | 1 | 0 | 1 | T | T |
| 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| | | | | | |
| 1 | 0 | 1 | 0 | T | T |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 |
| | | | | | |
| 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 |
| | | | | | |
| 0 | 0 | 0 | 1 | 1 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 |
| | | | | | |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 |

Table 2 Player P vs Player Q - Who win?

3.0 Additional Requirement – Rock vs Scissors vs Paper vs Fire vs Water

There are two extra addition hand signals: fire and water. In this case, a two-to-four decoder would not be able to be suitable, but a three-to-eight decoder is required because combinations would be greater than six. Thus, decoder has to be changed. In the selector part, additional comparisons between Fire and three basic hand signs, and comparisons between water and three basic hand signs, and comparisons between fire and water is needed to be added.