

**DIGITAL SYSTEMS**

**PRACTICUM 8**



**By :**

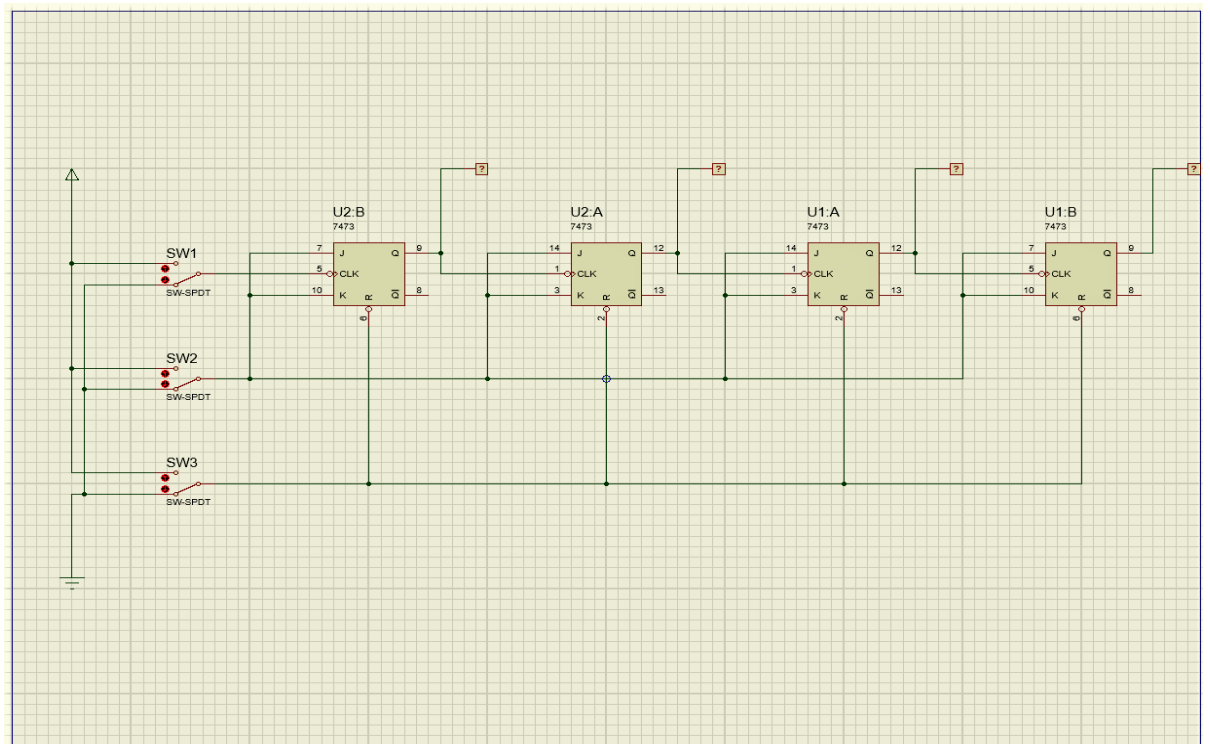
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## Task 1



Picture 1.1. JK flip-flop combination

### 1. Simulation table

|    | INPUT |    |     | OUTPUT |   |   |   |
|----|-------|----|-----|--------|---|---|---|
|    | CLEAR | JK | CLK | A      | B | C | D |
| 1  | 1     | 1  | 0   | 0      | 0 | 0 | 0 |
| 2  | 1     | 1  | 1   | 0      | 0 | 0 | 0 |
| 3  | 1     | 1  | 0   | 0      | 0 | 0 | 1 |
| 4  | 1     | 1  | 1   | 0      | 0 | 0 | 1 |
| 5  | 1     | 1  | 0   | 0      | 0 | 1 | 0 |
| 6  | 1     | 1  | 1   | 0      | 0 | 1 | 0 |
| 7  | 1     | 1  | 0   | 0      | 0 | 1 | 1 |
| 8  | 1     | 1  | 1   | 0      | 0 | 1 | 1 |
| 9  | 1     | 1  | 0   | 0      | 1 | 0 | 0 |
| 10 | 1     | 1  | 1   | 0      | 1 | 0 | 0 |
| 11 | 1     | 1  | 0   | 0      | 1 | 0 | 1 |
| 12 | 1     | 1  | 1   | 0      | 1 | 0 | 1 |
| 13 | 1     | 1  | 0   | 0      | 1 | 1 | 0 |
| 14 | 1     | 1  | 1   | 0      | 1 | 1 | 0 |
| 15 | 1     | 0  | 0   | 0      | 1 | 1 | 0 |
| 16 | 1     | 0  | 1   | 0      | 1 | 1 | 0 |

|           |   |   |   |   |   |   |   |
|-----------|---|---|---|---|---|---|---|
| <b>17</b> | 1 | 1 | 0 | 0 | 1 | 1 | 1 |
| <b>18</b> | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| <b>19</b> | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| <b>20</b> | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

2. What is the function of

a. Switch CLK:

Answer: Functions to continue to the next binary number at the output.

b. Switch JK:

Answer: Functions as an increase in binary numbers if the value is 1, if the JK input is 0 then the output of the binary number is not forwarded or remains the last output.

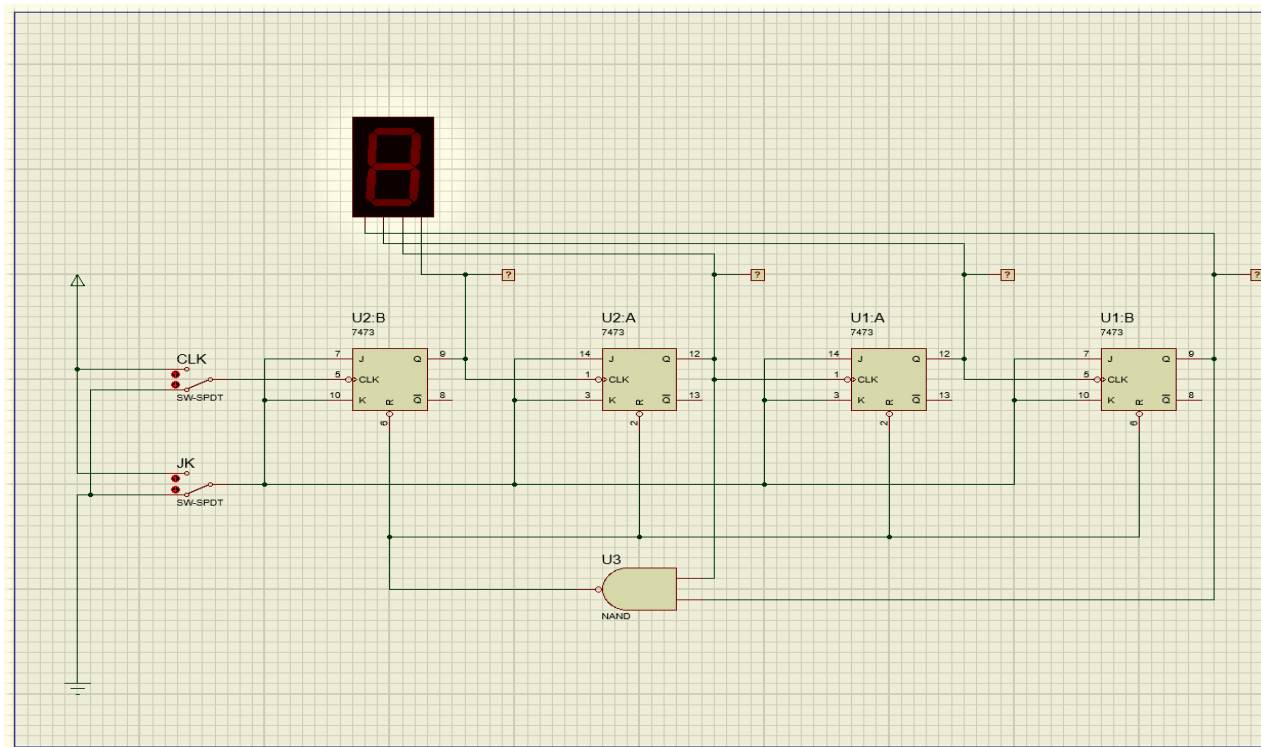
c. Switch CLEAR:

Answer: Functions to display the binary number output, if the CLEAR input is 0 then all the output results are 0

3. Conclusion

If the CLEAR input is 0 then all the output results are 0, if the JK input is 0 then the output of the binary number is not forwarded or remains the last output.

## Task 2



Picture 2.1. JK flip-flop combination

### 1. Simulation table

|    | INPUT |     | OUTPUT |   |   |   |
|----|-------|-----|--------|---|---|---|
|    | JK    | CLK | A      | B | C | D |
| 1  | 1     | 0   | 0      | 0 | 0 | 0 |
| 2  | 1     | 1   | 0      | 0 | 0 | 0 |
| 3  | 1     | 0   | 0      | 0 | 0 | 1 |
| 4  | 1     | 1   | 0      | 0 | 0 | 1 |
| 5  | 1     | 0   | 0      | 0 | 1 | 0 |
| 6  | 1     | 1   | 0      | 0 | 1 | 0 |
| 7  | 1     | 0   | 0      | 0 | 1 | 1 |
| 8  | 1     | 1   | 0      | 0 | 1 | 1 |
| 9  | 1     | 0   | 0      | 1 | 0 | 0 |
| 10 | 1     | 1   | 0      | 1 | 0 | 0 |
| 11 | 1     | 0   | 0      | 1 | 0 | 1 |
| 12 | 1     | 1   | 0      | 1 | 0 | 1 |
| 13 | 1     | 0   | 0      | 1 | 1 | 0 |
| 14 | 1     | 1   | 0      | 1 | 1 | 0 |
| 15 | 1     | 0   | 0      | 1 | 1 | 1 |
| 16 | 1     | 1   | 0      | 1 | 1 | 1 |
| 17 | 1     | 0   | 1      | 0 | 0 | 0 |

|           |   |   |   |   |   |   |
|-----------|---|---|---|---|---|---|
| <b>18</b> | 1 | 1 | 1 | 0 | 0 | 0 |
| <b>19</b> | 1 | 0 | 1 | 0 | 0 | 1 |
| <b>20</b> | 1 | 1 | 1 | 0 | 0 | 1 |
| <b>21</b> | 0 | 0 | 1 | 0 | 0 | 1 |
| <b>22</b> | 0 | 1 | 1 | 0 | 0 | 1 |
| <b>23</b> | 1 | 0 | 0 | 0 | 0 | 0 |
| <b>24</b> | 1 | 1 | 0 | 0 | 0 | 0 |

## 2. Conclusion

Functions of CLK switch is to continue to the next binary number at the output. Functions of JK switch is as an increase in binary numbers if the value is 1, if the JK input is 0 then the output of the binary number is not forwarded or remains the last output.

The diagram illustrates a 4-bit shift register implemented with four 7473 JK flip-flops (U1A, U1B, U2A, U2B) and a NOT gate (U4). The circuit is configured as follows:

- Inputs:** Three switches (JK, CLK, CLEAR) are connected to SW-SPDT inputs. The JK switch is connected to the J input of U4 (NOT gate). The CLK switch is connected to the CLK input of all four flip-flops. The CLEAR switch is connected to the CLEAR input of all four flip-flops.
- Logic:** The output of the first flip-flop (U1A) is connected to the J input of the second flip-flop (U1B). The output of the second flip-flop (U1B) is connected to the J input of the third flip-flop (U2A). The output of the third flip-flop (U2A) is connected to the J input of the fourth flip-flop (U2B). The output of the fourth flip-flop (U2B) is connected to the J input of the first flip-flop (U1A), forming a closed loop.
- Outputs:** The Q outputs of the four flip-flops are labeled 1, 2, 3, and 4, representing the 4-bit shift register output.

## 1. Simulation table

|    | INPUT |    |     | OUTPUT |   |   |   |
|----|-------|----|-----|--------|---|---|---|
|    | CLEAR | JK | CLK | A      | B | C | D |
| 1  | 0     | X  | -   | 0      | 0 | 0 | 0 |
| 2  | 1     | 1  | -   | 0      | 0 | 0 | 0 |
| 3  | 1     | 1  | 1   | 0      | 0 | 0 | 0 |
| 4  | 1     | 1  | 2   | 0      | 0 | 0 | 1 |
| 5  | 1     | 1  | 3   | 0      | 1 | 1 | 1 |
| 6  | 1     | 0  | 4   | 0      | 1 | 1 | 1 |
| 7  | 1     | 0  | 5   | 1      | 1 | 1 | 0 |
| 8  | 1     | 0  | 6   | 1      | 0 | 0 | 0 |
| 9  | 1     | 0  | 7   | 1      | 0 | 0 | 0 |
| 10 | 1     | 0  | 8   | 0      | 0 | 0 | 0 |
| 11 | 1     | 1  | 9   | 0      | 0 | 0 | 1 |
| 12 | 1     | 0  | 10  | 0      | 0 | 1 | 1 |
| 13 | 1     | 0  | 11  | 0      | 1 | 1 | 0 |
| 14 | 1     | 0  | 12  | 1      | 1 | 0 | 0 |
| 15 | 1     | 0  | 13  | 1      | 0 | 0 | 0 |

If the CLK switch is not connected then all output results will produce 0. If the input value of JK 0 then the output will move to

the output part that is located in front of it and the last output part changes to 0 until all output results are 0.