## PART: A

In this experiment we will study flip-flops. Like latches, Flip flops have memory and constitute an important element of a sequential circuit. Flip-flops have clock input which makes them synchronous. They are edge-triggered devices as the output of a flip-flop can only change at the positive or negative edge of the clock.

SR flip-flop has an invalid state which can be eliminated by JK flip flop. JK flip flops can be implemented from SR Flip flop using a feedback path.

J-K FLIP-FLOP

Steps to be followed: -

1. Use dual JK flip-flop IC (74HC73) in tinker cad. Give input switches for J, K and Reset. Use a function generator from tinker cad to give the clock input of frequency of 1 Hz, amplitude 5V and DC offset 2.5 V.
2. Observe and tabulate the sequence of Q and Q` in response of the following input sequence J K = 01, 00, 10, 00, 01, 11, 10, 11, 01
3. Verify the operation and write the observed results for the given sequence.
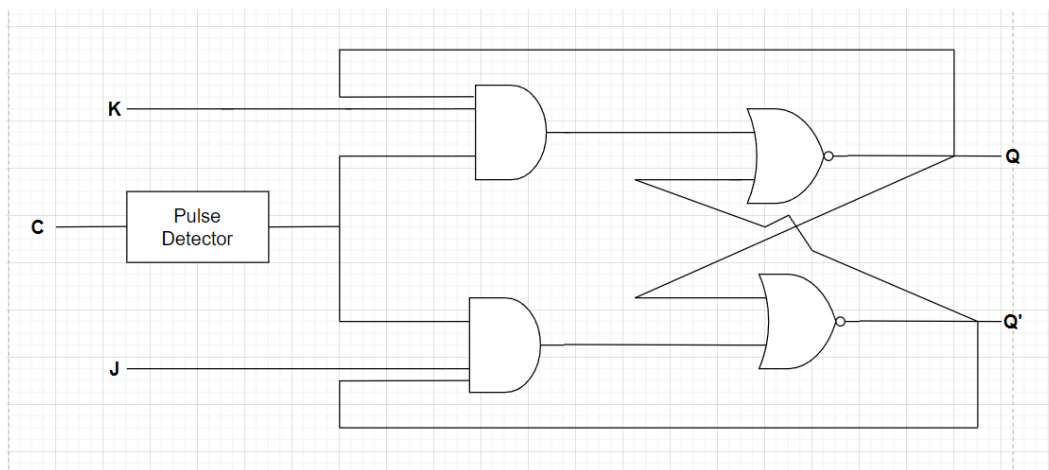
TRUTH TABLE

(Reset)'	C	J	K	Q	Q'
0	x	x	x	0	1
1	↑	0	0	Hold	Hold
1	↑	0	1	0	1
1	↑	1	0	1	0
1	↑	1	1	Toggle	Toggle
1	x	0	0	Latch	Latch
1	x	0	1	Latch	Latch
1	x	1	0	Latch	Latch
1	x	1	1	Latch	Latch

IC Symbol

PART: B

D FLIP-FLOP

D flip-flops are very commonly used flip flops. They can be implemented using an SR flip flop by connecting the S and R inputs to D and D' respectively. At every positive clock edge (or negative clock edge) they transmit the data input from the D pin to the Q output pin.
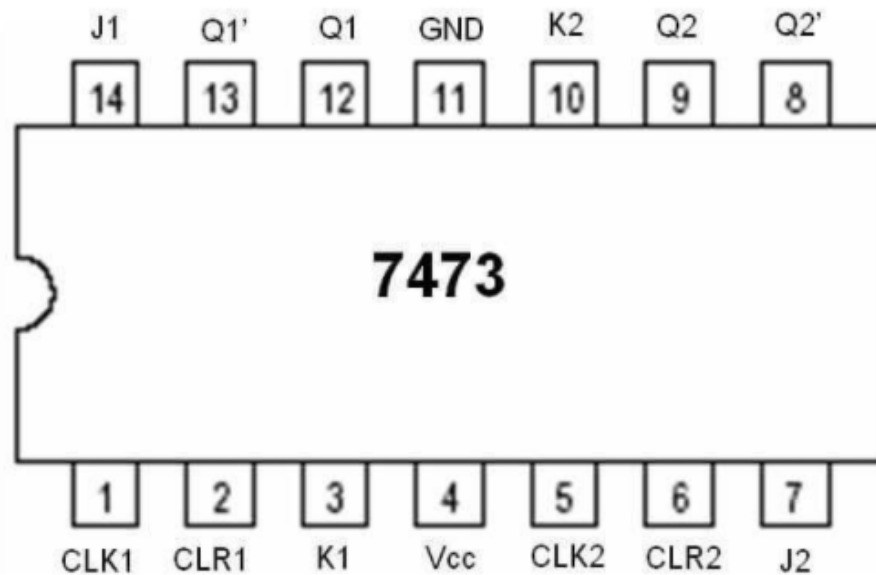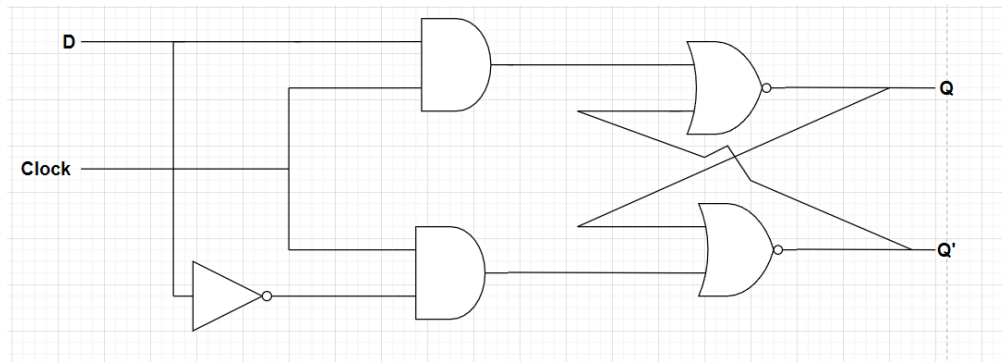
Steps to follow:-

1. Use dual D flip-flop IC (74HC74) in tinker cad. Give input switches for D, Set and Reset. Use a function generator from tinker cad to give the clock input of frequency 1 Hz, amplitude 5V and DC offset 2.5 V.
2. Observe and tabulate the values of Q and Q` in response to various combinations of Set', Reset and D
3. Verify the operation and write the observed results.

TRUTH TABLE

(SET)'	(RESET)'	D	CK	Q	Q'
0	1	-	-	1	0
1	0	-	-	0	1
0	0	-	-	1	1
1	1	1	⊓	1	0
1	1	0	⊓	0	1

IC Symbol

```
          ___
       1CLR ⌷ 1      14 ⌷ V_CC
         1D ⌷ 2      13 ⌷ 2CLR
       1CLK ⌷ 3      12 ⌷ 2D
       ___
       1PRE ⌷ 4      11 ⌷ 2CLK
                          ___
         1Q ⌷ 5      10 ⌷ 2PRE
         __
         1Q ⌷ 6       9 ⌷ 2Q
                          __
        GND ⌷ 7       8 ⌷ 2Q
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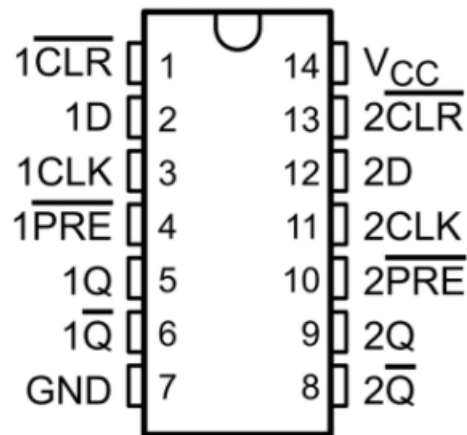
Deliverables

1) Tinker-Cad Link
2) Screenshot of the Tinker-Cad Circuit
3) Pin Diagram
4) Characteristic equation (K-map also)
5) Observations and justifications
6) Applications (at least two)

Note: - Set/Reset pins available in the flip-flops (f/f) are separate pins other than inputs, these are available to Set/Reset the f/f directly irrespective of the input states and clock. These pins can be of active low or high types. For example, if these pins are of active low type then we generally keep Set/Reset pins at logic High in order for the f/f to work normally. One of the popular applications of these pins can easily be seen in counter designs. One can decode this key information from the datasheet of the IC, provided or uploaded by the manufacturer.