UTM UNIVERSITI TEKNOLOGI MALAYSIA
Sekolah Pendidikan Profesional dan Pendidikan Berterusan (SPACE)

JABATAN KEJURUTERAAN ELEKTRIK
PUSAT PENGAJIAN DIPLOMA (PPD), SPACE
UNIVERSITI TEKNOLOGI MALAYSIA
KUALA LUMPUR

DIGITAL ELECTRONICS LABORATORY

EXPERIMENT 3

EDGE TRIGGERED J-K FLIP-FLOP (IC 7476), COUNTERS & SERIAL LOAD SHIFT REGISTER

EXPERIMENT 1 : EDGE TRIGGERED J-K FLIP-FLOP (IC 7476)

OBJECTIVES:

1. To investigate the operation of edge-triggered J-K flip-flop.

MATERIALS & EQUIPMENTS:

1. Digital Lab Trainer
2. IC 7476
3. Required data sheets

EXPERIMENT PROCEDURES

Part A : Edge-triggered J-K flip flops (IC 7476)

1. Install 7476 IC on the circuit board and make the connections as shown in Figure 5.
2. Refer to Table 5(a).
   i. Initially-set-the-direct inputs of **CLR to logic HIGH** and **PRE to logic LOW**. Record the output result of Q and Q' at entry no. 0.
   ii. Then, set both direct inputs of CLR and PRE to logic HIGH. Observe the operation of the flip-flop by properly completing Table 5(a) from entry no.1.
3. Refer to Table 5(b). Set both direct inputs of CLR and PRE as specified in the table. Observe the operation of the flip-flop by completing Table 5(b).

Note: When recording the result at every entry make sure that the particular logic level of data inputs J and K are settled first before setting the pulse at the clock input (CP).

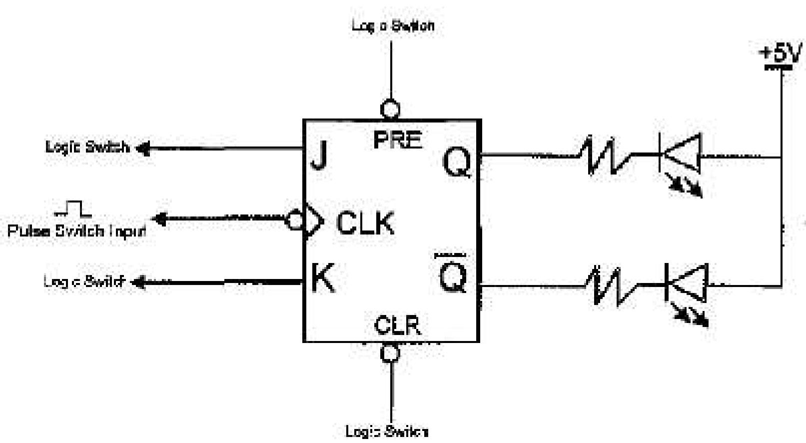

Figure 5

EXPERIMENT 2 : ASYNCHRONOUS BINARY UP COUNTER AND 7493 BINARY COUNTER

OBJECTIVES:

1. To construct and operate a counter that counts from 0-15 using 7476 IC.
2. To construct and operate a counter that counts from 0-15 using 7493 IC.

MATERIALS & EQUIPMENTS:

1. Digital Lab Trainer
2. IC 7476 & 7493
3. Required data sheets

EXPERIMENT PROCEDURES

Part A : Asynchronous Binary Up Counter

Assemble circuit as shown in Figure 1 using two (2) 7476 IC. Follow the instructions carefully and answer the questions accordingly. No need to do the experiment.

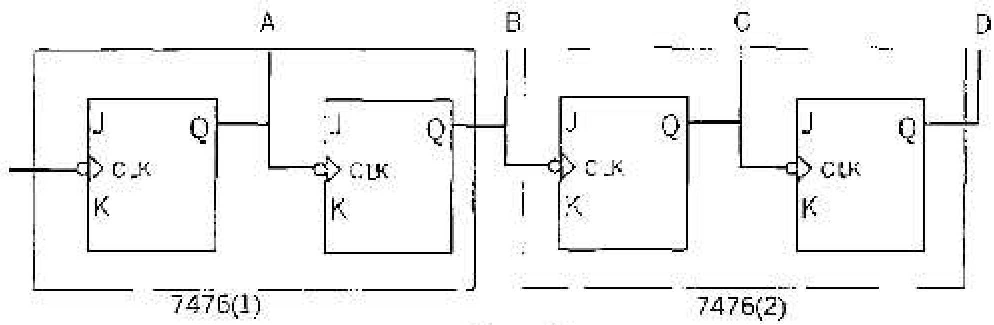

Figure 1

Step 1: Set all **J,K, PRE',CLR'** input to high.

Step 2: Connect all output pins to the LED display. Arrange accordingly from LSB to MSB. (Clear all pins by touching the CLR pins to GND)

Step 3: Observe the flip-flop outputs when the logic pulse button is pressed for the first time.

Q_D=……………. Q_C=……………. Q_B=……………., Q_A=…………….,

Step 4: Observe the flip-flop output when the logic pulse button is pressed for the second time.

Q_D=……………. Q_C=……………. Q_B=……………., Q_A=…………….,

Step 5: Using a wire/jumper connected to Ground (OV), touch the CLR pins for each flip-flop. What happens to:

Q_D=……………. Q_C=……………. Q_B=……………., Q_A=…………….,

Step 6: Repeat the experiment by pressing the logic pulse for each state starting from 0000. Observe all flip-flops output and record the observation in Table 1.

Note: You may want to use a 1Hz square wave signal from the Digital Lab Trainer signal generator to replace the Clock Pulse signal.

Part E : 7493 Binary Counter.

Assemble circuit as shown using a 7493 IC as shown in Figure 2. Follow the instructions carefully and answer the questions accordingly.

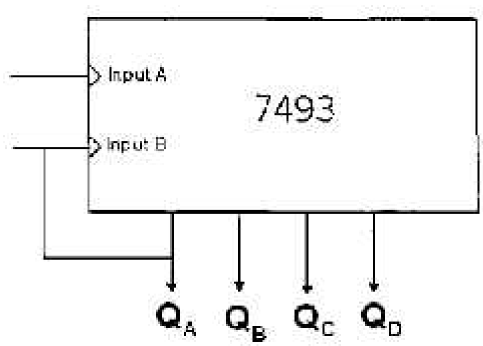

Figure 2

Step 1: Connect all outputs to the LED display of the Digital Lab Trainer. Arrange the output accordingly from LSB to MSB.

Step 2: Press the pulse switch to the first flip-flop, State the observation.

Q_D=…………… Q_C=…………… Q_B=……………, Q_A=……………,

Step 3: Connect R_{O1} and R_{O2} to Ground. State your observation.

Q_D=…………… Q_C=…………… Q_B=……………, Q_A=……………,

Step 4: Clean all flip-flop output by touching all CLR pins to Vcc. Make sure all pins are cleared.

Step 5: Start the experiment by pressing the logic pulse for each state starting from 0000. Observe all flip-flop output and record the observation in Table 2

Turn off the power.

Step 6: Clear all pins.

Step 7: Connect Q_B to R_{O1} and Q_D to R_{O2}. State all observation in Table 3.

EXPERIMENT 3 : SERIAL LOAD REGISTER

OBJECTIVES:

To construct 7474 ICs to operate as a 4 bit serial load register

MATERIALS & EQUIPMENTS:

1. Digital Lab Trainer
2. IC 7474
3. Required data sheets

EXPERIMENT PROCEDURES

Part A : Serial Load Register

- The circuit uses two 7474 ICs consisting of two *D* flip-flops each.
- A common clock input is connected to each flip-flop in the register.
- When a synchronous clock pulse is applied, all the bits in the register shift together one place to the right.
- The circuit can be used as a SISO or SIPO register.

Step 1: Assemble circuit as shown in Figure 3.1.

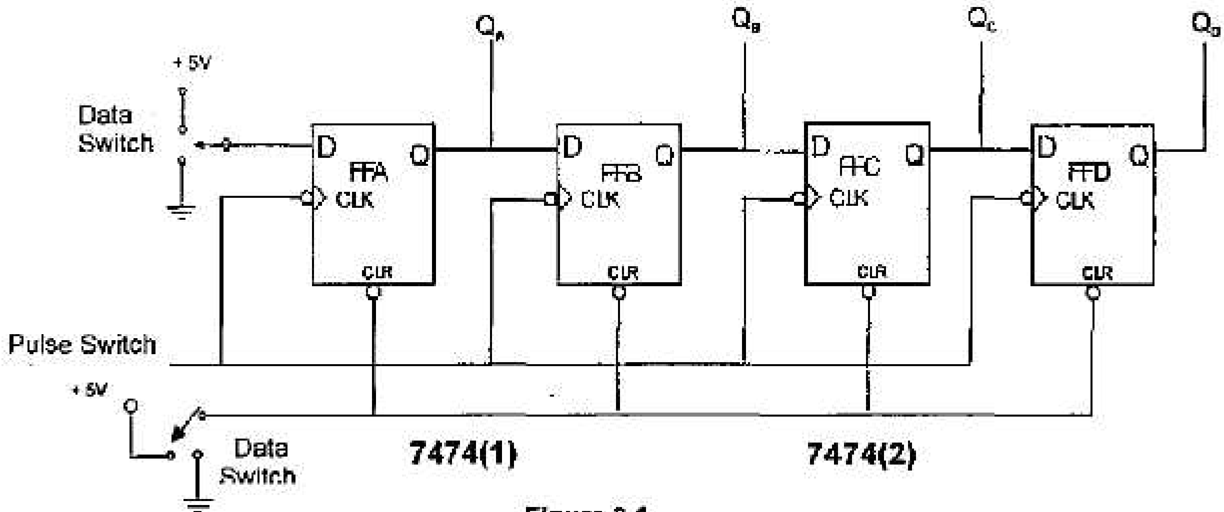

Figure 3.1

Step 2: Connect the output pins, Q_A, Q_B, Q_C and Q_D to the LED Display of Digital Lab Trainer.

Step 3: Connect all PRE' inputs to the Data switch of Digital Lab Trainer and Set to HIGH (1).

Step 4: Turn the power-ON of Digital Lab Trainer.

Step 5: Switch momentary the CLEAR inputs to LOW (0). So the data in the register is cleared out (data 0000 is in the register).

Step 6: Then, Set the switch of CLEAR inputs back to HIGH (1).

Step 7: Complete Table 3.1.