Digital trainer Kit Introduction link: https://www.youtube.com/watch?v=cUdKSQSxVl8

Experiment 1

In a battery powered computer, the diskette driver motor 1 should be ON iff

- **There is a diskette in the drive**
- **The diskette drive door is closed**
- **Diskette drive motor 2 is not ON**
- **The battery low signal is not present and**
- **The computer has started a read operation, or the computer has started a write operation**

Design a circuit using basic gates.

Aim: Realization of any given circuit using basic gates only**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS32 (2 input OR gate)
- IC 74LS08 (2 input AND gate)
- IC 74LS04 (NOT gate)
- Patch cards

Procedure:

1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entry in truth table cross verify it.

Designing of circuit

Consider variables for:

- There is a diskette in the drive: **A**
- The diskette drive door is Open: **B**
- Diskette drive motor 2 is ON: **C**
- The battery low signal is present: **D**
- The computer has started a read operation: **R**
- The computer has started a write operation: **W**

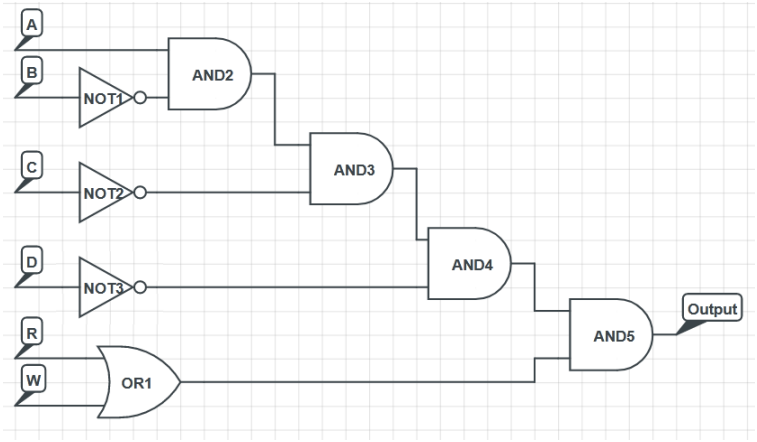
Output expression: A B' C' D' (R + W)

Truth Table:

- **Output should be high only when**

A	B	C	D	R	W	Y
1	0	0	0	1	0	1
1	0	0	0	0	1	1
1	0	0	0	1	1	1

Circuit:



Result: The given expression is verified with the help of truth table.

Experiment 1 URL: https://youtu.be/AsqpSUbaKXk

EXPERIMENT 2

You will gain weight if you eat too much or you do not exercise enough and your metabolism rate is too low. Design a system such that it alarms you when you gain weight using NAND gates.

Aim: Realization of any given circuit using NAND gates only**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 7400 (2 input NAND gate)
- IC 7410 (3 input NAND gate)
- Patch cards

Procedure:

1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entries in truth table cross verify it.

Designing of circuit

Consider variables for:

- Eat : X
- Exercise : Y
- Metabolism : Z

Truth Table:

X	Y	Z	OUTPUT
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

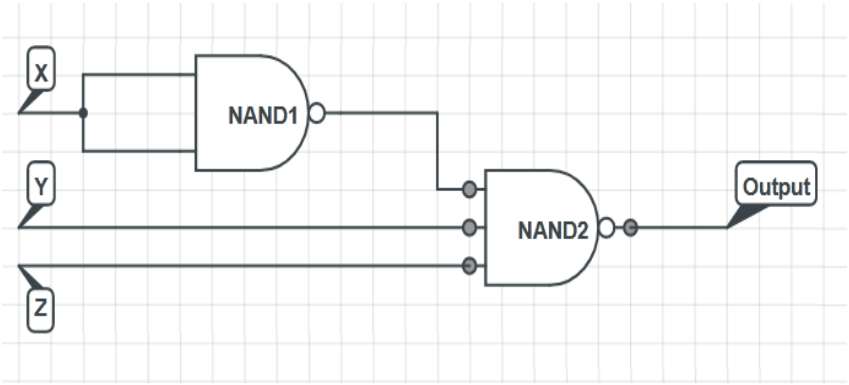
Karnaugh Map simplification

X\YZ	Y'Z'	Y'Z	YZ	YZ'
X'	1	1	0	1
X	1	1	1	1

Output Expression: X + Y' + Z'

Using only NAND gates: ((X + Y' +Z')')'
= (X'. Y . Z)'

Circuit:



Result:

The given expression is verified with the help of truth table.

Experiment 2 URL: https://youtu.be/b38JMmdFMcI

EXPERIMENT 3

The circuit breaker will trip iff

- **The hair drier is turned ON**
- **The microwave oven is used**
- **All the lights in the room are ON or**
- **There is a short circuit in any appliance**

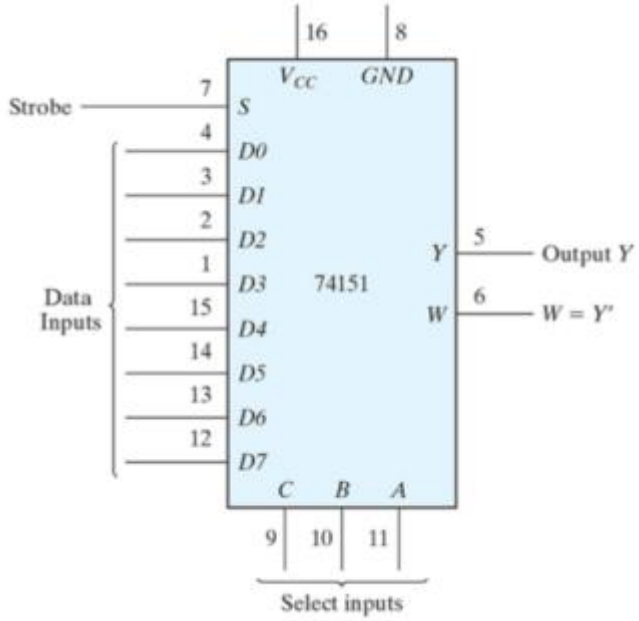
Solve the above issue using relevant MUX.

Aim: Realization of a given circuit using a 8:1 Multiplexer**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS151 (8:1 Multiplexer)
- Patch cards

Pin Diagram: 74151



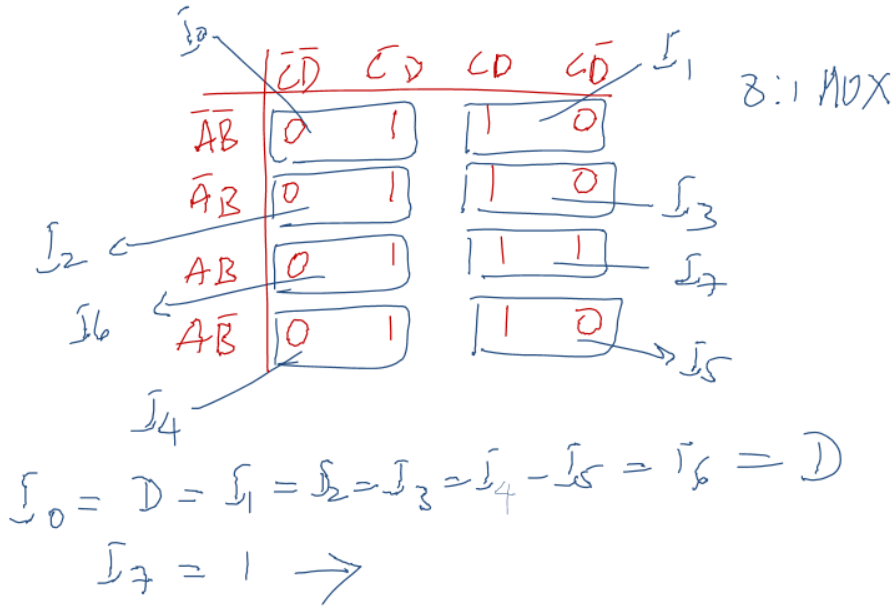
Procedure:

1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entries in truth table cross verify it.

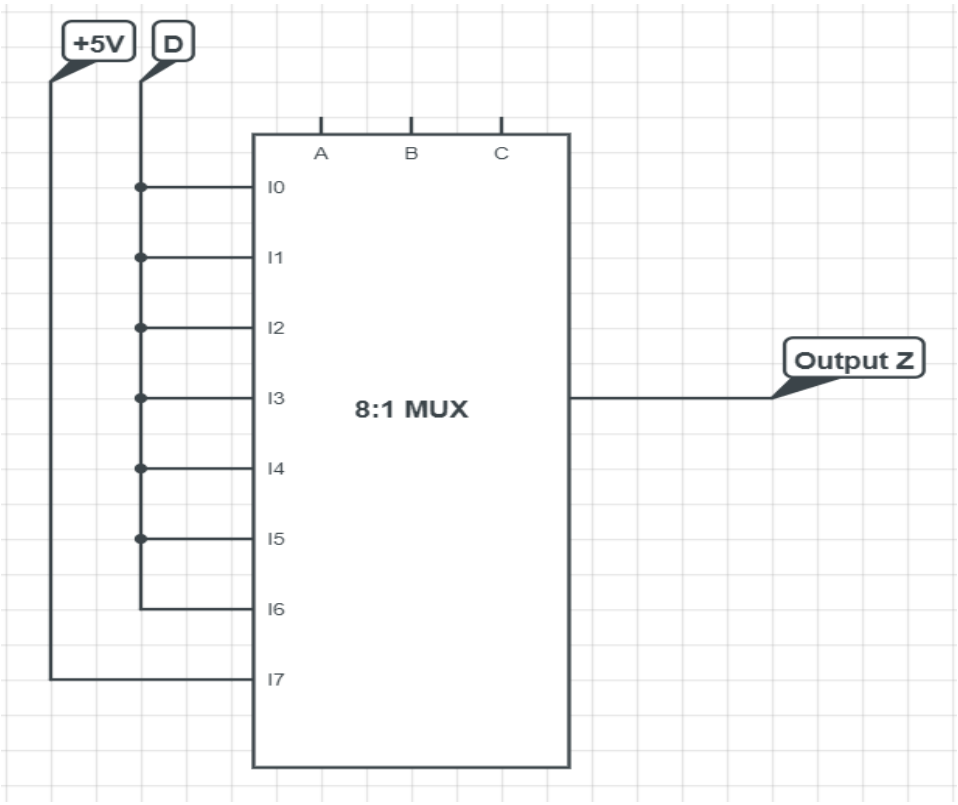
Truth Table

A	B	C	D	Output
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

K – map Simplification



Circuit Diagram:



Result:

The given expression is verified with the help of truth table.

Experiment 3 URL: https://youtu.be/ytqBeBsHuzI

EXPERIMENT 4

In an automated house, two lamps L1 and L2 are controlled by 3 switches: A, B, C. Any one of the lamps should be ON, following the below conditions

- **L1 is ON if switch A and B are open but not C**
- **L1 is ON if switch B and C are open but not A**
- **L2 is ON if only switch C is open**
- **L2 is ON if only switch B is open**
- **L2 is ON if switch A or C is open, but not B**

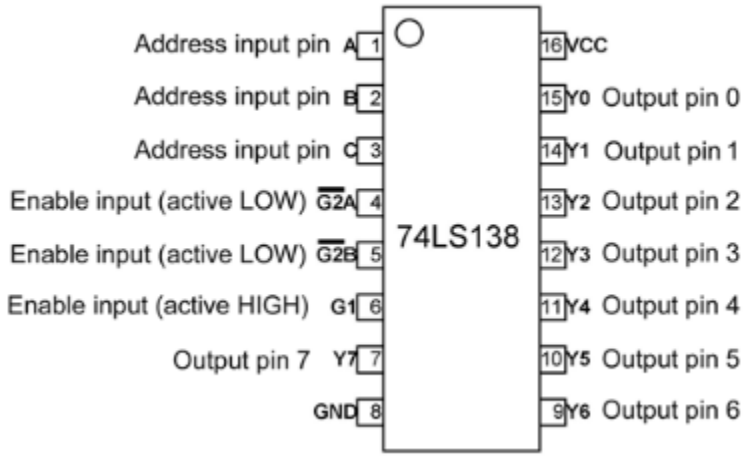
Design a circuit to make the lamp ON using decoder

Aim: Realization of a given circuit using a decoder**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS138 (3:8 Decoder)
- IC 74LS32 (2 input OR gate)
- IC 74LS04(NOT gate)
- Patch cards

Pin Diagram 74LS138



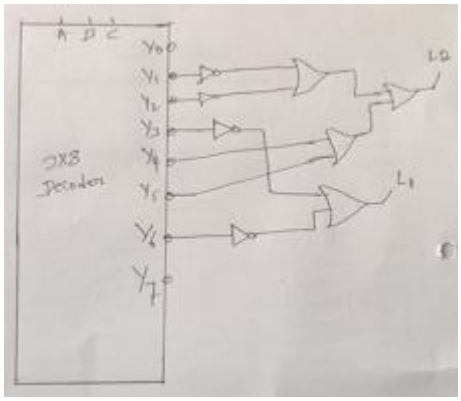
Procedure:

1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entries in truth table cross verify it.

Truth Table:

A	B	C	L1	L2
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	0	1
1	1	0	1	0
1	1	1	0	0

Circuit Diagram:



Result:

The given expression is verified with the help of truth table.

Experiment 4 URL: https://youtu.be/FhLRjJ0YbNY

EXPERIMENT 5

Assume you are generating and transmitting binary data from one place to another. Check whether the sent data is transmitted properly.

Aim: Realization of parity generator and checker**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS86 (XOR)
- IC 74LS04 (NOT)
- Patch cards

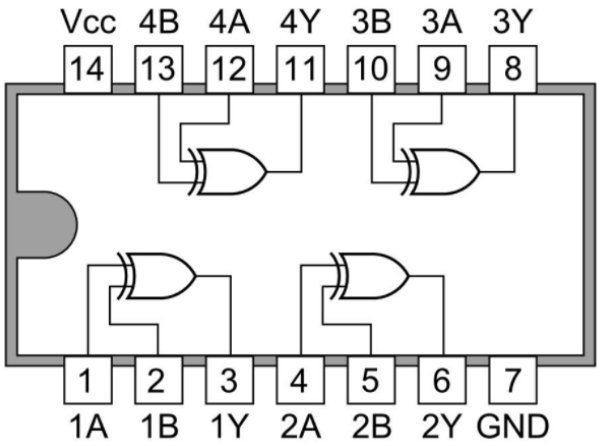
Procedure:

1. Design the circuit and plot the truth table for given expression and for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entries in truth table cross verify it.

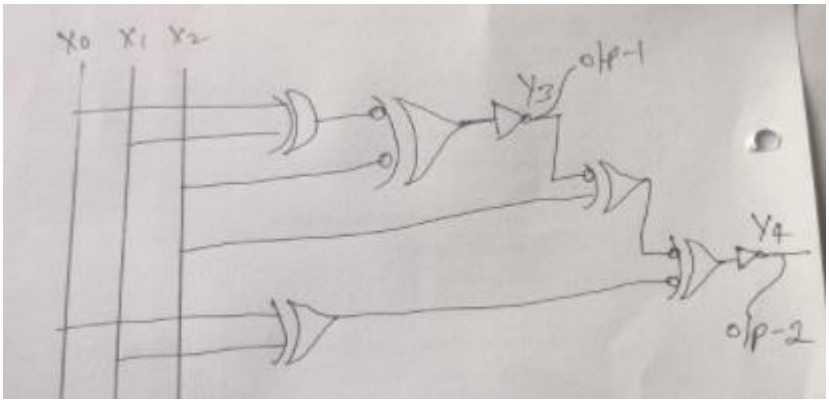
Truth table for ODD parity generator

X2	*X1*	*X0*	*Y3*	*Y2*	*Y1*	*Y0*
0	0	0	1	0	0	0
0	0	1	0	0	0	1
0	1	0	0	0	1	0
0	1	1	1	0	1	1
1	0	0	0	1	0	0
1	0	1	1	1	0	1
1	1	0	1	1	1	0
1	1	1	0	1	1	1

Pin Diagram of 7486



Circuit Diagram:



Result:

The given expression is verified with the help of truth table.

Experiment URL: *https://youtu.be/t-q3BRSNG_A*

EXPERIMENT - 6

Assume you need to send a secret message consisting of numbers from 1 to 9 and letters from A to F. Secret message is encoded using excess 3 code. Design a circuit using ADDER IC to send a secret message to your friend.

Aim: Realization of Excess 3 to BCD and vice-versa using adder.

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS83(4 bit Adder IC)
- IC 74LS86 (XOR)
- Patch cards

Procedure:

Case 1: BCD to Excess-3 code converter

- Check all the pins by connecting them and testing it with their respective truth tables.
- Label the pin diagram by referring the circuit diagram for the IC pins.
- Connect the IC's according to the pin diagram.
- Make **Cin as 0** and bit **B=3 i.e.B3, B2, B1, B0 = 0,0,1,1.**
- For each entry in the truth table, verify the values corresponding to it.

Case 2: Excess-3 to BCD code converter

- Check all the pins by connecting them and testing it with their respective truth tables.
- Label the pin diagram by referring the circuit diagram for the IC pins.
- Connect the IC's according to the pin diagram.
- Make **Cin as 1** and bit **B=3 i.e. B3, B2, B1, B0 = 0011.**
- For each entry in the truth table, verify the values corresponding to it.

Truth Table

BCD to Excess – 3:

C_{in} = 0, B = 3 i.e. B_3 B_2 B_1 B_0 = 1 1 0 1 (2's complement of 0 0 1 1)

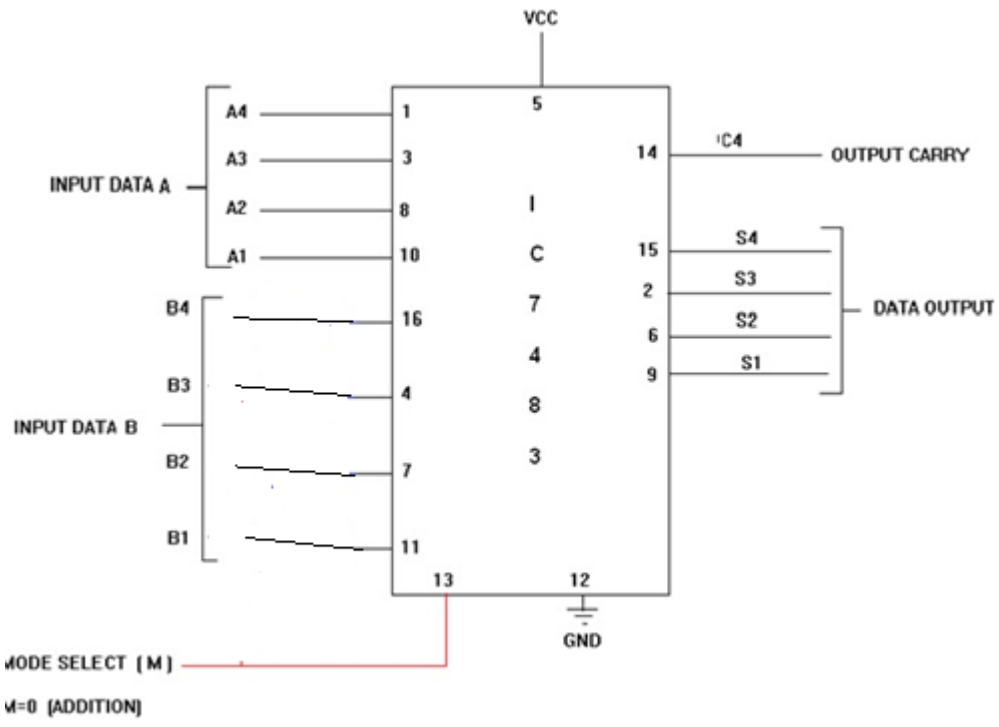
INPUT				OUTPUT			
A3	**A2**	**A1**	**A0**	**S3**	**S2**	**S1**	**S0**
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0

Excess – 3 to BCD:

Cin = 1, B = 3 i.e. $B_3 B_2 B_1 B_0$ = 0 0 1 1

INPUT				OUTPUT			
A3	A2	A1	A0	S3	S2	S1	S0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	1
0	1	0	1	0	0	1	0
0	1	1	0	0	0	1	1
0	1	1	1	0	1	0	0
1	0	0	0	0	1	0	1
1	0	0	1	0	1	1	0
1	0	1	0	0	1	1	1
1	0	1	1	1	0	0	0
1	1	0	0	1	0	0	1

Circuit Diagram:



Result:

The truth table is verified.

https://youtu.be/CdJ0mJkbKRU

EXPERIMENT – 7

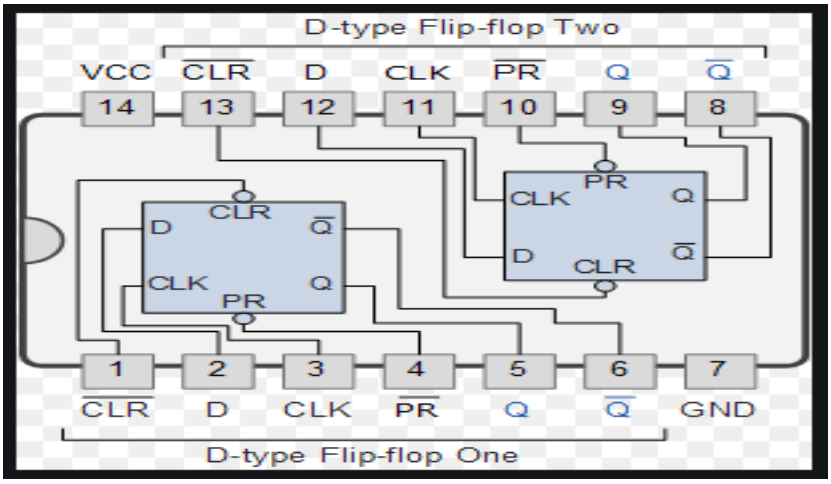
Consider a computer operator who needs to generate a sequence 1011 continuously which is transmitted across the network. Design a circuit to implement this job.

Aim: Realization of a shift register**.**

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 7474 (D Flip Flops)
- Patch cards

Pin Diagram of D Flip-Flop



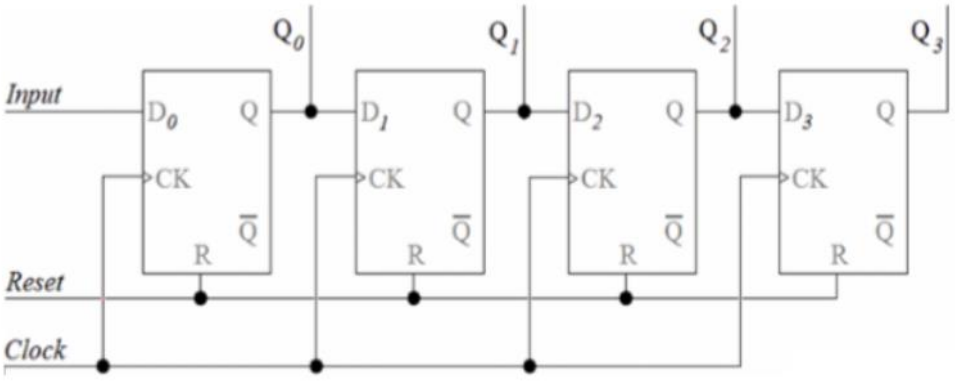
Procedure:

1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entry in truth table cross verify it.

Truth Table:

Clock	Serial input	Q_0	Q_1	Q_2	Q_3
0	1	0	0	0	0
1	0	1	0	0	0
2	1	0	1	0	0
3	1	1	0	1	0
4		1	1	0	1

Circuit Diagram:



Result:

The given expression is verified with the help of truth table.

URL: ***https://youtu.be/ouv4Y6ZwKR8***

EXPERIMENT 8

Consider a scenario where in you want to take print out of few selected random pages in sequence numbered from 0 to 5. Design a circuit to achieve this task using J-K Flipflops.

Aim: Realization of a counting sequence using JK flipflops

Components Required for the conduction of the experiment:

- Digital trainer kit.
- IC 74LS76 (JK Flipflop)
- IC 74LS08 (AND Gate)
- Patch cards

Procedure:

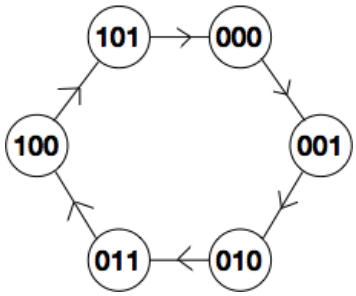
1. Design the circuit and plot the truth table for given expression and also for solved expression and verify.
2. Check the all required gates whether it is working.
3. Label with the pin numbers for the circuit, referring IC diagram.
4. Connection to be done as per the circuit.
5. For each entry in truth table cross verify it.

Designing of circuit

J – K flip – flop excitation table:

Present state	Next state	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

State Transition Diagram:



C_n	B_n	A_n	C_{n+1}	B_{n+1}	A_{n+1}	J_C	K_C	J_B	K_B	J_A	K_A
0	0	0	0	0	1	0	X	0	X	1	X
0	0	1	0	1	0	0	X	1	X	X	1
0	1	0	0	1	1	0	X	X	0	1	X
0	1	1	1	0	0	1	X	X	1	X	1
1	0	0	1	0	1	X	0	0	X	1	X
1	0	1	0	0	0	X	1	0	X	X	1

C \ BA	B'A'	B'A	BA	BA'
C'	0	0	1	0
C	X	X	X	X

J_C=BA

C \ BA	B'A'	B'A	BA	BA'
C'	X	X	X	X
C	0	1	X	X

K_B=A

C \ BA	B'A'	B'A	BA	BA'
C'	0	1	X	X
C	0	0	X	X

J_B=C'A

C \ BA	B'A'	B'A	BA	BA'
C'	X	X	1	0
C	X	X	X	X

K_B=A

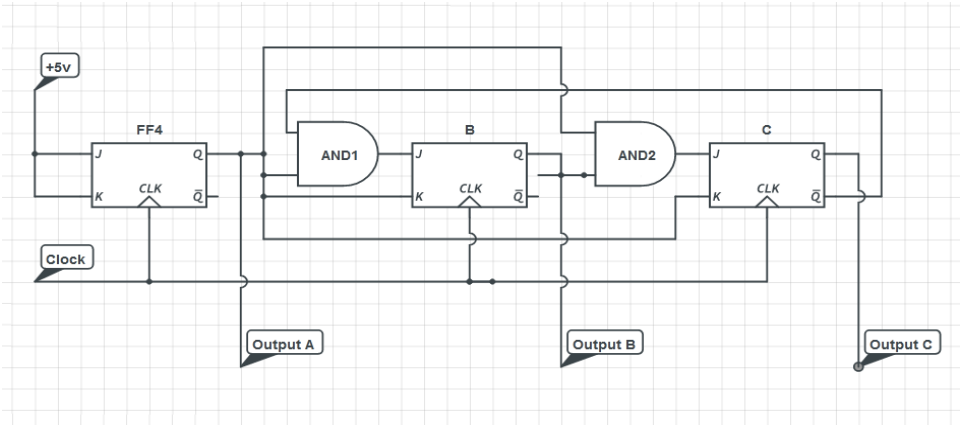
C \ BA	B'A'	B'A	BA	BA'
C'	1	X	X	1
C	1	X	X	X

J_A=1

C \ BA	B'A'	B'A	BA	BA'
C'	X	1	1	X
C	X	1	X	X

K_A=1

Circuit:



Result:

The given expression is verified with the help of truth table.

https://youtu.be/bLhKrLdpkBY