Design of Code Converters

Experiment no.   **Date:**

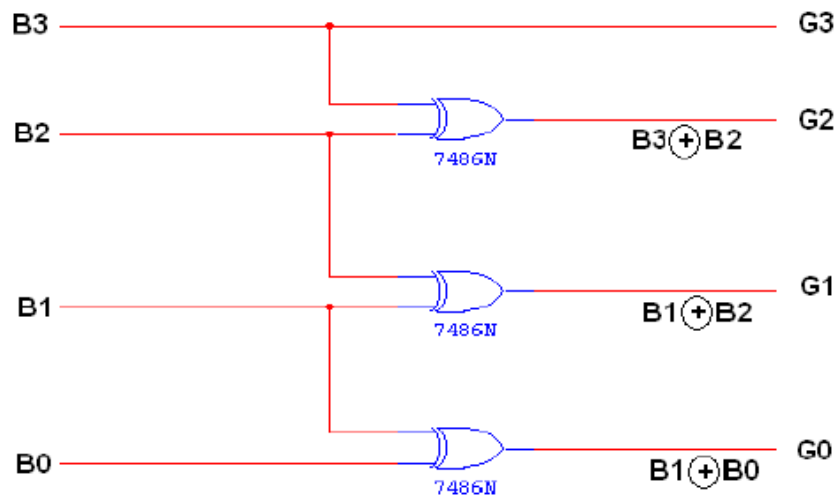## Aim:

Design and verify the working of :
  a) Binary to Gray Code Converter
  b) Gray to Binary Code Converter

Software Required: LTspice software

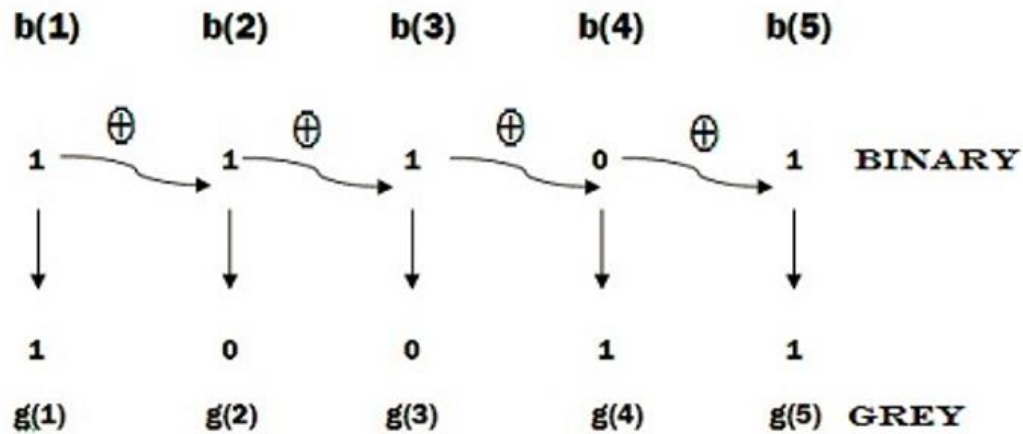## Circuit Diagram:

Binary to Gray Code Converter

Theory:

a) Binary to Gray Code Converter:

Example:

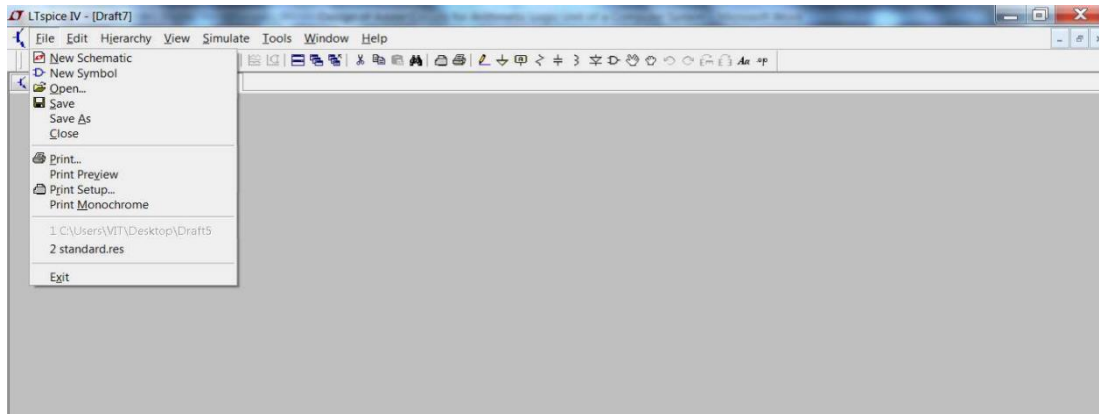The truth table of Binary to Gray Code Converter is given below:
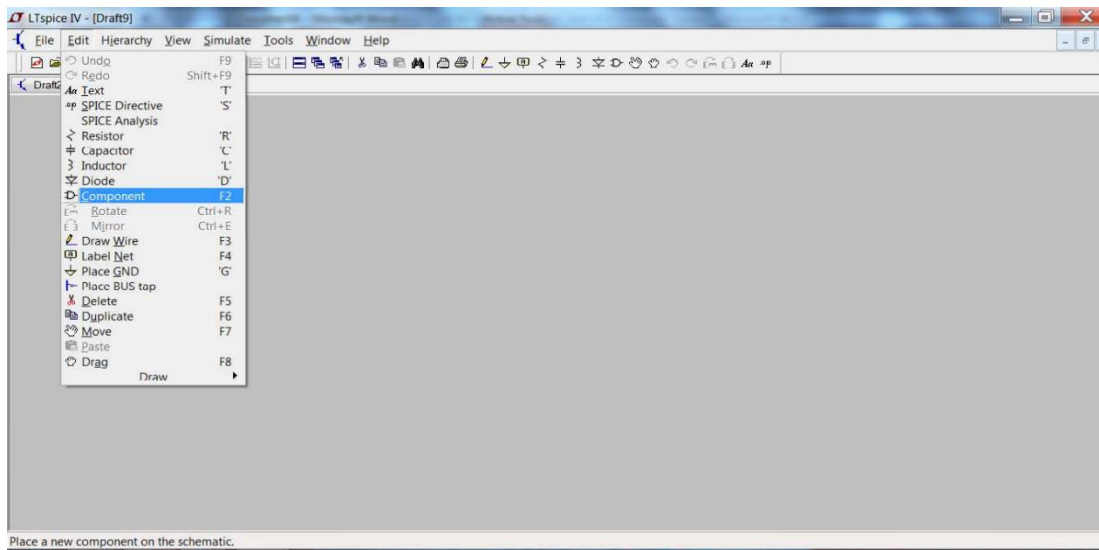
TRUTH TABLE:

	Binary input				Gray code output		
B3	B2	B1	B0	G3	G2	G1	G0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

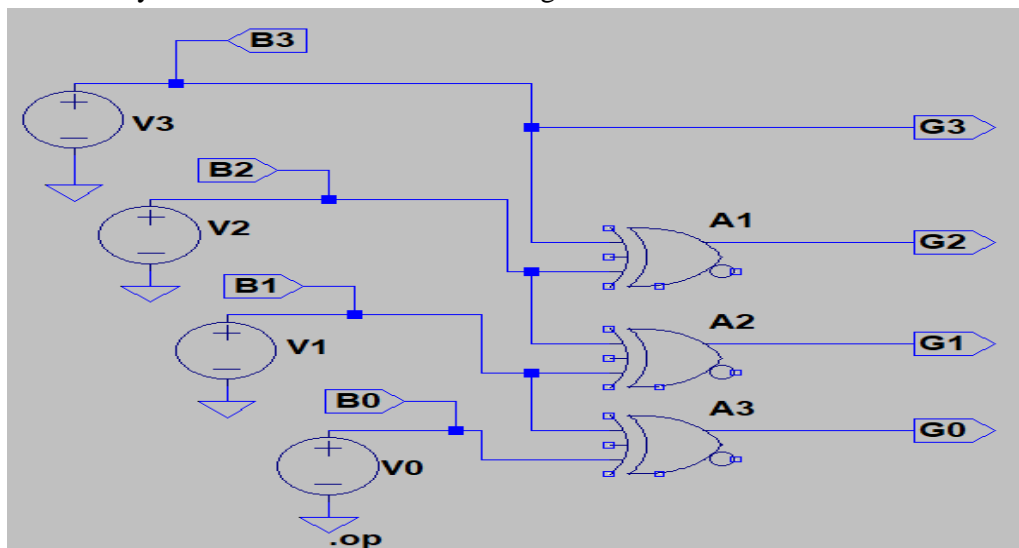## Procedure for Simulation:

1. Open LTspice. Goto File → New Schematic.

2. On the File Menu, click on Edit → Component.

3. **For Binary to Gray**: Place the voltage sources, XOR gate and ground onto schematic and make necessary connections as shown in the Figure.


Binary to Gray Code Converter

4. As shown in the figure below, For the binary input value of **1001**
Right click on the voltage sources V0 and then Enter DC Value 1 and then click OK option.
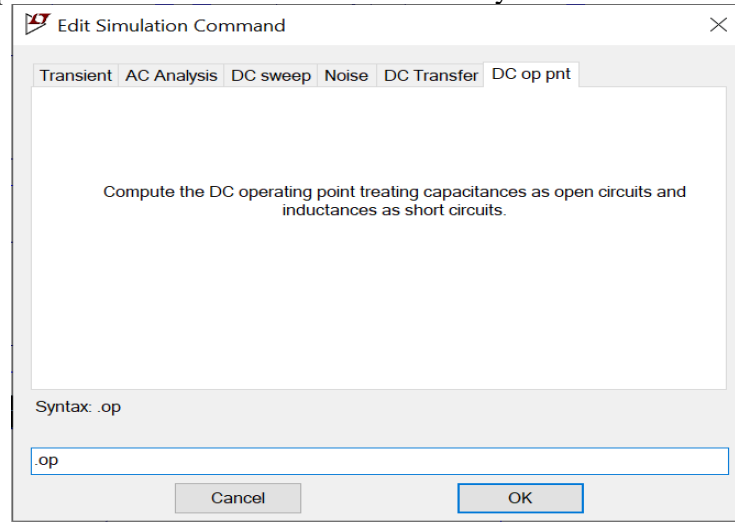Right click on the voltage sources V1 and then Enter DC Value 0 and then click OK option.
Right click on the voltage sources V2 and then Enter DC Value 0 and then click OK option.
Right click on the voltage sources V3 and then Enter DC Value 1 and then click OK option.
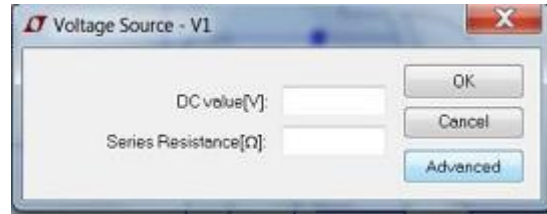
5. Goto Edit→SPICE analysis.

Select "DC op pnt" tab and Click "OK" and Press run symbol on menu bar.

Results are shown below for the binary input of 1001


```
--- Operating Point ---

V(g3)  = V(b3)   1            voltage
V(b2):           0            voltage
V(g2):           1            voltage
V(bl):           0            voltage
V(gl):           0            voltage
V(b0):           1            voltage
V(g0):           1            voltage
I(V0):           0            device_current
I(V1):           0            device_current
I(V3):           0            device_current
I(V2):           0            device_current
I8(A3):          0            device_current
I7(A3):          0            device_current
I8(A2):          0            device_current
I7(A2):          0            device_current
I8(Al):          0            device_current
I7(Al):          0            device_current
```

6. Repeat the procedure for different binary input and verify the truth table and present the screenshots of at least 3 values.
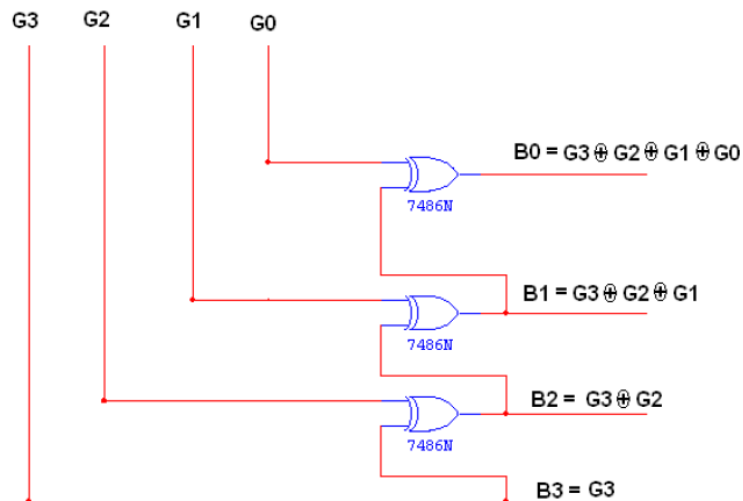
Theory:

b) Gray to Binary Code Converter:

Example:
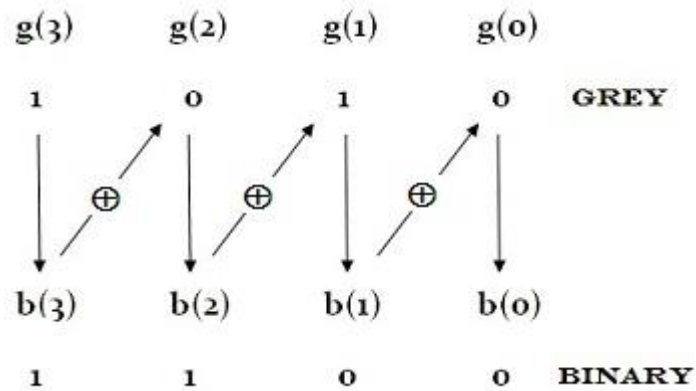
**Logic Circuit Diagram - Gray to Binary Code Converter**

The truth table of Gray to Binary Code Converter is given below:

TRUTH TABLE:

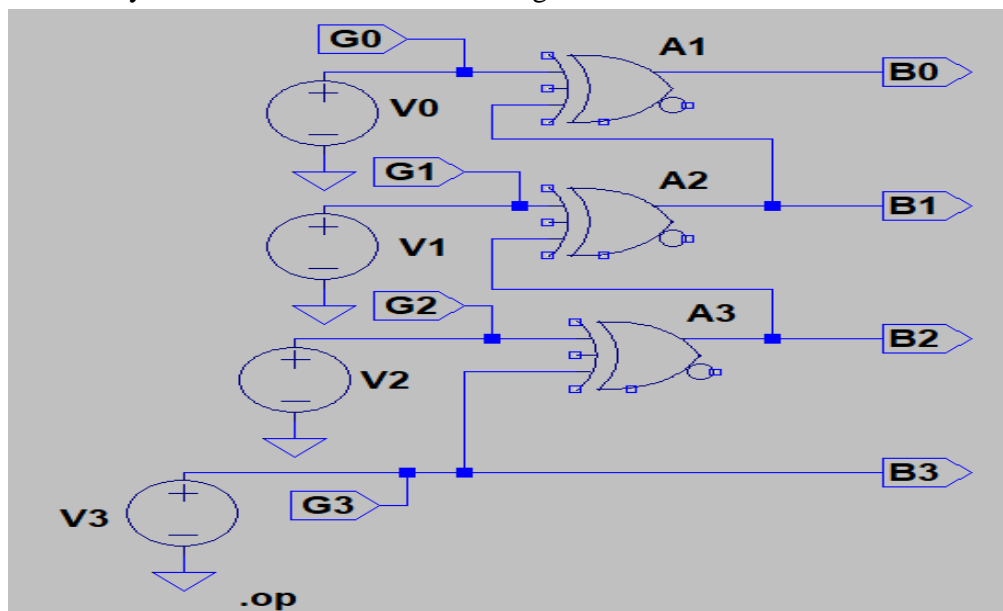|	Gray Code				Binary Code		
G3	G2	G1	G0	B3	B2	B1	B0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	1	0	0	1	0
0	0	1	0	0	0	1	1
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
0	1	0	1	0	1	1	0
0	1	0	0	0	1	1	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	1	1	0	1	0
1	1	1	0	1	0	1	1
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	0	0	1	1	1	1	0
1	0	0	0	1	1	1	1

Procedure for Simulation:

1.Open LTspice. Goto File → New Schematic.
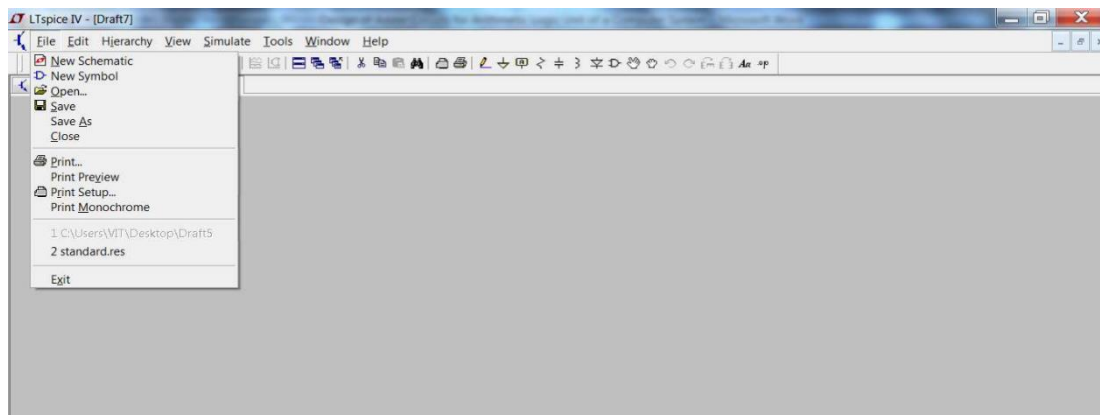
2. On the File Menu, click on Edit → Component.
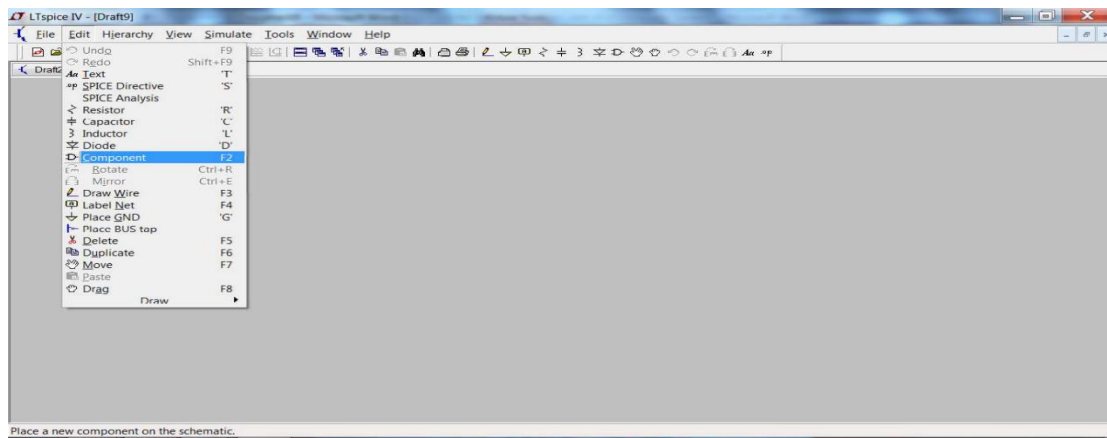
3. **For Gray to Binary:** Place the voltage sources, XOR gate and ground onto schematic and make necessary connections as shown in the Figure.
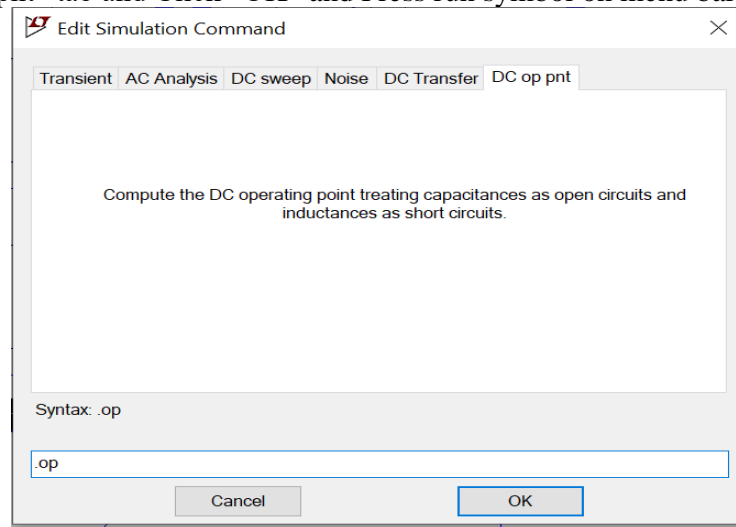

Gray to Binary Code Converter

4. As shown in the figure below, For the Gray input value of 1010
   Right click on the voltage sources V0 and then Enter DC Value 0 and then click OK option.
   Right click on the voltage sources V1 and then Enter DC Value 1 and then click OK option.
   Right click on the voltage sources V2 and then Enter DC Value 0 and then click OK option.
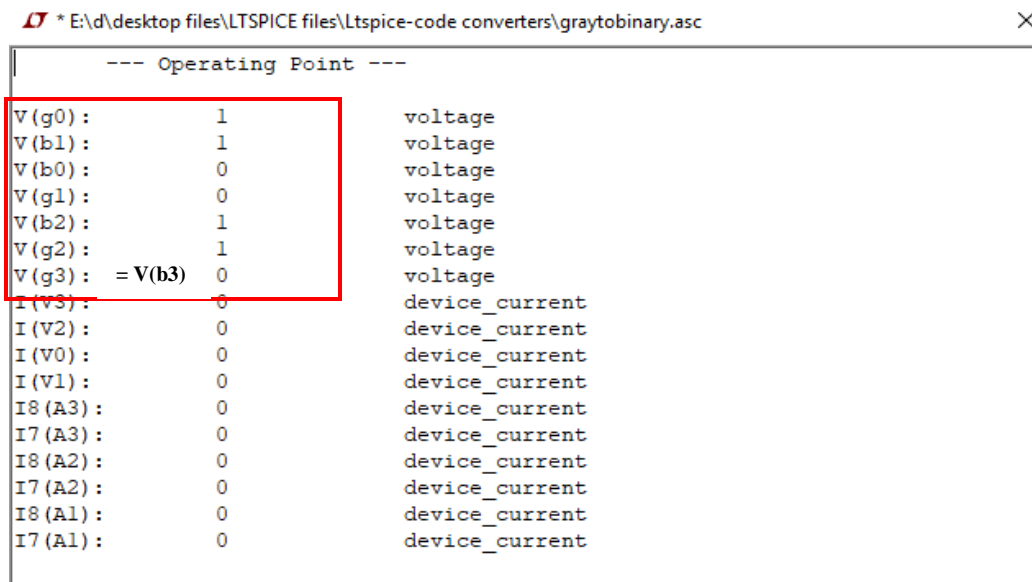   Right click on the voltage sources V3 and then Enter DC Value 1 and then click OK option.
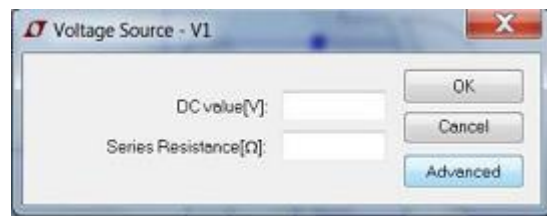
5. Goto Edit →SPICE analysis.

Select "DC op pnt" tab and Click "OK" and Press run symbol on menu bar.

Results are shown below for the gray input of 0101

6. Repeat the procedure for different Gray input and verify the truth table and present the screenshots of at least 3 values.

Result

Thus , Binary to Gray and Gray to Binary Code Converters are designed, implemented and verified in LTspice software.