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RollNumber:
2k23-BSSE-143

Subject:
DigitalLogicDesign

Contents

LABMANUAL

DigitalLogicDesign

Experiment#1

CEDARLogicSimulator

WhatisCEDARLogicSimulator?

CEDARLogicSimulator(software):

Thisisanopen-source,freedigitallogicsimulatoroftenusedforeducationalpurposes.Itwas developedbyprofessorsatCedarvilleUniversityandhasbeenavailablesince2006.Thelatest stableversionis1.5,whichwasreleasedin2011.Itincludesallthebasiclogicgates,buses,JK and D flip flops, muxes, decoders, and even a Z80 microprocessor emulator.

WorkingofCEDARLogicSimulator:

Corefunctionalities:

- Graphicaluserinterface(GUI):Usersbuildcircuitsbydragginganddropping components like gates, flip-flops, andotherelements onto a virtual canvas.
- Simulationengine:Theengineevaluatesthecircuit'sbehaviorbasedonuser-defined inputs and the logic rules of each component. It uses an event-driven approach,meaningitupdatesthestateofthecircuitonlywheninputschange.
- Visualization:Thesimulatordisplaysthecircuit'sstateinreal-time,highlightingactive signals, propagating changes, and showing output values.

Keypointsaboutitsworking:

- Libraryofcomponents:CEDARoffersawidelibraryofbasicandcomplexdigitallogic components, including gates (AND, OR, NOT, NAND, NOR, XOR), flip-flops (JK,D),muxes,decoders,adders,comparators,memoryelements(RAM,ROM),and even a Z80 microprocessor emulator.
- Event-drivensimulation:Thesimulatorprioritizesprocessingevents(changesinsignal values) efficiently. This makes it effective for simulating both simple and complex circuits.
- Time-basedsimulation:Userscandefinedelaysforcomponentstosimulatereal-world behavior where signals take time to propagate.
- Debuggingtools:Thesimulatorprovidestoolslikesignalprobing,waveformviewing,and breakpoints to help identify and troubleshoot issues in circuits**.**

Features:

ThereareManymenusandoptionavailableinCEDARLogicSimulatorwhichcanbeusedto create logic design and gates

- **Mainwindow:**Thisiswhereyoudraganddropcomponentstobuildyourcircuit.
- **Componentlibrary:**Thispanelontheleftsidedisplaysavailablecomponents(gates,flip- flops, etc.).
- **Toolbar:**Abovethemainwindow,youfindbasicbuttonsforsimulationcontrols (Start, Step, Pause, Reset), file operations, and other essential features.

- **Statusbar**:Atthebottom,thestatusbarprovidesinformationaboutthesimulation state, current time step, and any debugging messages.
- **Mainmenu:**Providesaccesstodifferentfunctionalitieslikelog ingestion, monitoring, alerting, searching, and configuration.
- **Navigationpane:**Listsavailableresources(logsources,dashboards,alerts)forquick access.
- **Searchbar:**Letsyousearchspecificlogsorevents**.**
- **Topbar:**Oftenhousesuseroptions,notifications,andhelpresources.

Experiment#2

Objective:

TodetermineAND,OR,NOT,andXORusingCEDARlogicsimulator.

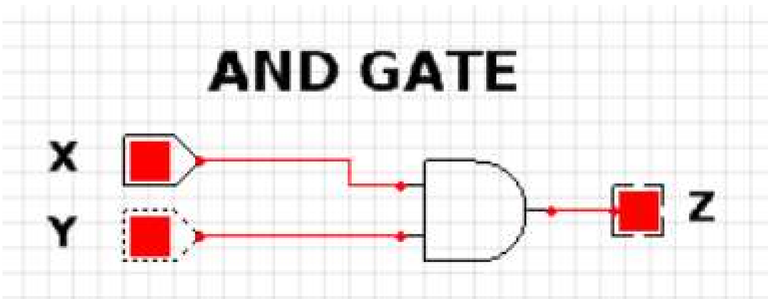
Apparatus:

CEDARLogicSimulator

ANDGATE

AnANDgate,inthecontextofdigitalelectronics,isalogicgatethatperformsalogicalconjunction operation. Ittakestwo binary inputsignals, often labeled as A andB, andproduces a single binary output.TheoutputofanANDgateishigh(1)onlywhenbothofitsinputsignalsarehigh(1).Ifeitheror both of the input signals are low (0), the output is low (0).

Diagram:



Note:

0*0=0	1*0=0
0*1=0	1*1=1

TruthTable:

X	Y	Z =X*Y
0	0	0
0	1	0
1	0	0
1	1	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputAND gate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.

13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

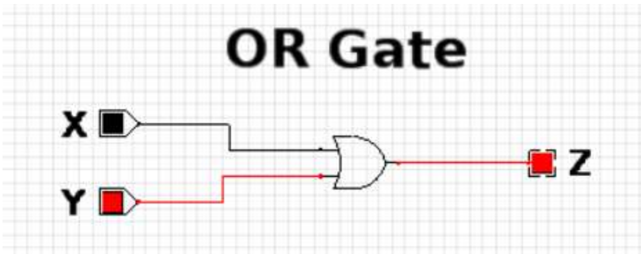
Apparatus:

CEDARLogicSimulator

ORGATE

An OR gate, in the realm of digital electronics, is a logic gate that performs a logical disjunction operation.Ittakestwobinaryinputsignals,oftenlabeledasAandB,andproducesasingle binary output.TheoutputofanORgateishigh(1)ifatleastoneofitsinputsignalsishigh(1).Ifbothinput signals are low (0), the output is low (0).

Diagram:



Note:

0*0=0	1*0=1
0*1=01	1*1= 1

TruthTable:

X	Y	Z =X+Y
0	0	0
0	1	1
1	0	1
1	1	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.

13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

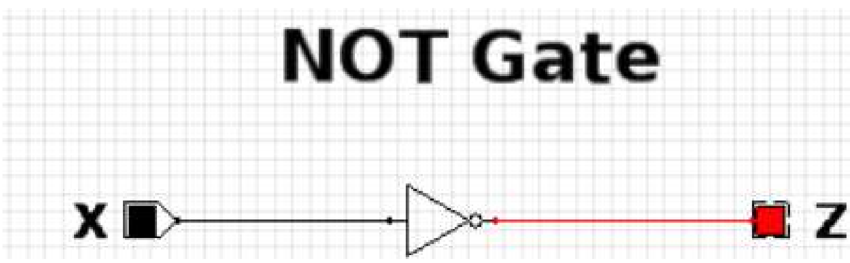
Apparatus:

CEDARLogicSimulator

NOTGATE

ANOTgate,alsoknownasaninverter,isabasicdigitallogicgatethatperformsalogicalnegation operation. It takes a single binary input signal, often labeled as A, and produces a single binary output. TheoutputofaNOTgateistheopposite(complement)ofitsinput.Iftheinputishigh(1),theoutputis low (0), and vice versa.

Diagram:



TruthTable:

X	Y=X
1	0
0	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoInvertandConnect.
3. Selectthe inverter.
4. Dragthegate(inverter)tothesheet.
5. NowgotoInputandOutput Section.
6. Selectasingletoggleswitchanddragitonthe sheet.
7. FromthesamesectionselectLEDlightasoutput.
8. DragtheLEDonthesheet.
9. Nowconnectbothinputandoutputtotheinverter.
10. Youwillseethatwhatevertheinputisgiven,theoutputwillbeexactlytheopposite.

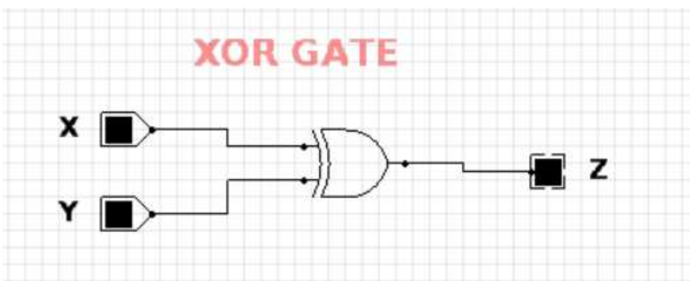
Apparatus:

CEDARLogicSimulator

XORGATE

An XOR gate, short for exclusive OR gate, is a digital logic gate that performs a logical exclusive disjunctionoperation.Ittakestwobinaryinputsignals,oftenlabeledasAandB,andproducesasingle binary output. The output of an XOR gate is high (1) if the inputs are different; if both inputs are the same,theoutputislow(0).

Diagram:



Note:

0*0=0	1*0=1
0*1=1	1*1=0

TruthTable:

X	Y	$Z=\bar{A}B+A\bar{B}$
0	0	0
0	1	1
1	0	1
1	1	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputXORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#3

Objective:

TodetermineNAND,NOR,andXNORusingCEDARlogicsimulator.

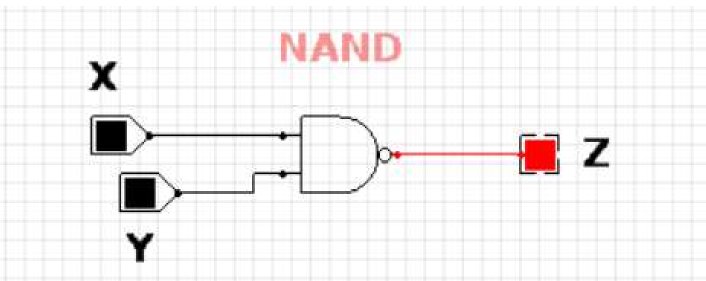
Apparatus:

CEDARLogicSimulator

NANDGATE

ANANDgate,shortforNOT-ANDgate,isadigitallogicgatethatperformsalogicaloperationcombining thefunctionalityofanANDgatefollowedbyaNOTgate.Ittakestwobinaryinputsignals,oftenlabeled as A and B, and produces a single binary output. The output of a NAND gate is low (0) only when both inputs are high (1); otherwise, the output is high (1).

Diagram:



Note:

0*0=1	1*0=1
0*1=1	1*1=0

TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputNANDgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheNANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.

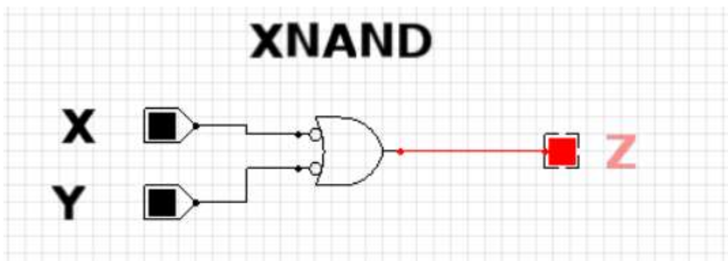
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchY andnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

XNANDGATE

Diagram:



Note:

0*0=1	1*0=1
0*1=1	1*1=0

TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputXNAND gate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXNANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

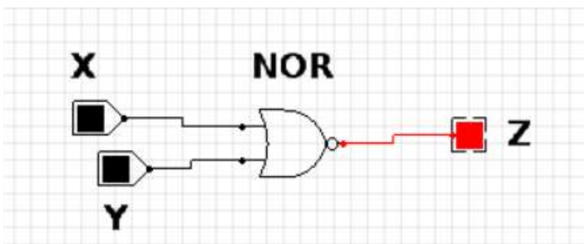
Apparatus:

CEDARLogicSimulator

NORGATE

ANORgate,shortforNOT-ORgate,isadigitallogicgatethatperformsalogicaloperationcombiningthe functionality of an OR gate followed by a NOT gate. It takes two binary input signals, often labeled as A and B, and produces a single binary output. The output of a NOR gate is high (1) only when both inputs are low (0); otherwise, the output is low (0).

Diagram:



Note:

0*0=0	1*0=0
0*1=0	1*1=1

TruthTable:

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

Procedure:

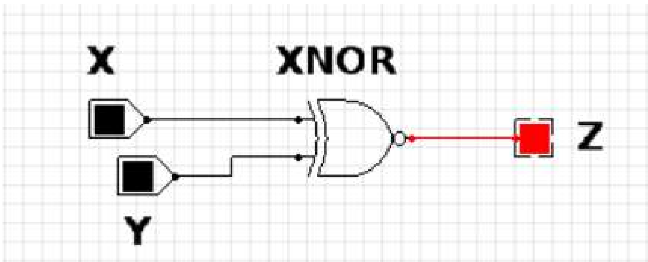
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputNORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheNORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

XNORGATE

Diagram:



Note:

0*0=1	1*0=0
0*1=0	1*1=1

TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputXNORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXNORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasXandY.
12. LEDwillberepresentedasZ.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

3-INPUTCIRCUITS

Objective:

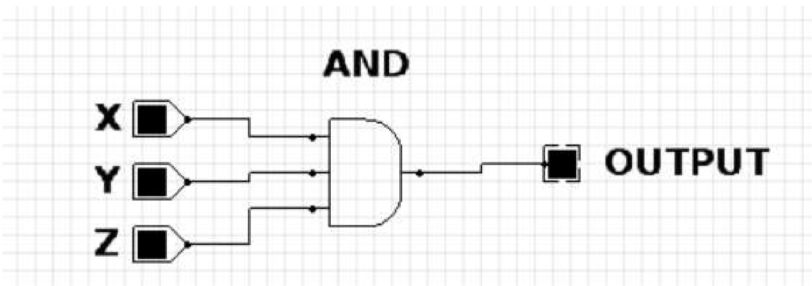
TodetermineAND,OR,NOT,XOR,NAND,XNAND,NORandXNORusing3-InputcircuitsinCEDARlogic simulator.

Apparatus:

CEDARLogicSimulator

ANDGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogic simulator.
2. GotoBasicgatesandselect3InputAND gate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.

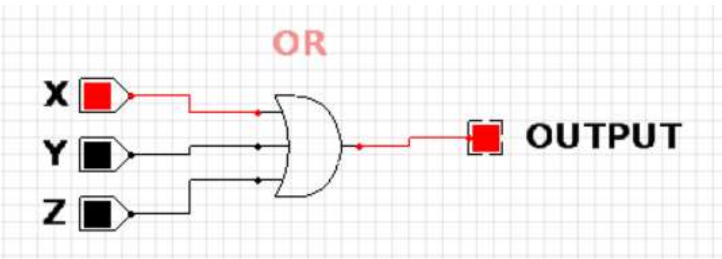
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

ORGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogic simulator.
2. GotoBasicgatesandselect3InputORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.

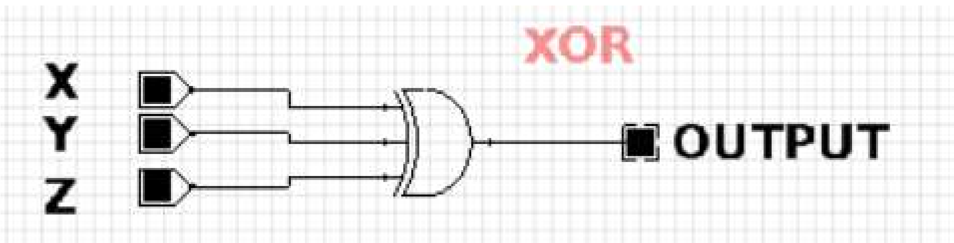
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

XORGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3InputXORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.

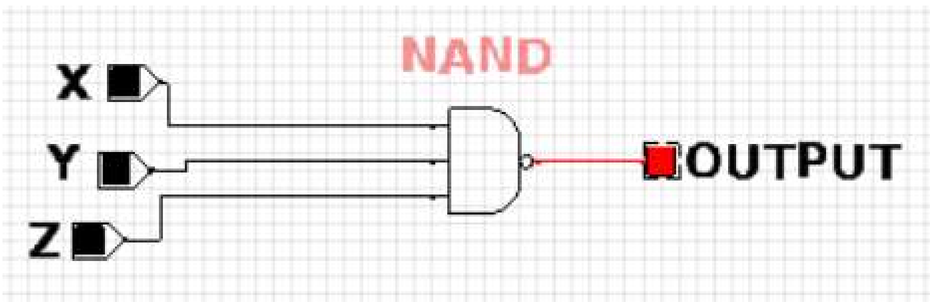
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

NANDGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3InputNANDgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.

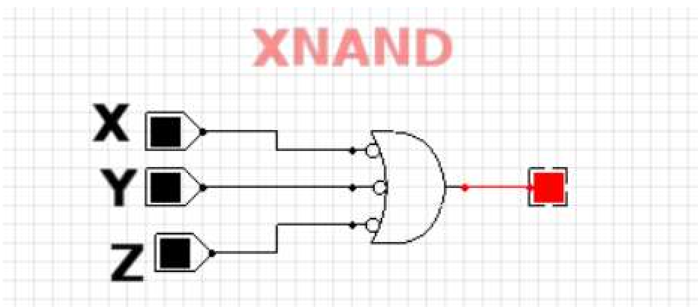
9. ThenconnecttheNANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

XNANDGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3InputXNAND gate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
6. FromthesamesectionselectLEDlightasoutput.

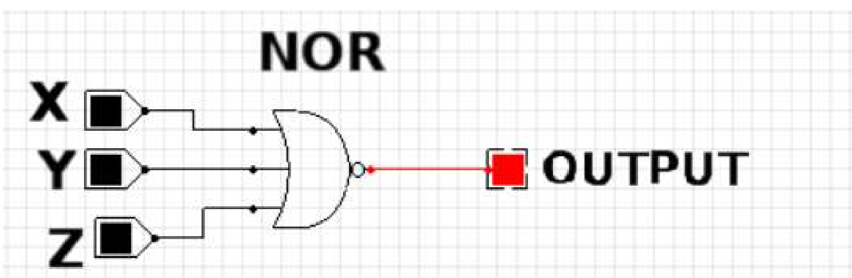
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXNANDgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

NORGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3InputNORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.

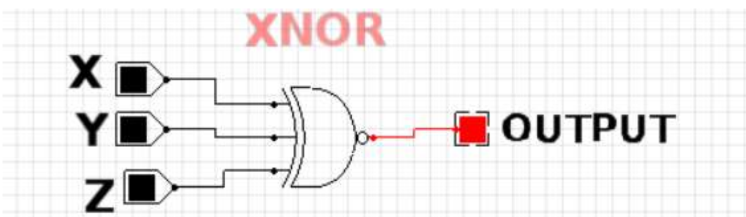
6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheNORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator

XNORGATE

Diagram:



TruthTable:

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

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3InputXNORgate.
3. Dragthegatetothesheet.
4. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.

6. FromthesamesectionselectLEDlightasoutput.
7. DragtheLEDonthesheet.
8. Nowconnectbothinputandoutputtothegate.
9. ThenconnecttheXNORgatetotheLEDwhichisthesourceofoutput.
10. NowgototheDecorationandplacethetext.
11. DecoratetheToggleswitchesasX,YandZ.
12. LEDwillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#4

Boolean Expression

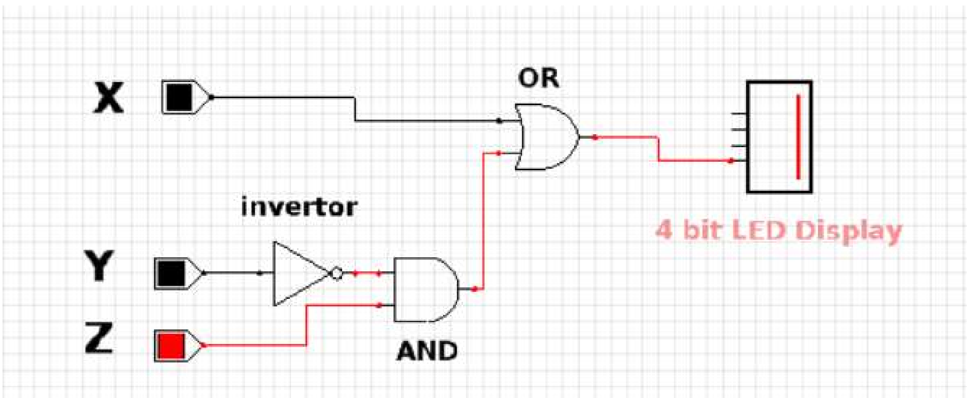
Objective:

ToimplementBooleanexpressionbyusinglogicgates.

Apparatus:

CEDARLogicSimulator.

Diagram:



TruthTable:

X	Y	Z	Y'	Y'Z	XY'Z
0	0	0	1	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	1	0	0	0
1	0	0	1	0	0
1	0	1	1	1	1
1	1	0	0	0	0
1	1	1	0	0	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2-inputAND,OR&NOTgate.
3. Dragthegatetothesheet.
4. ConnectNOT&ANDgatesthanORgate.
5. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
6. DragthreeON\OFFtoggleswitchesandplacethembesidethegate.
7. Select4-bitLEDDisplayfrominvertorandconnectsection.
8. Dragthe4-bitLEDonthesheet.
9. Nowconnectbothtogglesand4-bitLEDDisplaytothegate.
10. NowgototheDecorationandplacethetext.

11. DecoratetheToggleswitchesasX,YandZ.
12. 4-bitLEDDisplaywillberepresentedasoutput.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. ThenONtheswitchYandnotetheoutput.
16. ThenONtheswitchZandnotetheoutput.
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

De-morganLaw

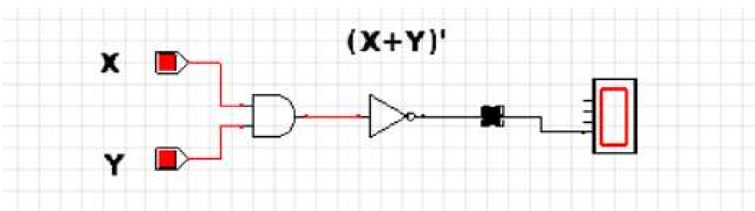
Objective:

ToimplementDe-MorganLawbyusinglogicgates.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

(X+Y)'=(X'+Y')=0

(X.Y)'=(X'.Y')= 1

TruthTable:

X	Y	X+Y	(X+Y)'
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

Procedure:

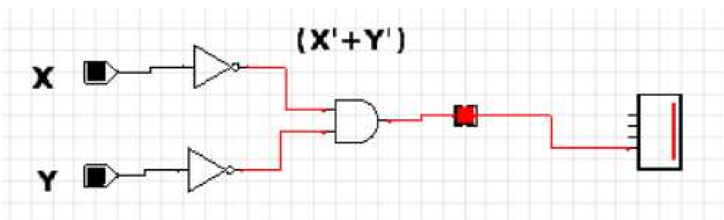
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2Inputgate.
3. DragtheAND&NOTgatetothesheet.
4. Connectbothtogether.
5. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
6. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
7. Select4-bitLEDDisplayfrominvertorandconnectsection.
8. Dragthe4-bitLEDDisplayonthesheet.
9. Nowconnectbothinputandoutputtothegate.
10. Thenconnectitto4-bitLEDDisplayforoutput.

11. ThenconnecttheAND&NOTgatetothe4-bitLED.
12. 4-bitLEDDisplayshowtheoutputinbinary.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasXandY.
15. LEDwillberepresentedas(X+Y)’.
16. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
17. ONtheswitchXandthenotetheoutput.
18. ThenONtheswitchYandnotetheoutput.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

$(X+Y)'=(X'+Y')=0$

$(X.Y)'=(X'.Y')=$ 1

TruthTable:

X	Y	X’	Y’	(X’+Y’)
0	0	1	1	1
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

Procedure:

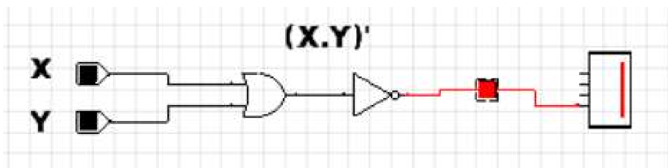
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputAND gate.
3. Dragthegatetothesheet.
4. Gotoinvertorandconnectsectionanddrag2invertorsonsheet.
5. Connectbothinvertorstogate
6. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
8. Select4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Nowconnectbothinputandoutputtothegate.
11. 4-bitLEDDisplayisforoutput.
12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.

14. DecoratetheToggleswitchesasXandY.
15. LEDwillberepresentedas(X’+Y’).
16. 4-bitLEDDisplayshowtheoutputinbinary.
17. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
18. ONtheswitchXandthenotetheoutput.
19. ThenONtheswitchYandnotetheoutput.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

(X+Y)’=(X’+Y’)=0
(X.Y)’=(X’.Y’)= 1

TruthTable:

X	Y	X.Y	(X.Y)’
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

Procedure:

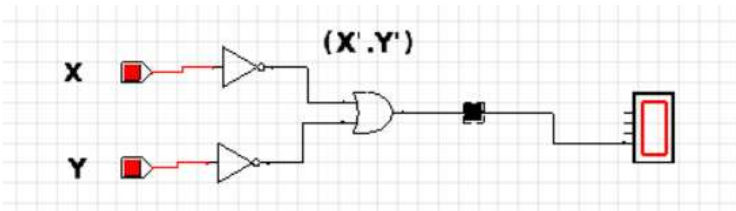
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputORgate.
3. Dragthegatetothesheet.
4. Gototheinvertorandconnectsectionanddragsingleinputinvertor.
5. Connectbothtogether.
6. NowgotoInputandOutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
8. Select4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Nowconnectbothinputandoutputtothegate.
11. Thenconnectitto4-bitLEDDisplayforoutput.
12. ThenconnecttheAND&NOTgatetothe4-bitLED.
13. 4-bitLEDDisplayshowtheoutputinbinary.
14. NowgototheDecorationandplacethetext.
15. DecoratetheToggleswitchesasXandY.
16. LEDwillberepresentedas(X.Y)’.
17. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
18. ONtheswitchXandthenotetheoutput.

19. ThenONtheswitchYandnotetheoutput.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

(X+Y)’=(X’+Y’)=0

(X.Y)’=(X’.Y’)= 1

TruthTable:

X	Y	X’	Y’	(X’.Y’)
0	0	1	1	1
0	1	1	0	0
1	0	0	1	0
1	1	0	0	0

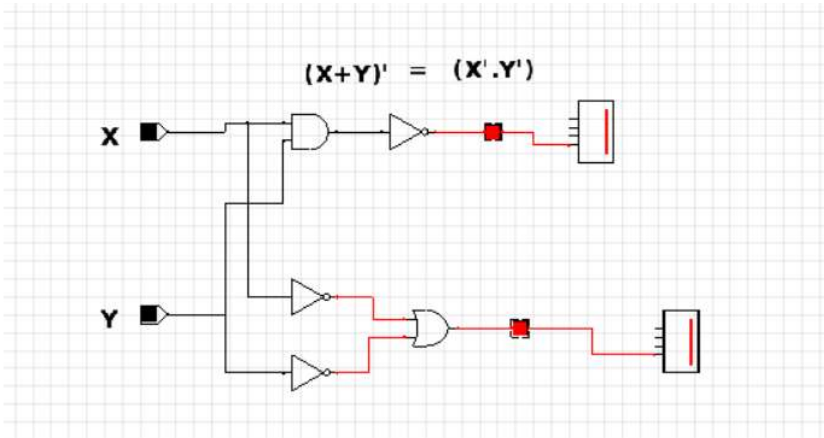
Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputORgate.
3. Dragthegatetothesheet.
4. Gotoinvertorandconnectsectionanddrag2invertorsonsheet.
5. Connectbothinvertorstogate
6. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
8. Select4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Nowconnectbothinputandoutputtothegate.
11. 4-bitLEDDisplayisforoutput.
12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasXandY.
15. LEDwillberepresentedas(X’.Y’).
16. 4-bitLEDDisplayshowtheoutputinbinary.
17. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
18. ONtheswitchXandthenotetheoutput.
19. ThenONtheswitchY andnotetheoutput.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

(X+Y)’=(X’+Y’)=0
(X.Y)’=(X’.Y’)= 1

TruthTable:

X	Y	X’	Y’	(X+Y)	(X+Y)’	(X’.Y’)
0	0	1	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	1	0	0

Procedure:

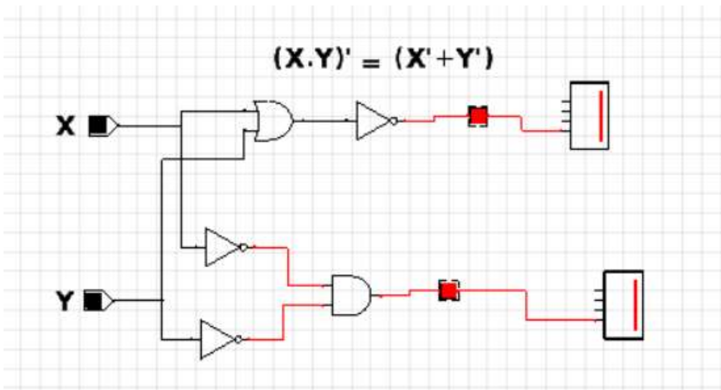
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputOR&ANDgates.
3. Dragthegatetothesheet.
4. Gotoinvertorandconnectsectionanddrag3invertorsonsheet.
5. ConnectoneinvertortoANDgateandtwoinvertorstoORgate.
6. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
8. Selecttwo4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Nowconnectinvertorswithgatesandthen LED.
11. 4-bitLEDDisplayisforoutput.
12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasXandY.
15. 4-bitLEDDisplayshowtheoutputinbinary.
16. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
17. ONtheswitchXandthenotetheoutput.

18. ThenONtheswitchYandnotetheoutput.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



Note:

(X+Y)’=(X’+Y’)=0

(X.Y)’=(X’.Y’)= 1

TruthTable:

X	Y	X’	Y’	X.Y	(X.Y)’	(X’+Y’)
0	0	1	1	0	1	1
0	1	1	0	0	1	1
1	0	0	1	0	1	1
1	1	0	0	1	0	0

Procedure:

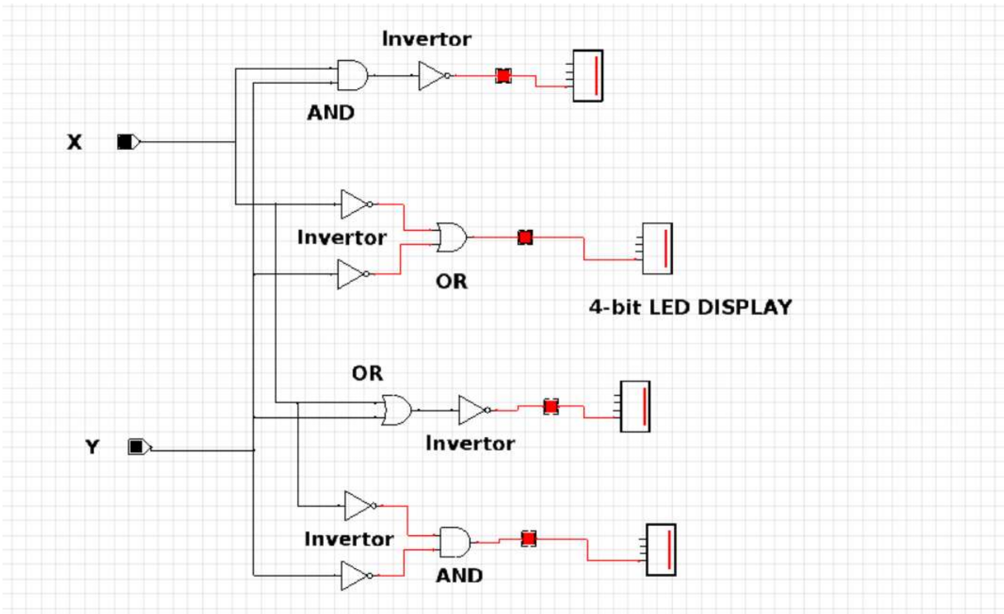
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputOR&ANDgates.
3. Dragthegatetothesheet.
4. Gotoinvertorandconnectsectionanddrag3invertorsonsheet.
5. ConnectoneinvertortoORgateandtwoinvertorstoANDgate.
6. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
8. Selecttwo4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. NowconnectinvertorswithgatesandthenLED.
11. 4-bitLEDDisplayisforoutput.
12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasXandY.
15. 4-bitLEDDisplayshowtheoutputinbinary.
16. Toggletheswitchesonandofftoconfirmthetruthtablevalues.

17. ONtheswitchXandthenotetheoutput.
18. ThenONtheswitchYandnotetheoutput.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



TruthTable:

X	Y	X’	Y’	(X+Y)	(X+Y)’	(X’.Y’)	(X.Y)	(X.Y)’	(X’+Y’)
0	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	0	0	1	1
1	0	0	1	1	0	0	0	1	1
1	1	0	0	1	0	0	1	0	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselecttwo2InputOR&ANDgates.
3. Dragthegatetothesheet.
4. Gotoinvertorandconnectsectionanddrag6invertorsonsheet.
5. ConnectoneinvertortoORgateandtwoinvertorstoANDgate.
6. ConnectoneinvertortoANDgateandtwoinvertorstoORgate.
7. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
8. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.

9. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
10. Dragthe4-bitLEDDisplayonthesheet.
11. NowconnectinvertorswithgatesandthenLED.
12. 4-bitLEDDisplayisforoutput.
13. Thenconnectthecircuitgatetothe4-bitLED.
14. NowgototheDecorationandplacethetext.
15. DecoratetheToggleswitchesasXandY.
16. 4-bitLEDDisplayshowtheoutputinbinary.
17. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
18. ONtheswitchXandthenotetheoutput.
19. ThenONtheswitchYandnotetheoutput.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#5

NANDGATEASUniversalGate

Objective:

ToImplementofNANDGateasuniversalgate.

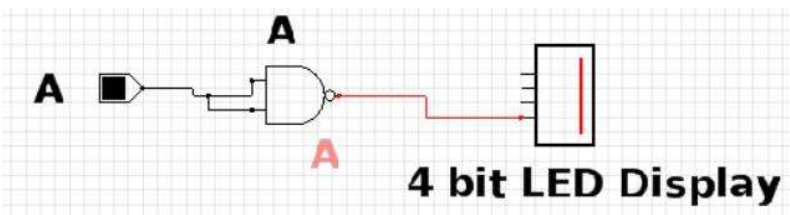
Explanation:

NAND and NOR possess special property. They are universal. That is given either type of gate isable to mimictheoperationofanyothergatetype.679i;itispossibletobuildacircuitexhibitstheORfunction using the interconnected NAND gates. The ability for a single gate type to be ableto mimic any other gate type is one enjoyed by only NAND and NOR. In fact, digital control system has been designed aroundnothingbuteitherNANDandNORgates.Allthenecessarylogicfunctionisbeingderivedfrom collection of interconnected NAND or NOR.

Apparatus:

CEDARLogicSimulator.

Diagram:



EquivalentCircuitusingNANDgate.

TruthTable:

A	A. A	(A.A)’
0	0	1
1	1	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect2InputNANDgates.
3. Dragthegatetothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragonlyoneON\OFFtoggleswitchesandplacethembesidethegate.
6. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
7. Dragthe4-bitLEDDisplayonthesheet.
8. Nowconnectgateandtoswitch.
9. Thenconnectthecircuitgatetothe4-bitLED.
10. NowgototheDecorationandplacethetext.

11. DecoratetheToggleswitchesasX.
12. 4-bitLEDDisplayshowtheoutputinbinary.
13. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
14. ONtheswitchXandthenotetheoutput.
15. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

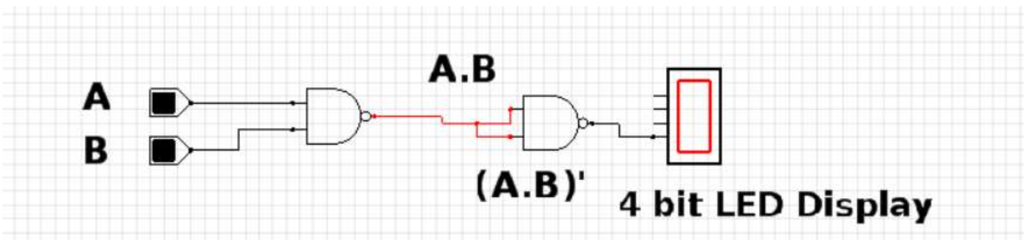
Objective:

ToImplementofNANDGateasuniversalgate.

Apparatus:

CEDARLogicSimulator.

Diagram:



EquivalentCircuitusingNANDgate.

TruthTable:

A	B	(A.B)’	A. B
0	0	1	0
0	1	1	0
1	0	1	0
1	1	0	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselecttwo2InputNANDgates.
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
7. Dragthe4-bitLEDDisplayonthesheet.
8. Nowconnectgateandtoswitch.
9. TheNANDgateisconnectedtootherNANADgate.
10. Thenconnectthecircuitgatetothe4-bitLED.

11. NowgotootheDecorationandplacethetext.
12. DecoratetheToggleswitchesasXandotheras Y.
13. 4-bitLEDDisplayshowtheoutputinbinary.
14. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
15. ONtheswitchXandthenotetheoutput.
16. ONtheswitchYandthenotetheoutput
17. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

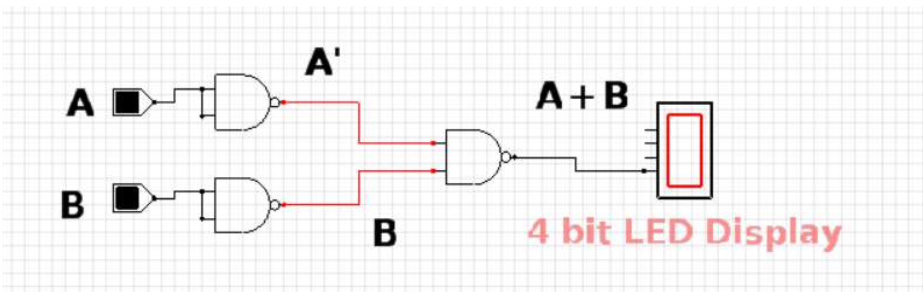
Objective:

ToImplementofNANDGateasuniversalgate.

Apparatus:

CEDARLogicSimulator.

Diagram:



EquivalentCircuitusingNANDgate.

TruthTable:

A	B	A'	B'	A'.B'	(A'.B')'	A+B
0	0	1	1	1	0	0
0	1	1	0	0	1	1
1	0	0	1	0	1	1
1	1	0	0	0	1	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectthree2InputNANDgates.
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
7. Dragthe4-bitLEDDisplayonthesheet.
8. NowconnectswitchAtobothinputsofNAND.

9. RepeatsameprocesswithSwitch Y.
10. ThetwoseparateNANDgateisconnectedtoanothersingleNANDgate.
11. Thenconnectthecircuitgatetothe4-bitLED.
12. NowgototheDecorationandplacethetext.
13. DecoratetheToggleswitchesasXandotheras Y.
14. 4-bitLEDDisplayshowtheoutputinbinary.
15. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
16. ONtheswitchXandthenotetheoutput.
17. ONtheswitchYandthenotetheoutput
18. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#6

ImplementofNANDGateasuniversalgate

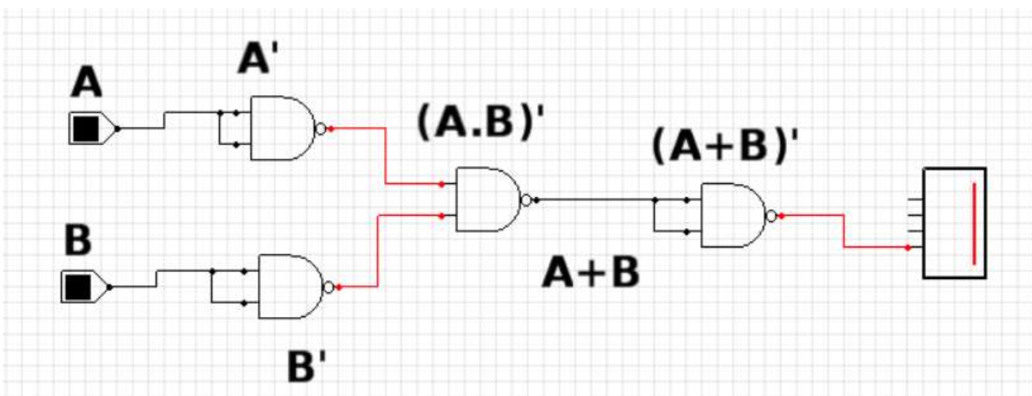
Objective:

ToImplementofNANDGateasuniversalgateusingNORGate.

Apparatus:

CEDARLogicSimulator.

Diagram:



EquivalentCircuitusingNANDgate.

TruthTable

A	B	A’	B’	A’.B’	A+B	(A+B)’
0	0	1	1	1	0	1
0	1	1	0	0	1	0
1	0	0	1	0	1	0
1	1	0	0	0	1	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectfour2InputNANDgates.
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragtwoON\OFFtoggleswitchesandplacethembesidethegate.
6. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
7. Dragthe4-bitLEDDisplayonthesheet.
8. NowconnectswitchAtobothinputsoffirstsingle NAND.
9. RepeatsameprocesswithSwitchYandconnectittosecondNAND.
10. ThetwoseparateNANDgateisconnectedtoanothersingleNAND.
11. NowtheoutputofthirdNANDisconnectedtobothinputogfourthNANDgate

12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasXandotheras Y.
15. 4-bitLEDDisplayshowtheoutputinbinary.
16. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
17. ONtheswitchXandthenotetheoutput.
18. ONtheswitchYandthenotetheoutput
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

ExperimentsAfterMIDTerms

Experiment#7

IntroductionofK-Map(KarnaughMap)

Inmanydigitalcircuitsand practicalproblems,weneedtofindexpressionswithminimum variables.WecanminimizetheBooleanexpressionof3,4variablesveryeasilyusingk-map withoutusinganyBooleanalgebratheorems.K-MapcantaketwoformsSumofProduct(SOP) andProductofSum(POS)accordingtotheneedofproblem.K-Maptableislikerepresentation but it gives more information than TRUTH TABLE. We will grid of K-Map with 0's and 1's then solveitbymake groups.

Steptosolveexpressionusingk-map:

- SelectK-Mapaccordingtothenumbersofvariables.
- Identifymintermsandmaxtermsgivenintheproblem.
- ForSOPput1'sintheblocksofk-maprespectivetotheminterms(0'selsewhere).
- ForPOSput0'sintheblocksofk-maprespectivetothemaxterms(1'selsewhere).
- Makerectangulargroupscontainingtotaltermsofpowerintwolike2,4,8except1andtryto cover as many elements as you can in one group.
- Fromthegroupmadeinstep5findtheproducttermsandsumthemupforSOPform

2Variables

F=A'B+AB'+AB

Objective:

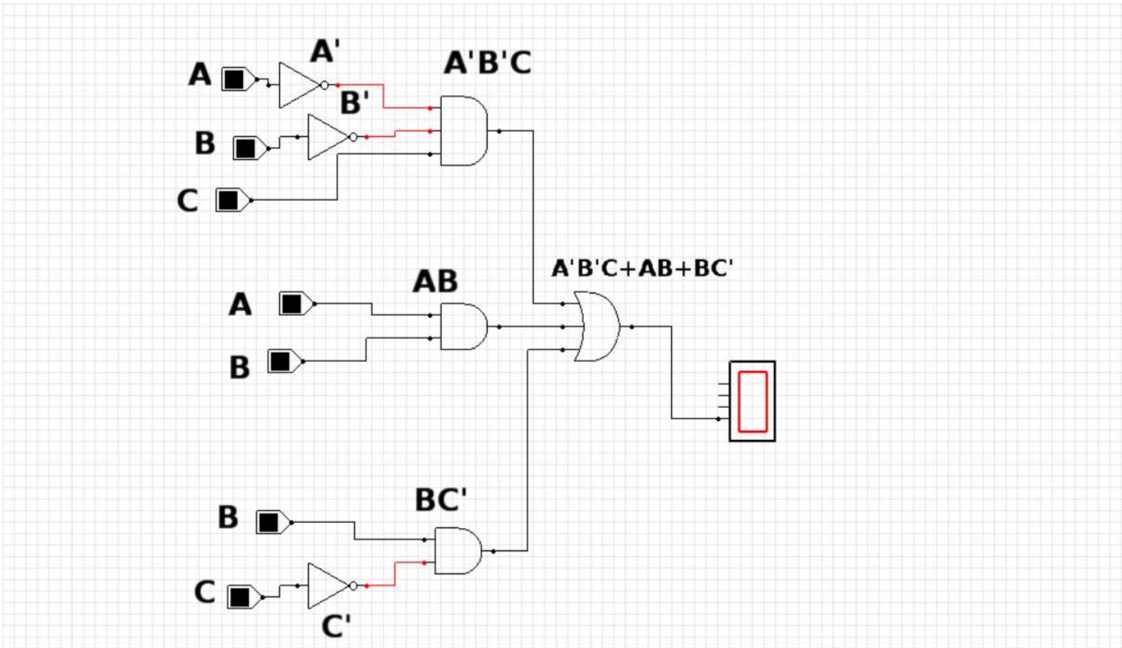
MakingcircuitofBooleanfunctionusingK-Map. A'B'C+AB+BC' =

A'B'C+ A'BC'+ ABC'+ ABC

Apparatus:

CEDARLogicSimulator.

Diagram:



TruthTable:

A	B	C	A’	B’	C’	A. B	B.C’	A’.B’.C	B.C’+A.B	OUTPUT
0	0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	0	1	0	0
0	1	0	1	0	1	0	1	0	0	0
0	1	1	1	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0	0	0
1	0	1	0	1	0	0	0	0	0	0
1	1	0	0	0	1	1	1	0	1	0
1	1	1	0	0	0	1	0	0	0	0

Procedure:

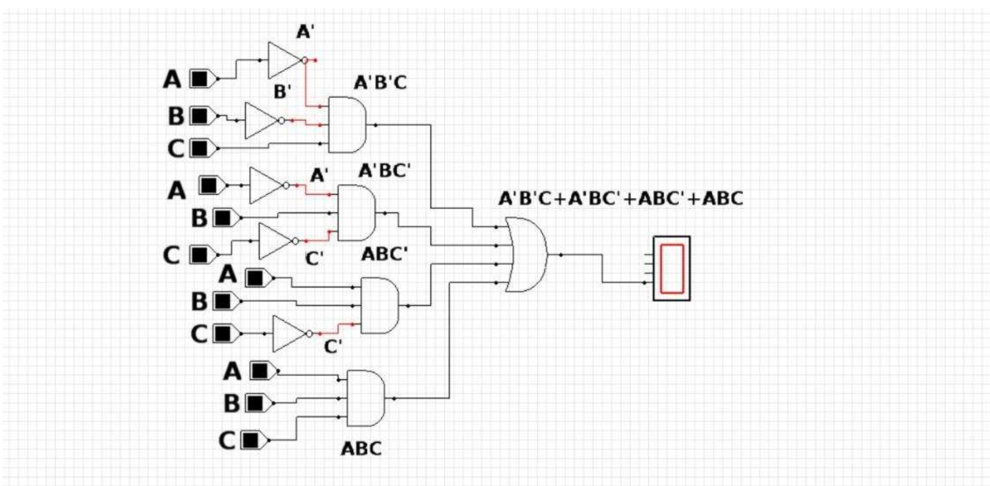
1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselecttwo2Inputandone3inputANDgates.
3. Alsoselect3inputORgate.
4. Dragthegatestothesheet.
5. Alsoselect3invertersandplaceeachtodestinedswitch.
6. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
7. DragsevenON\OFFtoggleswitchesandplacethembesidethegates.
8. Nowconnectallswitchestogates.
9. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
10. Dragthe4-bitLEDDisplayonthesheet.

11. ThreeANDgateisconnectedtoasingle3-inputORgate.
12. Thenconnectthecircuitgatetothe4-bitLED.
13. NowgototheDecorationandplacethetext.
14. DecoratetheToggleswitchesasA,BandC
15. 4-bitLEDDisplayshowtheoutputinbinary.
16. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
17. ONtheswitchAandthenotetheoutput.
18. ONtheswitchBandthenotetheoutput.
19. ONtheswitchCandthenotetheoutput.
20. Nowtrytonoteoutputwhileallswitchesare ON.
21. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Apparatus:

CEDARLogicSimulator.

Diagram:



TruthTable:

A	B	C	A’	B’	C’	A’B’C	A’BC’	ABC’	ABC	OUTPUT
0	0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	1	0	0	0	0
0	1	0	1	0	1	0	1	0	0	0
0	1	1	1	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0	0	0
1	0	1	0	1	0	0	0	0	0	0
1	1	0	0	0	1	0	0	1	0	0
1	1	1	0	0	0	0	0	0	1	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectfour3InputANDandone4inputORgates.
3. Dragthegatestothesheet.
4. Alsoselect5invertersandplaceeachtodestinedswitch.
5. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
6. DragtwelveON\OFFtoggleswitchesandplacethembesidethegates.
7. Nowconnectallswitchestogates.
8. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Four3inputANDgateisconnectedtoasingle4-inputORgate.
11. Thenconnectthecircuitgatetothe4-bitLED.
12. NowgototheDecorationandplacethetext.
13. DecoratetheToggleswitchesasA,BandC
14. 4-bitLEDDisplayshowtheoutputinbinary.
15. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
16. ONtheswitchAandthenotetheoutput.
17. ONtheswitchBandthenotetheoutput.
18. ONtheswitchCandthenotetheoutput.
19. Nowtrytonoteoutputwhileallswitchesare ON.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#8

Objective:

ImplementBinarytoGraycodeconversion

BinaryCode:

A binary code represents text, computer processor instructions, or any other data using two-symbol system.Thetwo-symbolledsystemusedisoften“0”and“1”fromthebinarynumbersystem.Thebinary code assigns a pattern of binary digits, also known as bits, to each character, instructions etc.

GrayCode:

Thereflectedbinarycode,alsoknownjustasreflectedbinaryorgraycodeafterFeankGray,isan orderingof the binary numeral system such thattwo successive values differ inonly onebit. For example,therepresentationofdecimalvalue“1”inbinarywouldnormallybe“001”and“2”wouldbe “101”.

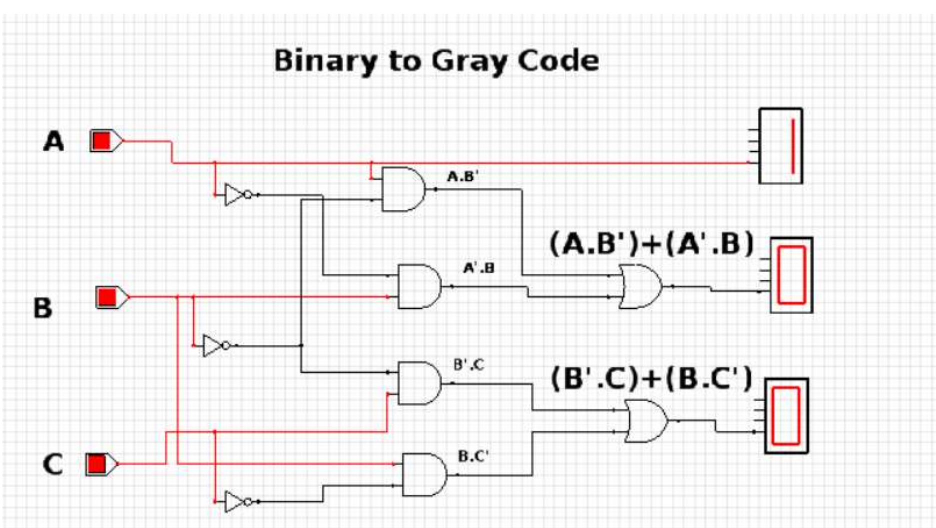
BinarytoGraycodeconversion:

Thelogiccircuitwhichconvertsthebinarycodetoequivalentgraycodeisknownasbinarytograycode conversion. An n-bit can be obtained by reflecting an n-1 bit code about an axis after 2n-1 rows and putting the MSB of 0 above the axis and MSB of 1 below the axis.

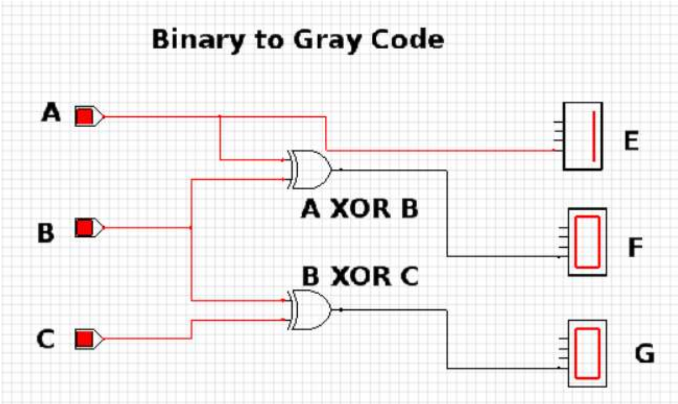
Apparatus:

CEDARLogicSimulator.

Diagram:



AlternativeDiagram:



TruthTable:

A	B	C	A'	B'	C'	AB'	A'B	B'C	BC'	AB'+A'B	B'C+BC'
0	0	0	1	1	1	0	0	0	0	0	0
0	0	1	1	1	0	0	0	1	0	0	1
0	1	0	1	0	1	0	1	0	1	1	1
0	1	1	1	0	0	0	1	0	0	1	0
1	0	0	0	1	1	1	0	0	0	1	0
1	0	1	0	1	0	1	0	1	0	1	1
1	1	0	0	0	1	0	0	9	0	0	0
1	1	1	0	0	0	0	0	9	0	0	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectfour2InputANDandtwo2inputORgates.
3. Dragthegatestothesheet.
4. Alsoselect3invertersandplaceeachtodestinedswitch.
5. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
6. DragthreeON\OFFtoggleswitchesandplacethembesidethegates.
7. Nowconnectallswitchestogates.
8. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Three2inputANDgatesconnectedtotwo2inputORgates.
11. Thenconnectthecircuitgatetothe4-bitLED.
12. NowgototheDecorationandplacethetext.
13. DecoratetheToggleswitchesasA,BandC.
14. 4-bitLEDDisplayshowtheoutputinbinary.
15. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
16. ONtheswitchAandthenotetheoutput.
17. ONtheswitchBandthenotetheoutput.

18. ONtheswitchCandthenotetheoutput.
19. Nowtrytonoteoutputwhileallswitchesare ON.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot.

Experiment#9

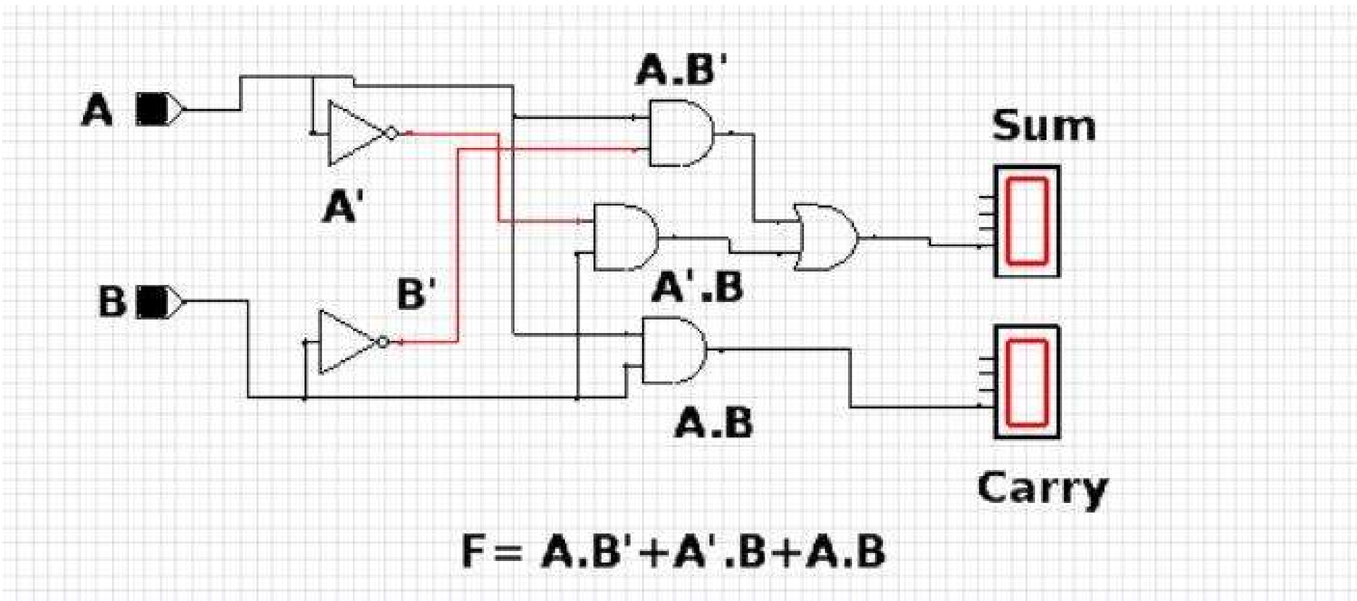
Objective:

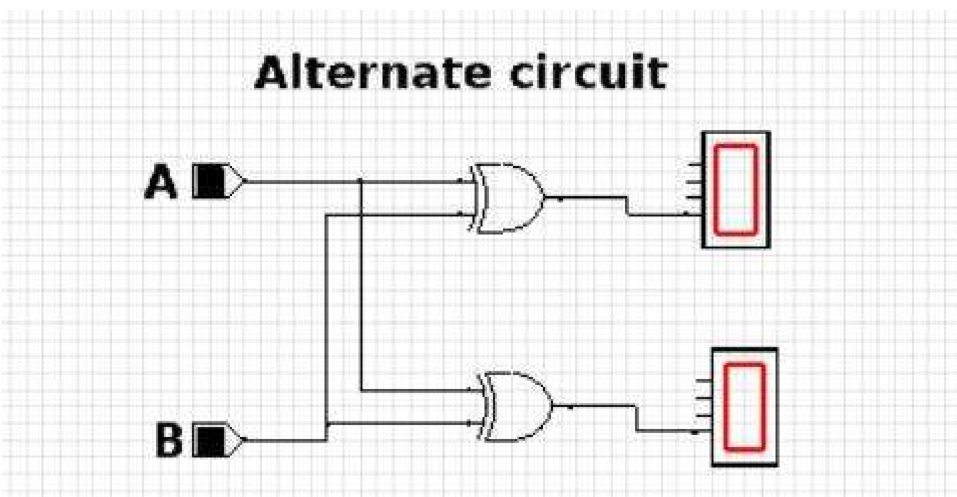
To implement or verify the half Adder circuit.

Apparatus:

CEDAR LOGIC SIMULATOR

Diagram:





A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectfour2InputANDandtwo1inputORgates.
3. Dragthegatestothesheet.
4. Alsoselect2invertersandplaceeachtodestinedswitch.
5. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
6. DragthreeON\OFFtoggleswitchesandplacethembesidethegates.
7. Nowconnectallswitchestogates.
8. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
9. Dragthe4-bitLEDDisplayonthesheet.
10. Three2inputANDgatesconnectedtotwo2inputORgates.
11. Thenconnectthecircuitgatetothe4-bitLED.
12. NowgototheDecorationandplacethetext.
13. DecoratetheToggleswitchesasA,BandC.
14. 4-bitLEDDisplayshowtheoutputinbinary.
15. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
16. ONtheswitchAandthenotetheoutput.
17. ONtheswitchBandthenotetheoutput.
18. ONtheswitchCandthenotetheoutput.
19. Nowtrytonoteoutputwhileallswitchesare ON.
20. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot

Experiment#10

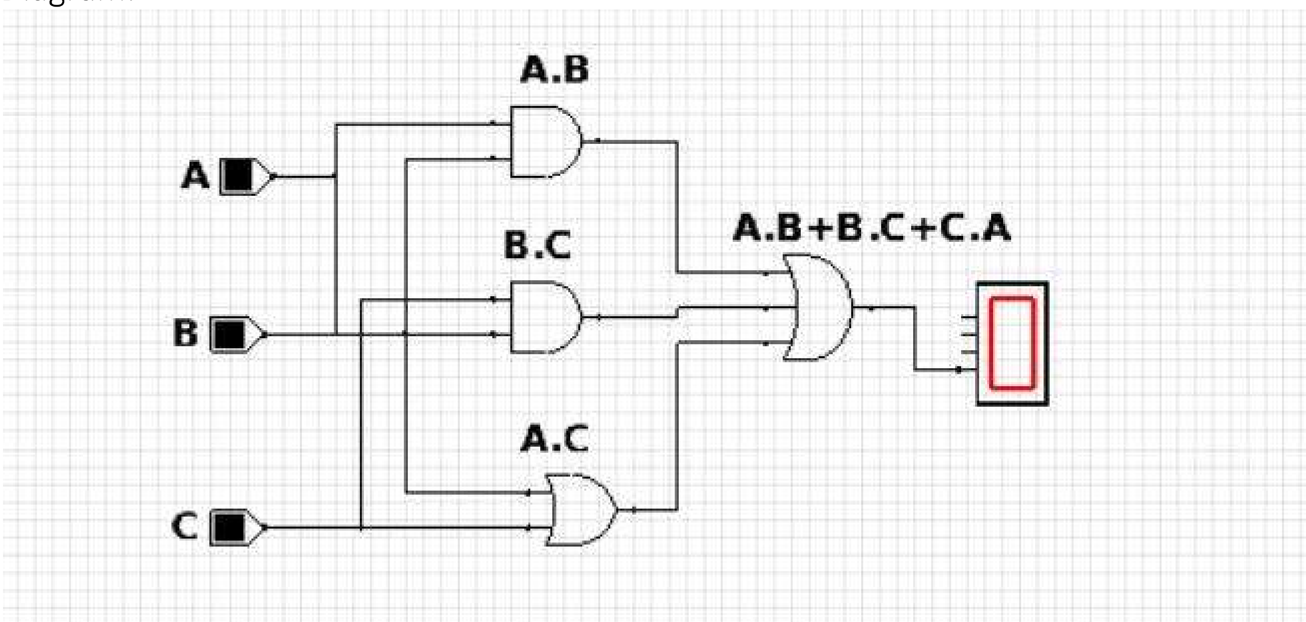
Objective:

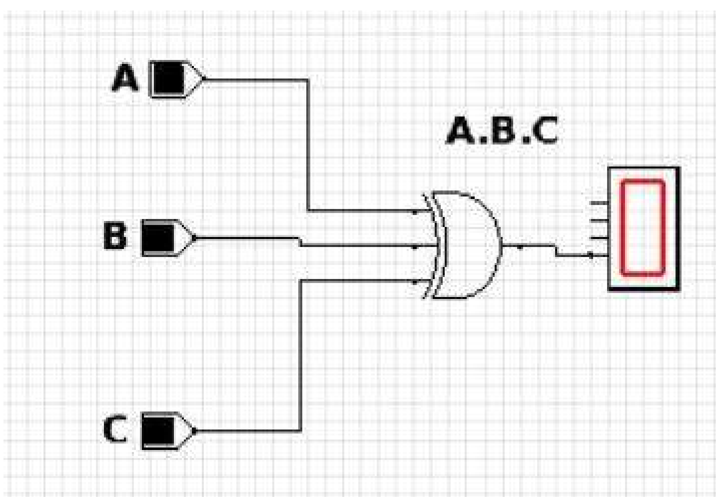
To implement or verify the full Adder circuit.

Apparatus:

CEDAR LOGIC SIMULATOR

Diagram:





A	B	C	A.B	B.C	A.C	A.B+B.C+A.C
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	1	0	1
1	0	0	0	0	0	0
1	0	1	0	0	1	1
1	1	0	1	0	0	1
1	1	1	1	1	1	1

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselect3inputXNORgatee
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegates.
6. Nowconnectallswitchestogates.
7. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
8. Dragthe4-bitLEDDisplayonthesheet.
9. Three2inputANDgatesconnectedtotwo2inputORgates.
10. Thenconnectthecircuitgatetothe4-bitLED.
11. NowgototheDecorationandplacethetext.
12. DecoratetheToggleswitchesasA,BandC.
13. 4-bitLEDDisplayshowtheoutputinbinary.
14. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
15. ONtheswitchAandthenotetheoutput.
16. ONtheswitchBandthenotetheoutput.
17. ONtheswitchCandthenotetheoutput.
18. Nowtrytonoteoutputwhileallswitchesare ON.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot

Experiment#11

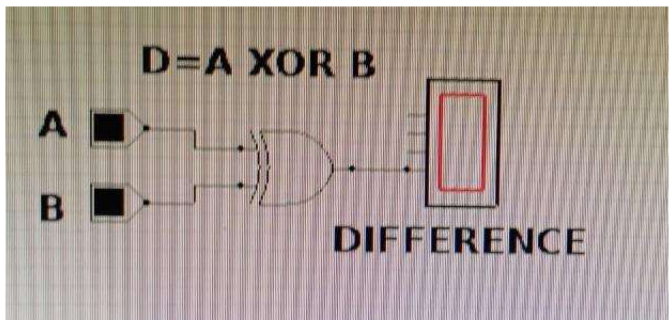
Objective:

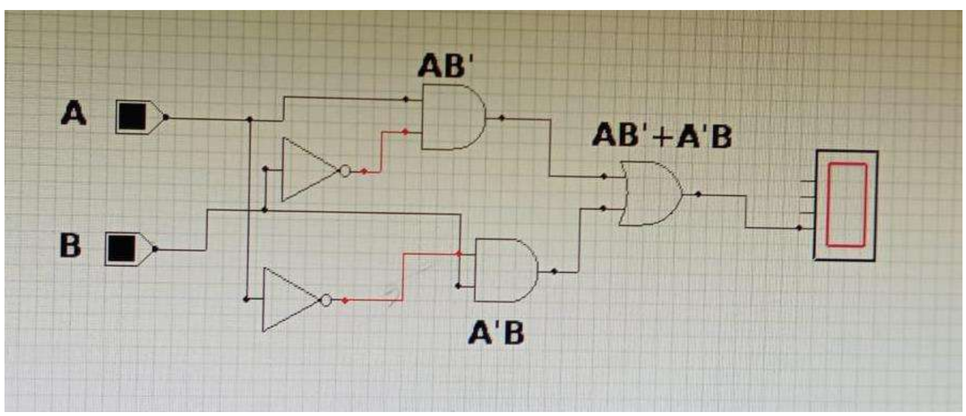
To implement or verify the half subtractor circuit using AND & OR Gate

Apparatus:

CEDAR LOGIC SIMULATOR

Diagram:





A	B	D	B
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselecttwo2inputANDgatee
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegates.
6. Nowconnectallswitchestogates.
7. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
8. Dragthe4-bitLEDDisplayonthesheet.
9. Two2inputANDgatesconnectedtoone2inputORgates.
10. Thenconnectthecircuitgatetothe4-bitLED.
11. NowgototheDecorationandplacethetext.
12. DecoratetheToggleswitchesasA,BandC.
13. 4-bitLEDDisplayshowtheoutputinbinary.
14. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
15. ONtheswitchAandthenotetheoutput.
16. ONtheswitchBandthenotetheoutput.
17. ONtheswitchCandthenotetheoutput.
18. Nowtrytonoteoutputwhileallswitchesare ON.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot

Conclusion:

Implementing a half subtractor in Cedar logic provides efficient subtraction capability with low power consumption and high-speed operation. Cedar's modular design and hierarchical support make integration seamless, enabling robust digital systems with enhanced efficiency and reliability.

Experiment#12

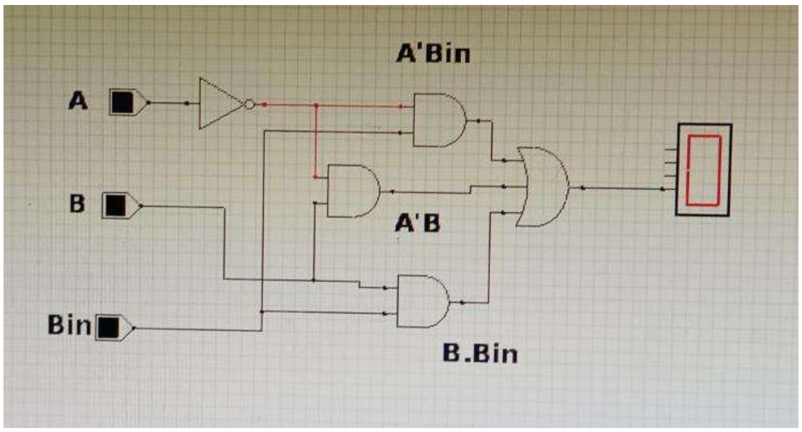
Objective:

To implement or verify the full subtractor circuit using AND & OR Gate

Apparatus:

CEDAR LOGIC SIMULATOR

Diagram:



A	B	bin	D	b-out
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	0	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Conclusion:

Implementing a full subtractor in Cedar logic delivers efficient subtraction with optimized performance. Cedar's design principles ensure low power consumption and high-speed operation, facilitating seamless integration into complex digital systems for reliable functionality.

Procedure:

1. OpenCEDARlogicsimulator.
2. GotoBasicgatesandselectthree2inputANDgatee
3. Dragthegatestothesheet.
4. NowgotoInputandoutputSectionandselectON\OFFtoggleswitchesanddragthemonthe sheet.
5. DragthreeON\OFFtoggleswitchesandplacethembesidethegates.
6. Nowconnectallswitchestogates.
7. Selectfour4-bitLEDDisplayfrominvertorandconnectsection.
8. Dragthe4-bitLEDDisplayonthesheet.
9. Three2inputANDgatesconnectedtotwo2inputORgates.
10. Thenconnectthecircuitgatetothe4-bitLED.
11. NowgototheDecorationandplacethetext.
12. DecoratetheToggleswitchesasA,BandC.
13. 4-bitLEDDisplayshowtheoutputinbinary.
14. Toggletheswitchesonandofftoconfirmthetruthtablevalues.
15. ONtheswitchAandthenotetheoutput.
16. ONtheswitchBandthenotetheoutput.
17. ONtheswitchCandthenotetheoutput.
18. Nowtrytonoteoutputwhileallswitchesare ON.
19. Comparetheoutputofthegatewiththetruthtabletoseeifitiscorrectornot