# SNS COLLEGE OF TECHNOLOGY

**Coimbatore-35**
**An Autonomous Institution**

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

# DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

# 19ECB231 – DIGITAL ELECTRONICS

NAND- NOR Implementation /19ECB231/ DIGITAL ELECTRONICS/K.SURIYA,AP/ECE/SNSCT

## II YEAR/ III SEMESTER

## UNIT 1 – MINIMIZATION TECHNIQUES AND LOGIC GATES

## TOPIC – NAND-NOR IMPLEMENTATION

# NAND and NOR implementation

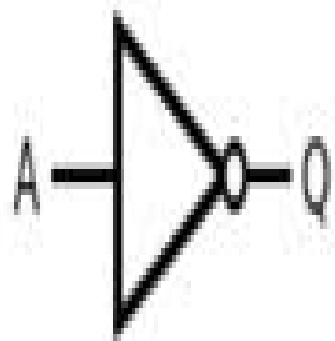> ➢ Any Boolean function can be created using AND OR and NOT gates.

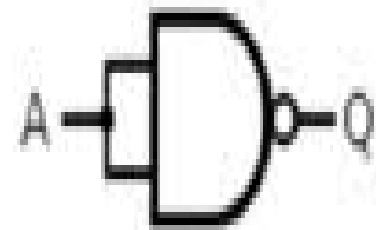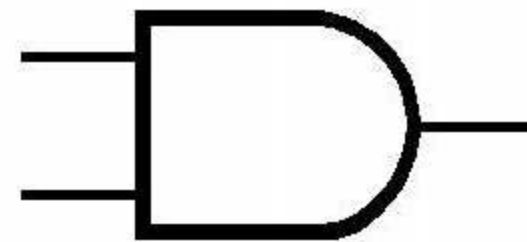> ➢ AND, OR and NOT gates can be implemented using NAND and NOR gates.

➤ A NAND gate with single input acts like a NOT gate.

➤ As a NAND gate is the invert of AND so by putting an inverter on the output of NAND we can have AND gate.
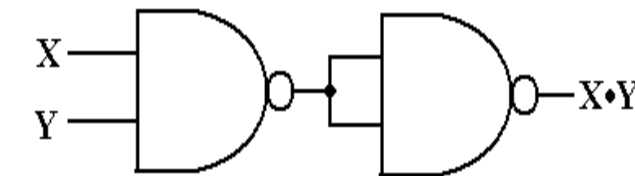
NOT gate
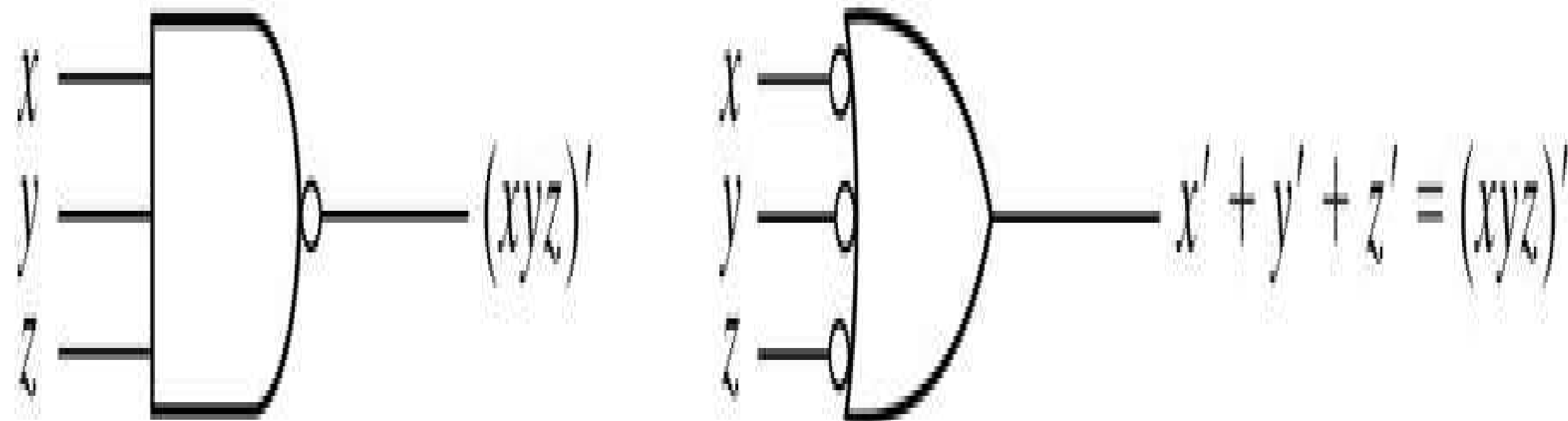
NAND construction of NOT gate

AND Gate

NAND Construction of ANDG ate
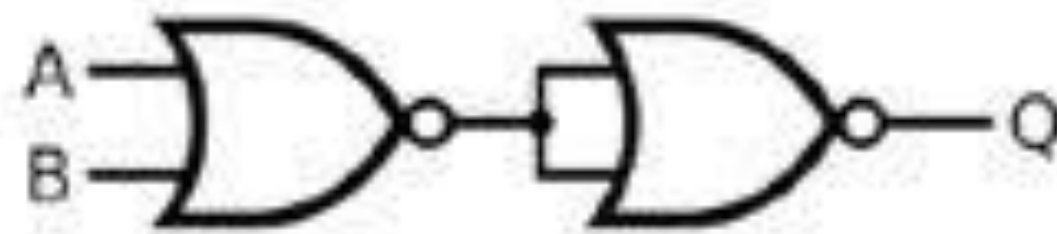
# Symbolic Equivalence of NAND Gate

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➢As NOR is the invert of OR gate so by putting an inverter in the output of NOR we get OR gate
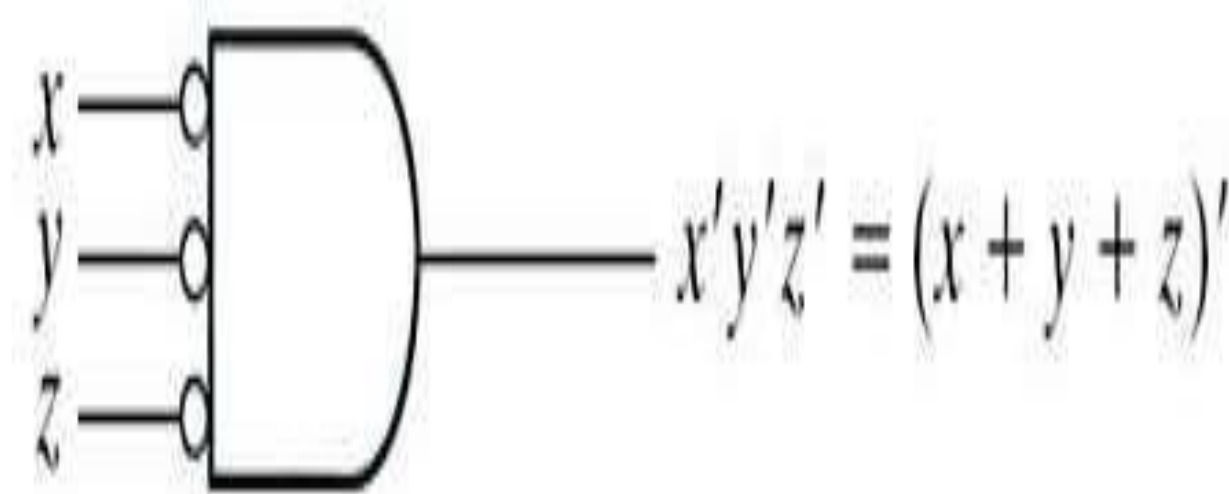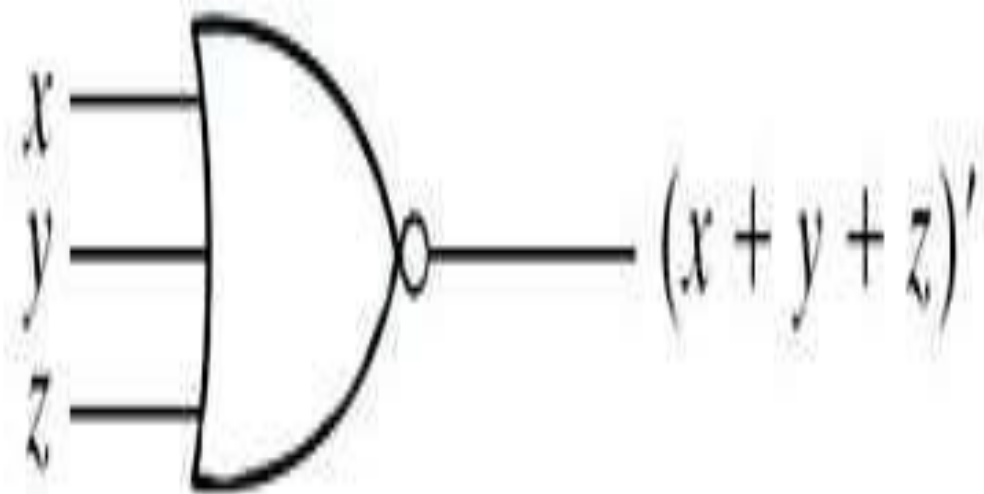
OR gate

NOR implementation of OR gate

# Graphical equivalence of NOR gate

➢By De Morgan's Law we can describe NOR gate graphically by the following symbols



$(x + y + z)'$      $x'y'z' = (x + y + z)'$

NAND - NOR Implementation:-

NAND - NAND Implementation:-

NAND = Bubbled OR   (According to De morgan's theorem)



$$\overline{ABC} \equiv \overline{A} + \overline{B} + \overline{C}$$

procedure:-

(i) Simplify the given logical expression and convert it in the sop form.

(ii) Draw the AND - OR - NOT realization.

(iii) Replace every AND gate by a NAND, every OR gate by a bubbled OR gate & NOT gate by a NAND inverter

(iv) finally draw the circuit using only NAND gates

# Example

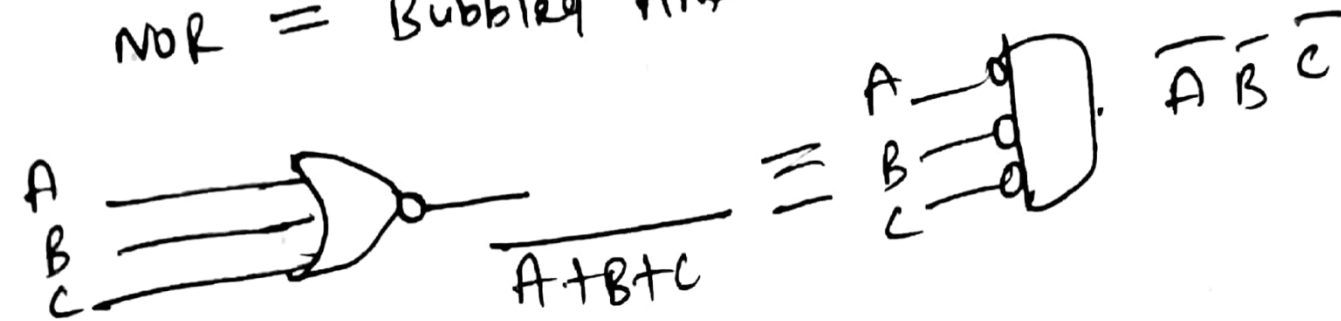Implement the following Boolean function using only NAND gates.

$$Y = AB + CDE + F$$

(i)



$$Y = AB + CDE + F$$

(ii)



$Y$

(iv)

$$Y = \overline{(\overline{AB})\,(\overline{CDE})\,(\overline{F})}$$

$$= AB + CDE + F$$
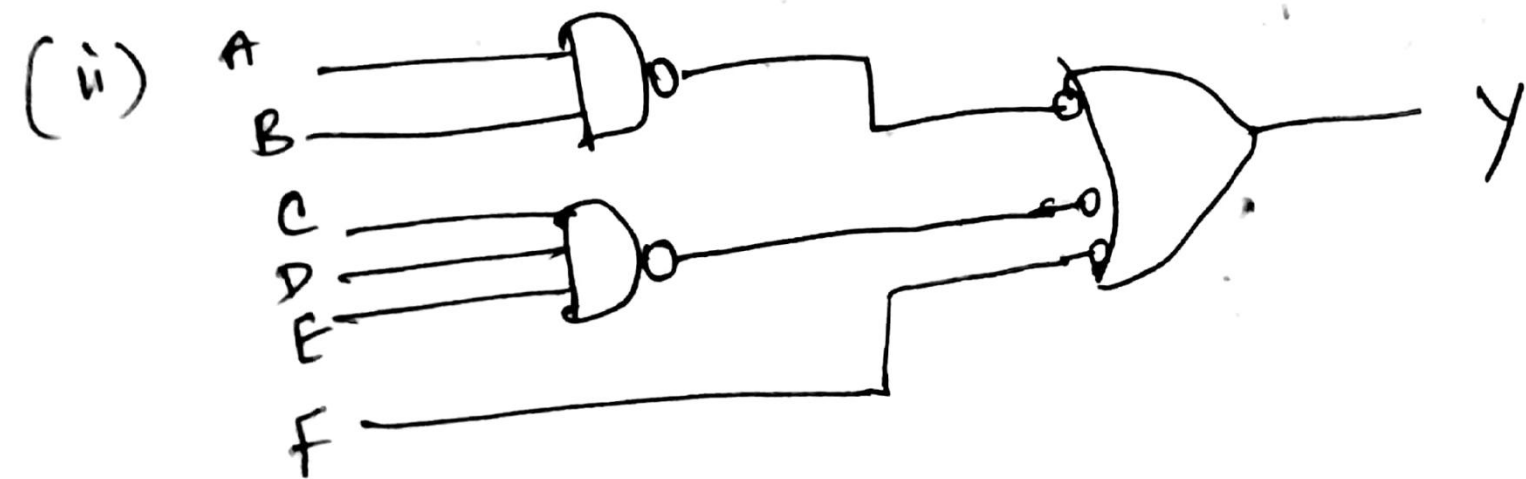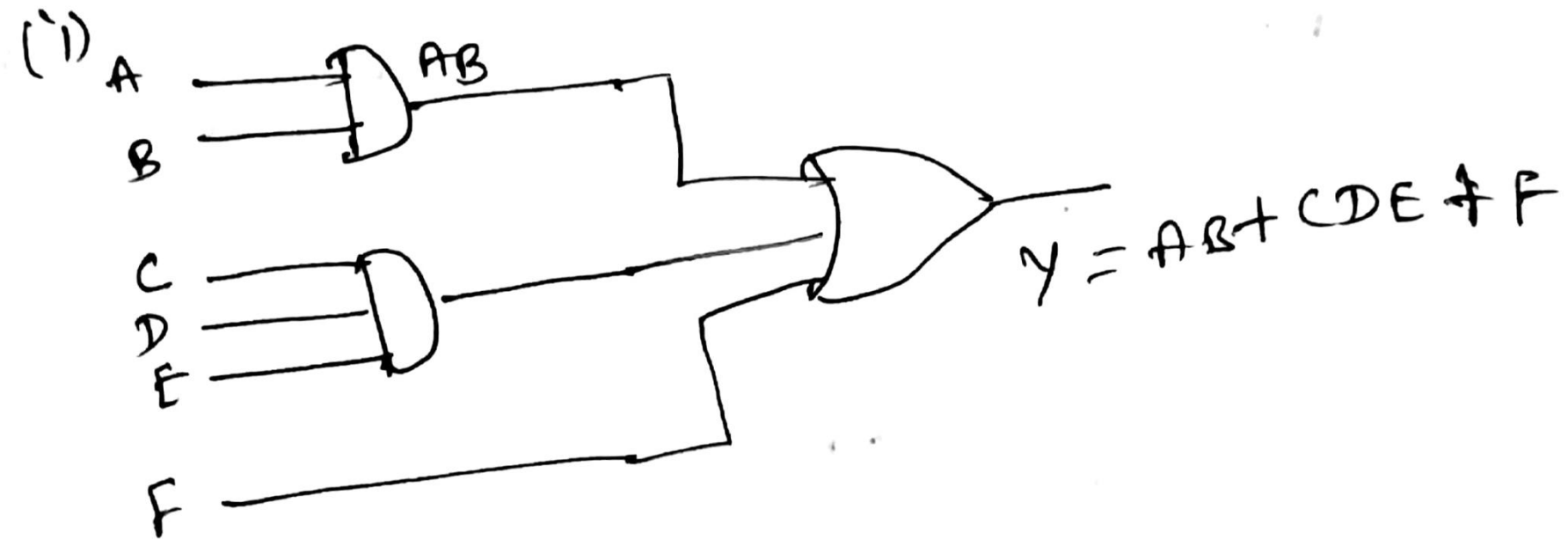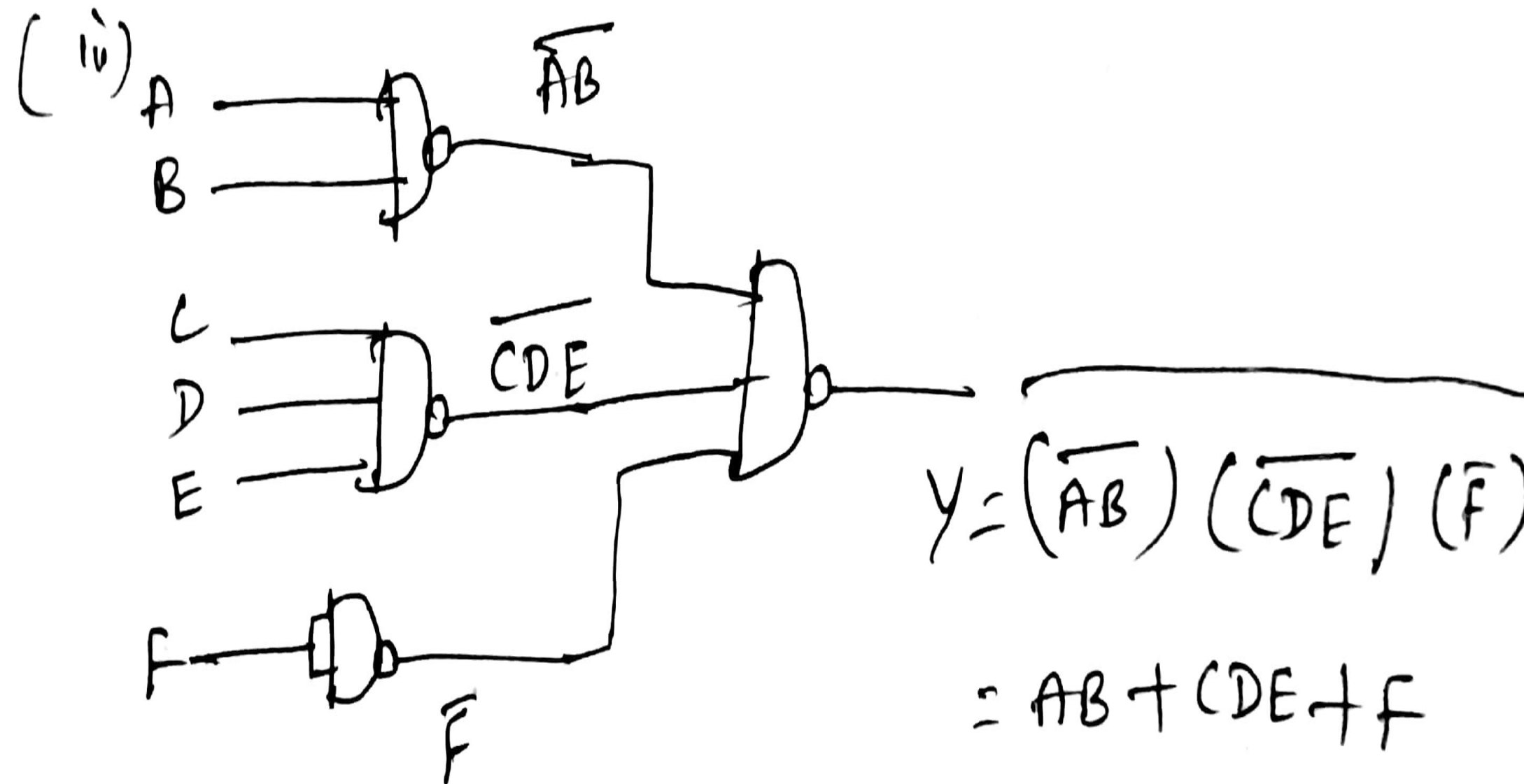
# NOR - NOR Implementation :-

NOR = Bubbled AND



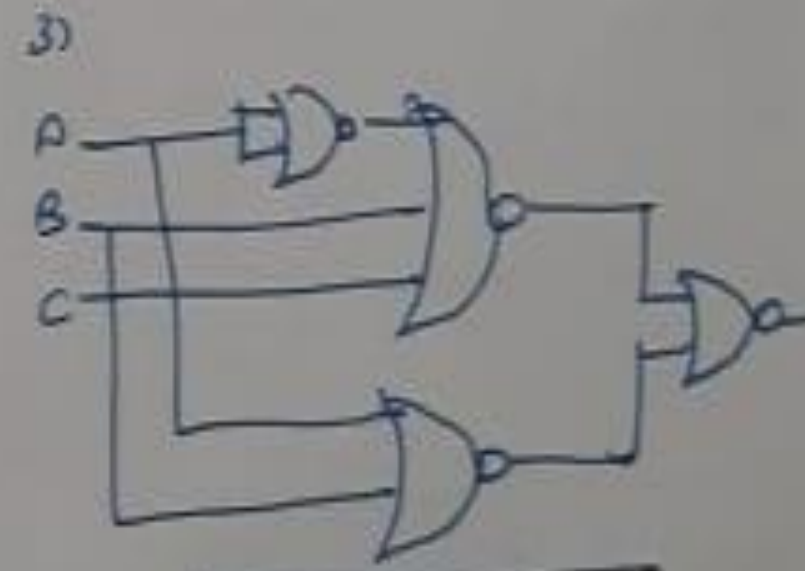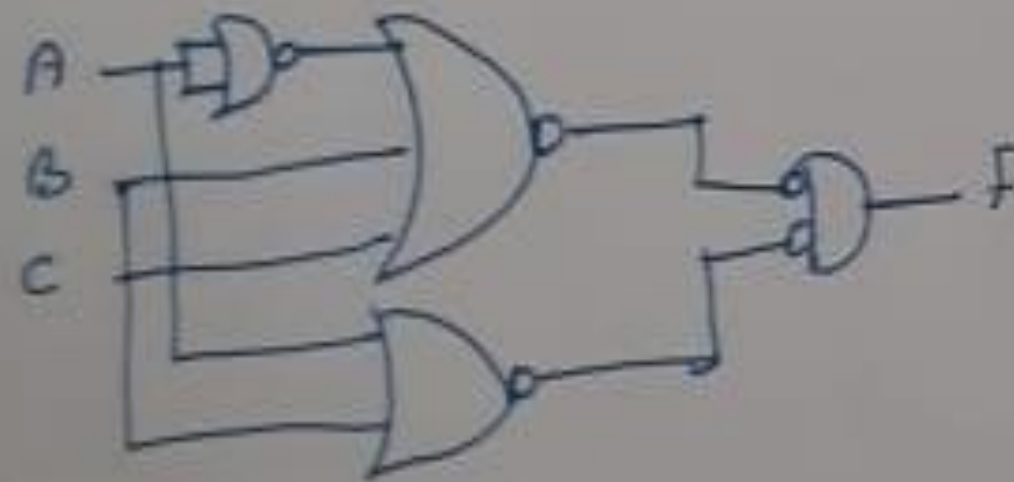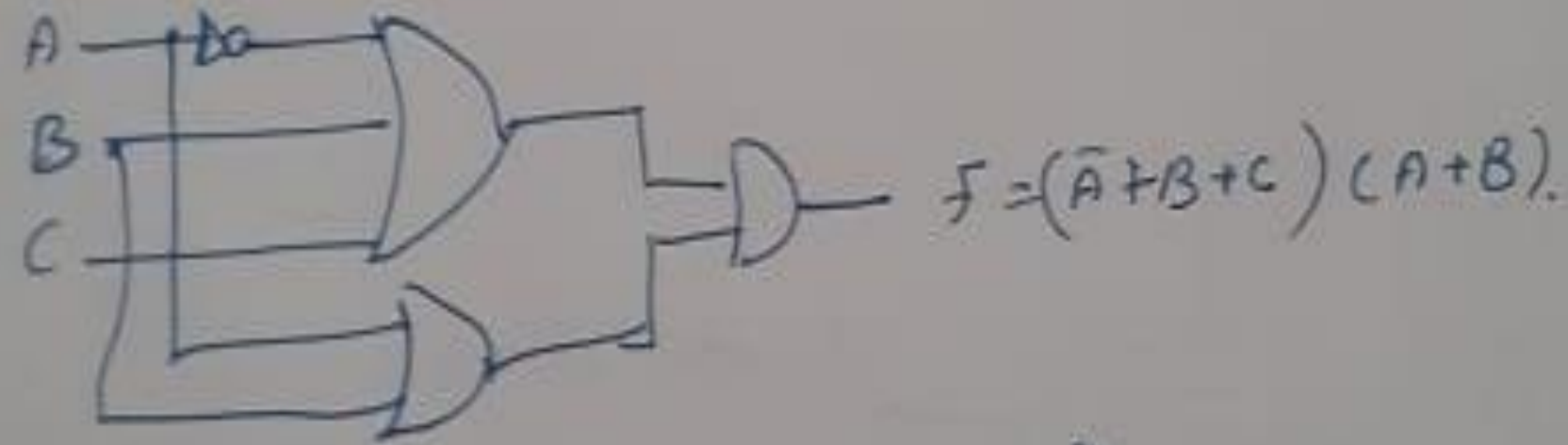$$\overline{A+B+C} \equiv \overline{A}\,\overline{B}\,\overline{C}$$

## Procedure

(i) expression convert it into POS form.

(ii) draw AND-OR-NOT realization

(iii) Replace every OR gate by NOR, AND by a bubbled AND gate and inverter by a NOR inverter

(iv) Finally, draw the final circuit using only the NOR gate.

eg : $(\bar{A} + B + C)(A + B)$



$f = (\bar{A} + B + C)(A + B).$



F

3)



$f = \overline{(\bar{A} + B + C)} + \overline{(A + B)}$

$(\bar{A} + B + C) \cdot (A + B)$

# THANK YOU