



# **SNS COLLEGE OF TECHNOLOGY**

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



Accredited by NBA – AICTE and Accredited by NAAC – UGC with ‘A++’ Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB231 – DIGITAL ELECTRONICS**

II YEAR/ III SEMESTER

UNIT 1 – MINIMIZATION TECHNIQUES AND LOGIC GATES

TOPIC 9– NAND-NOR IMPLEMENTATION

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## NAND and NOR implementation



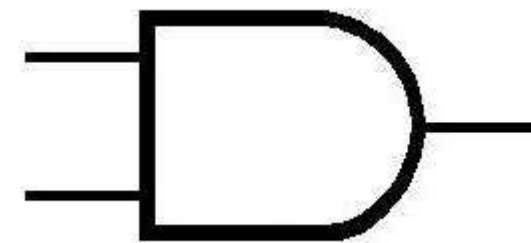
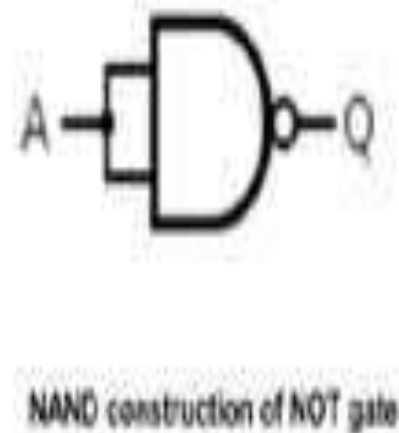
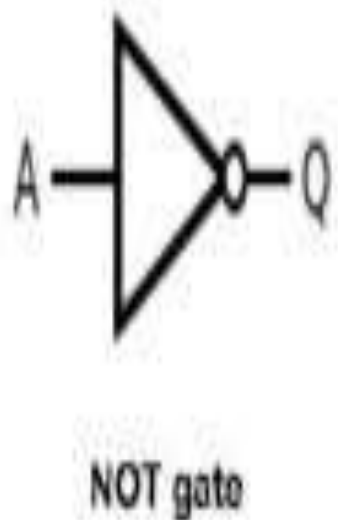
- Any Boolean function can be created using AND OR and NOT gates.
- AND, OR and NOT gates can be implemented using NAND and NOR gates.



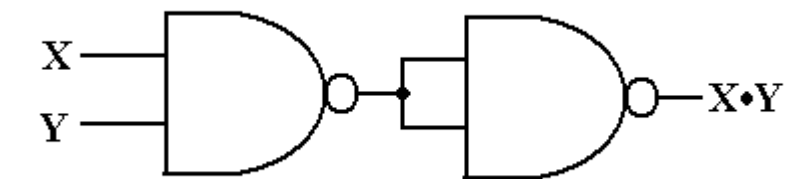
## NAND implementation - Implementation of NOT and AND using NAND gate



- 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.

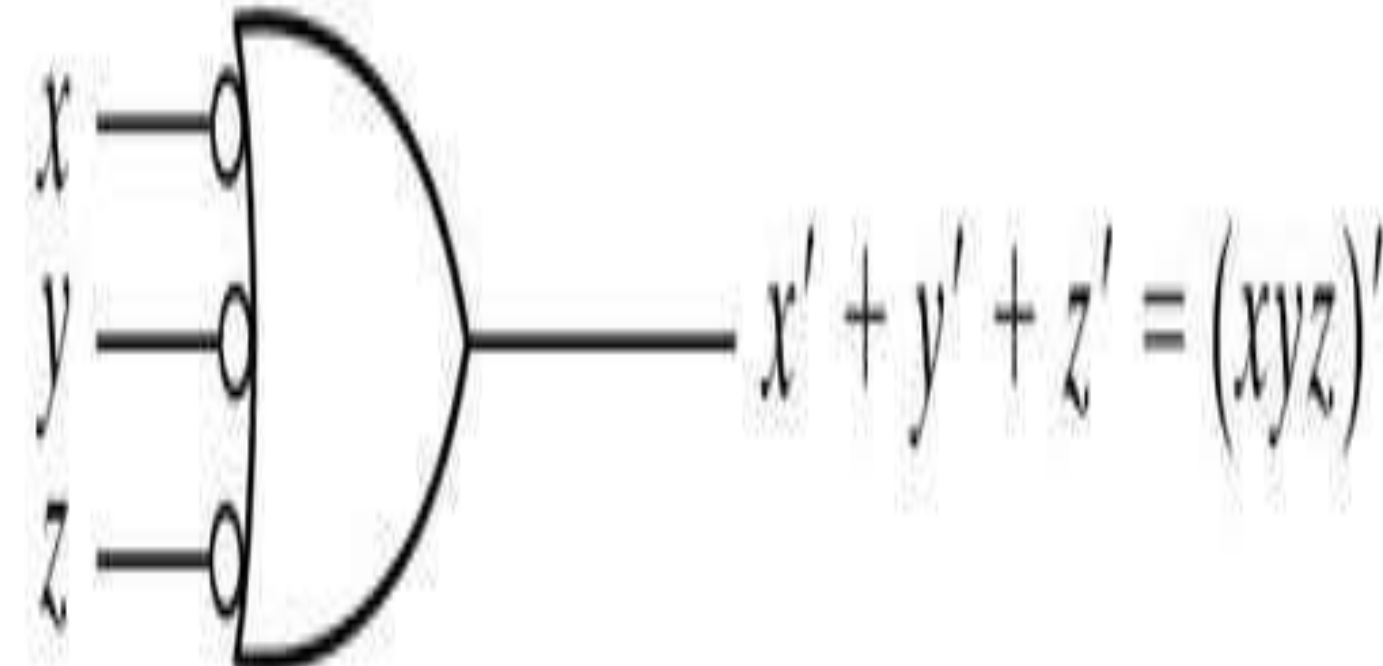
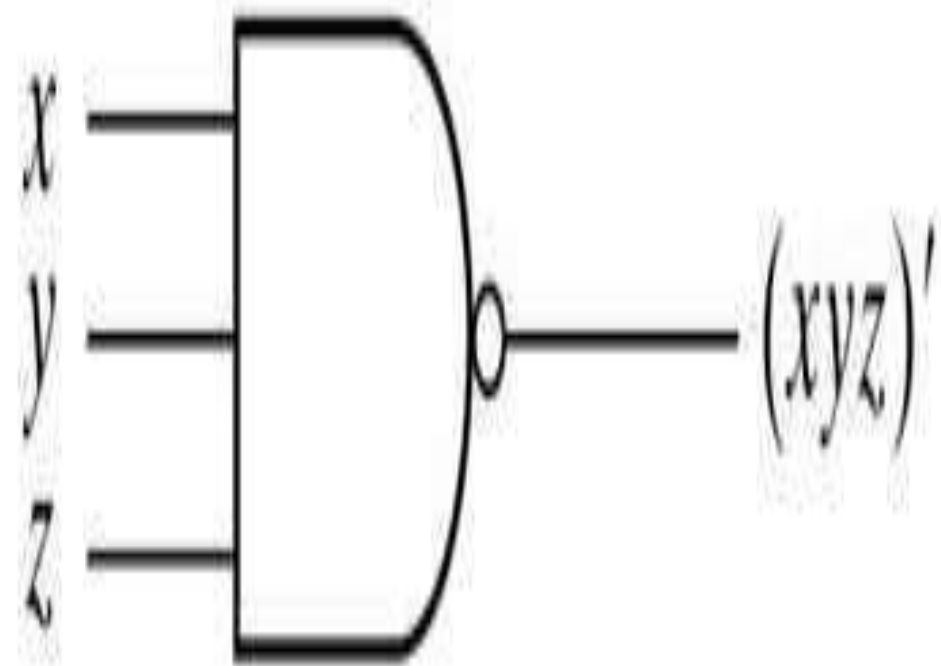


AND Gate





# Symbolic Equivalence of NAND Gate

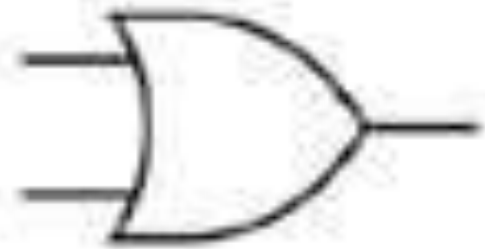




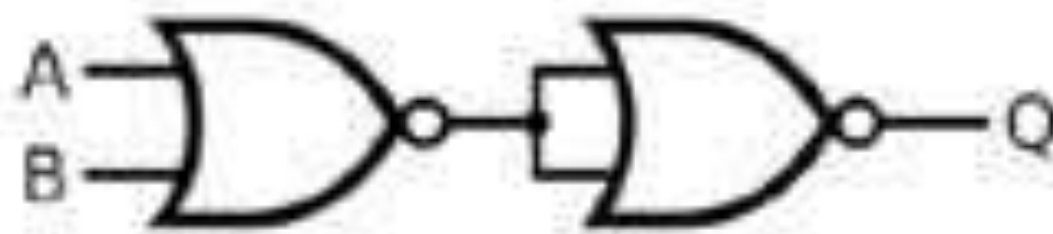
## NOR implementation - Implementation of OR gate using NOR gate



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



OR gate



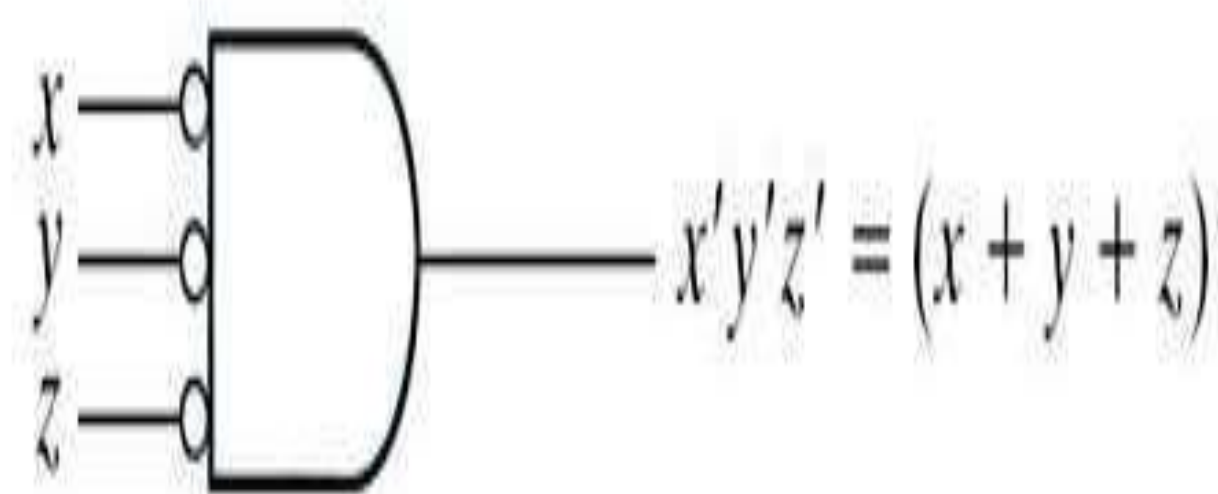
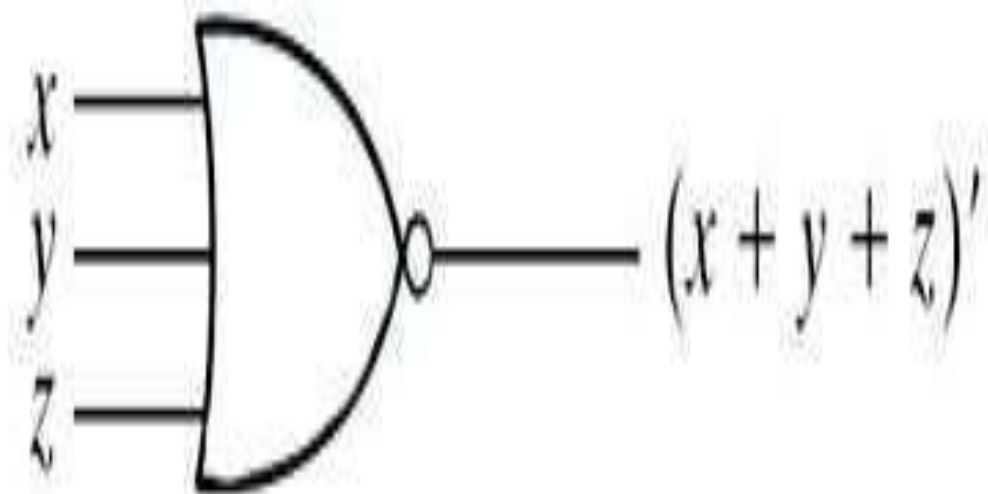
NOR implementation of OR gate



## Graphical equivalence of NOR gate



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





NAND - NOR Implementation :-

NAND - NAND Implementation :-

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

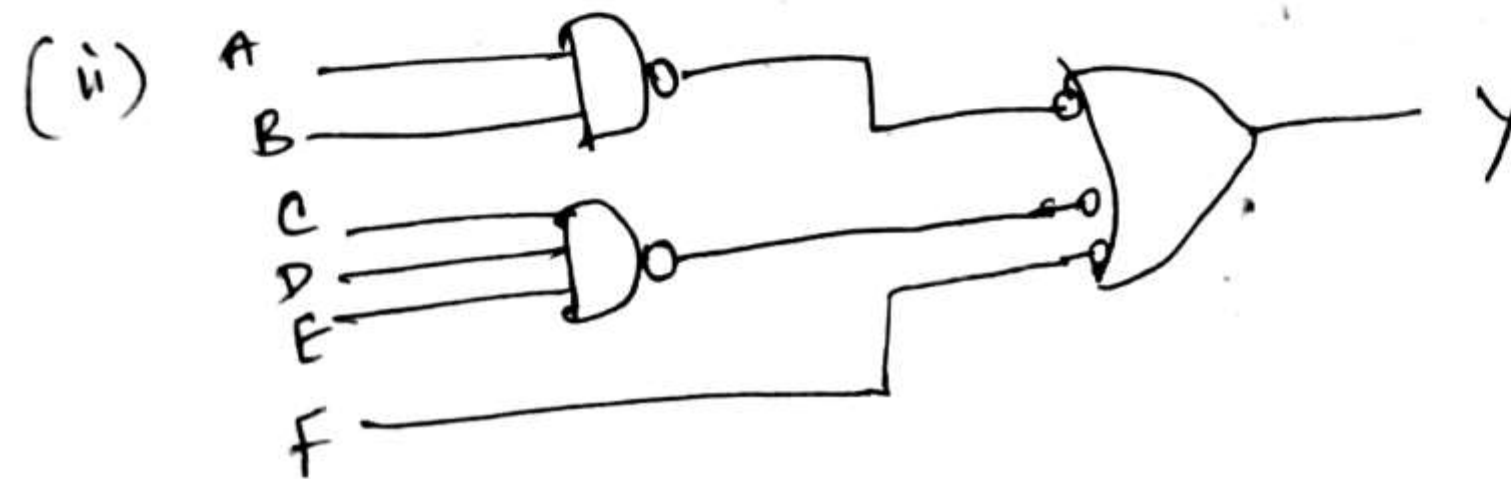
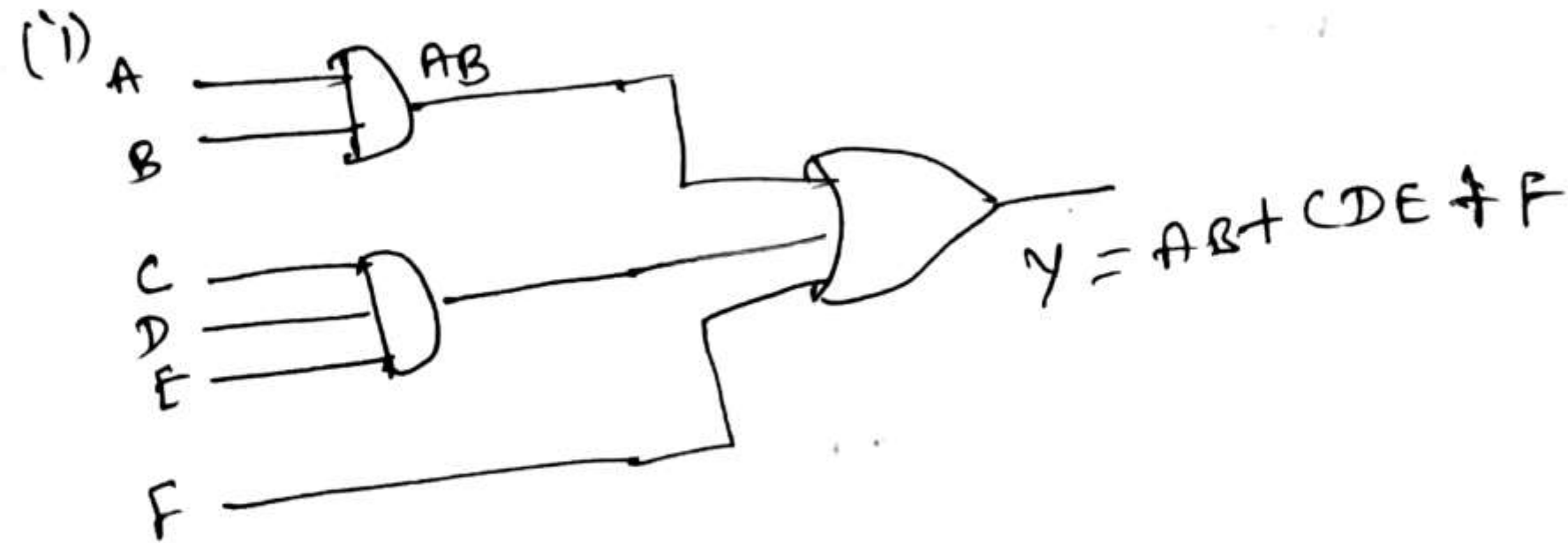


procedure :-

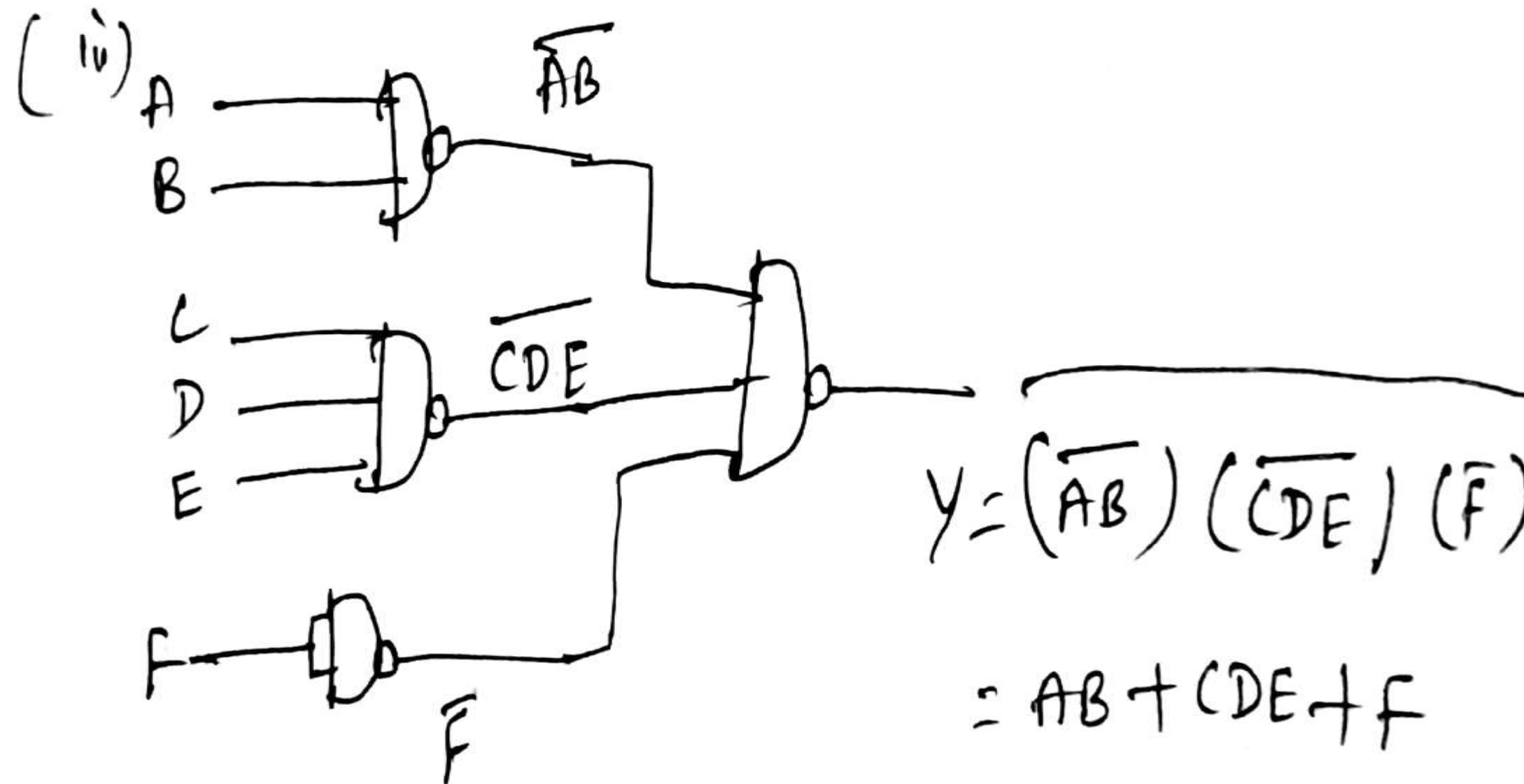
- (i) Simplify the given logical expression and convert it in the SOP form.
- (ii) Draw the AND - OR - NOT realization.
- (iii) Replace every AND gate by a NAND, every OR gate by a bubbled OR gate & NOT gate by a NAND inverter.
- (iv) Finally draw the circuit using only NAND gates.



Example Implement the following Boolean function using only NAND gates.

$$Y = AB + CDE + F$$


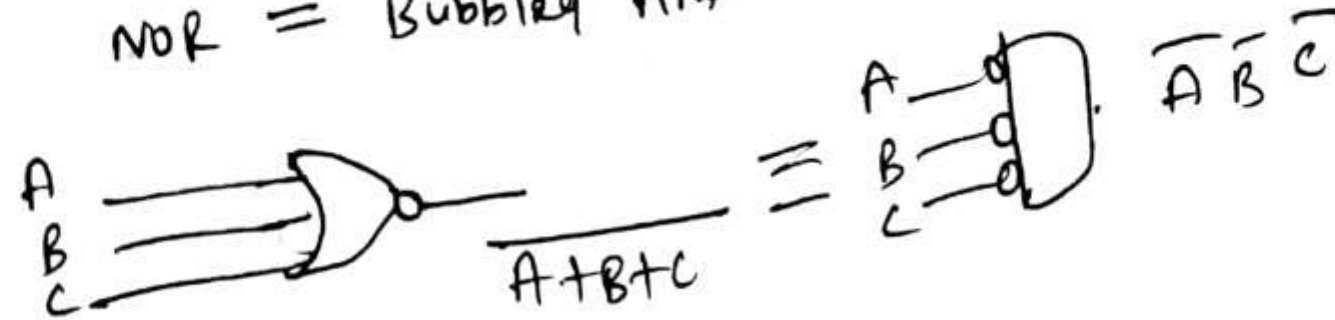






## NOR-NOR Implementation:-

NOR = Bubbled AND

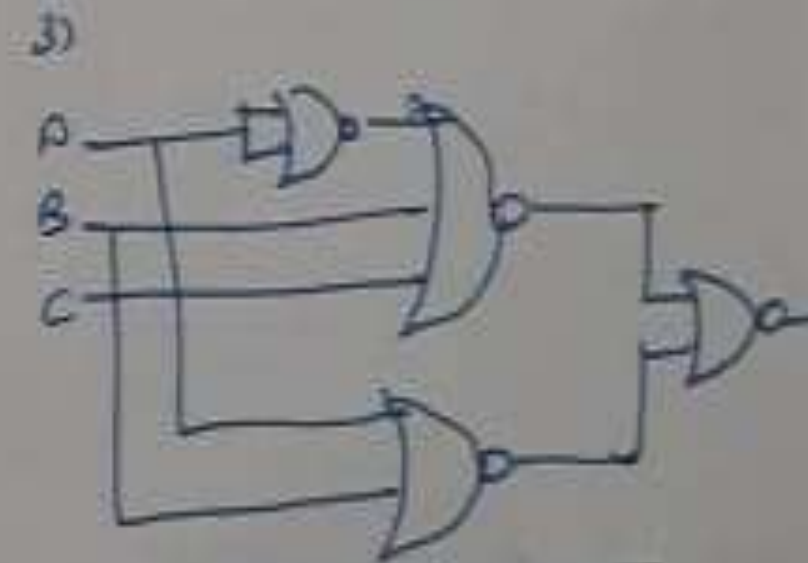
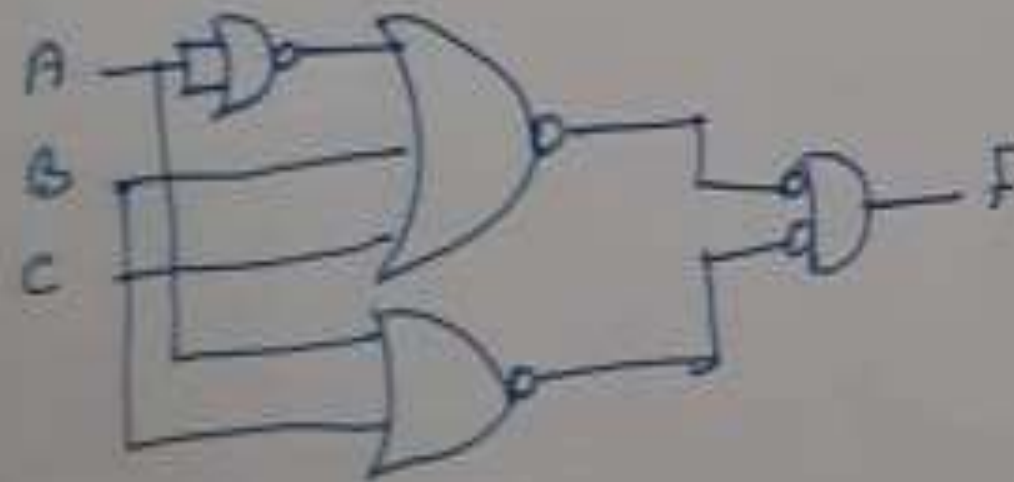
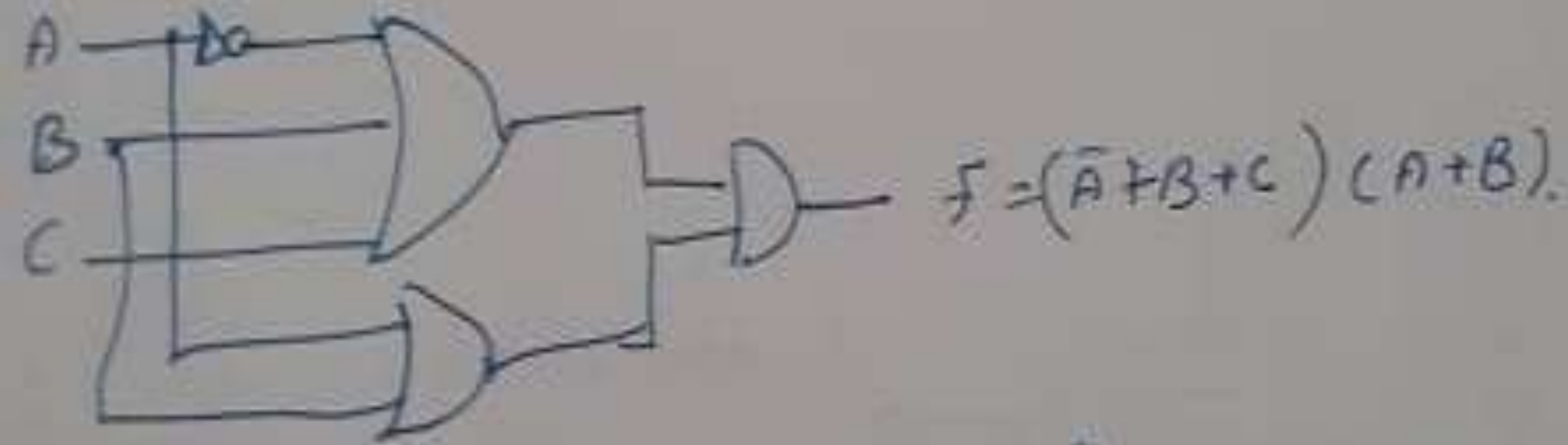


### Procedure

- (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 in only the NOR gates.



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



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

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



**THANK YOU**