





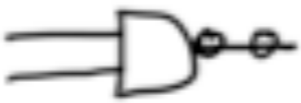



Digital Logic and Computer Organization

Universal Gate Implementation

NAND/NOR Design

- Universal Gates: NAND/NOR
- Universal gates are easier to fabricate with electronic components.
- Functionally complete: Any valid Boolean function containing AND, OR or NOT can find an equivalent expression using NAND (or NOR) only.
- Proof by construction (done in Lab 2 for NAND)

Gate Construction

Gate Type	NAND Form	NOR Form
NAND		
NOR		
AND		
OR		

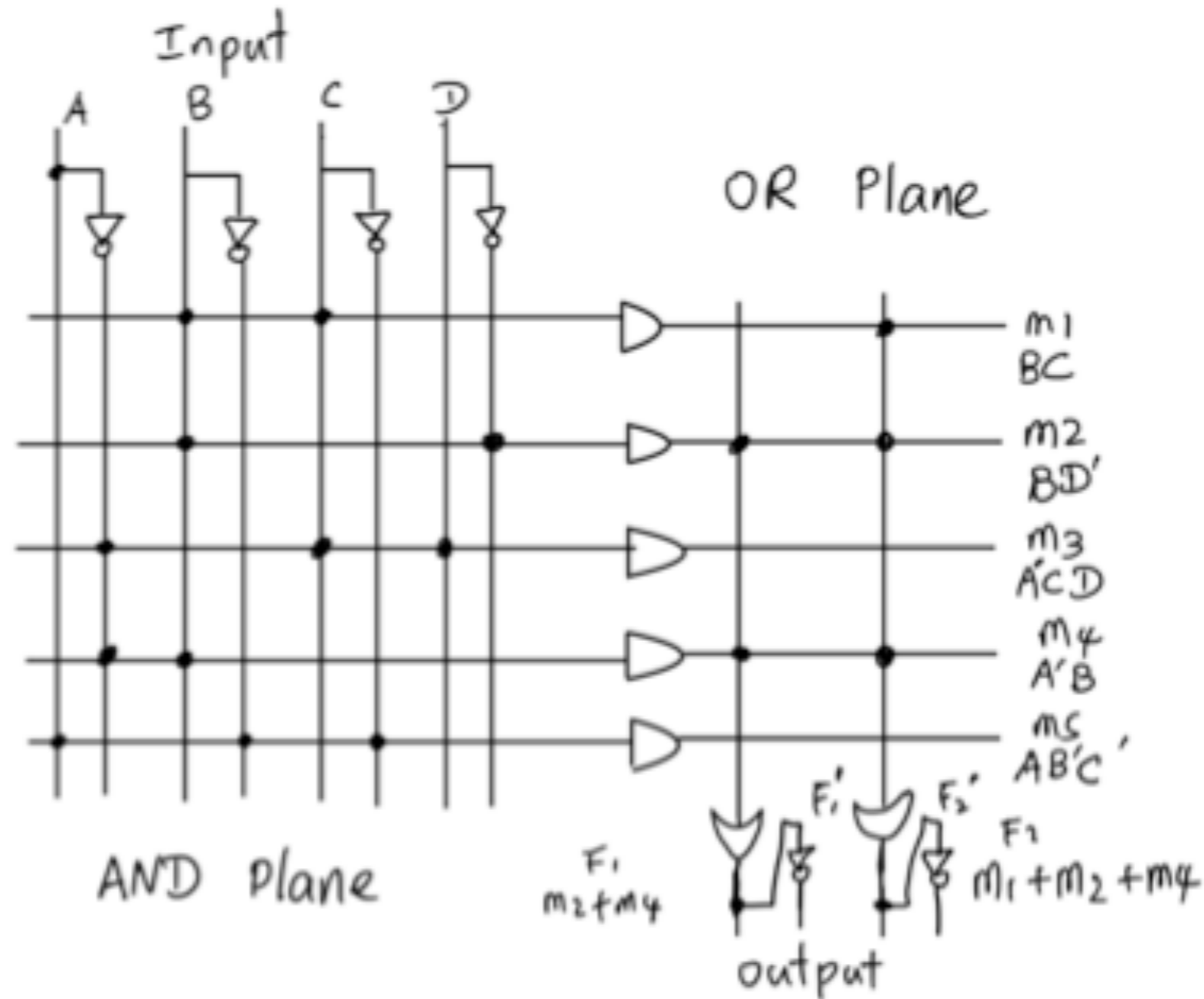
Universal Gate Circuit

- NAND Implementation algorithm:
 - replace all AND gates their NAND form
 - replace all OR gates with their NAND form
 - add inverters where bubbles not attached with NAND gates don't cancel
- NOR Implementation algorithm

Universal Gate Circuits

- From AND-OR-NOT circuits examples
 - one level
 - two levels
 - multiple levels

AND-OR PLA



NAND-NAND PLA

