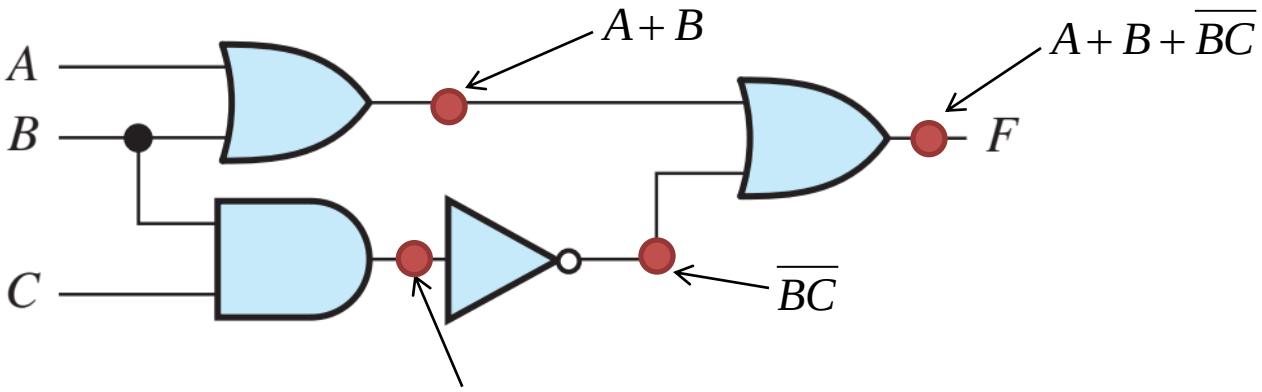
EEE1024: Fundamentals of Electrical and Electronics Engineering

Dr. Sanchit Khatavkar

Boolean Expressions Examples -2

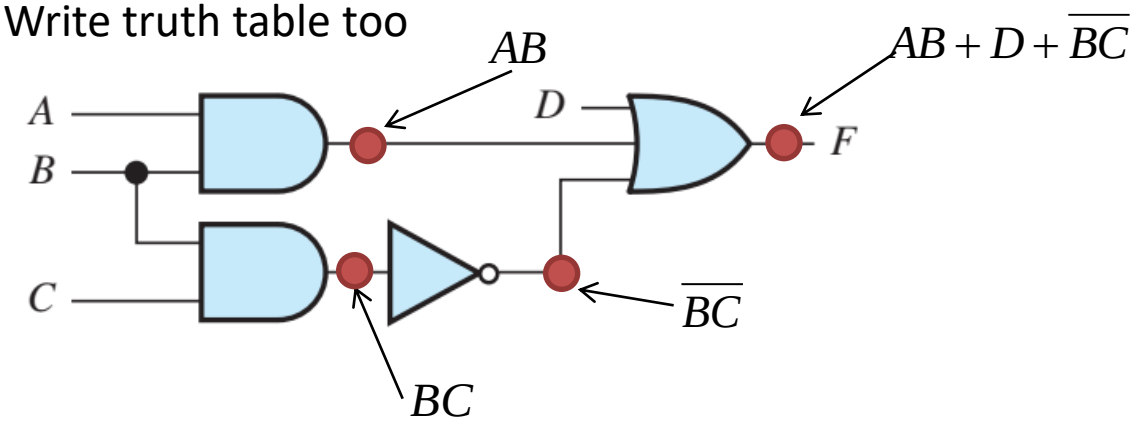
Give the Boolean expression for the logic circuits shown
Write the truth table too



A	B	C	A+B	BC	$\overline{BC}$	$A+B+\overline{BC}$
0	0	0	0	0	1	1
0	0	1	0	0	1	1
0	1	0	1	0	1	1
0	1	1	1	1	0	1
1	0	0	1	0	1	1
1	0	1	1	0	1	1
1	1	0	1	0	1	1
1	1	1	1	1	0	1

Boolean Expressions Examples -3

Give the Boolean expression for the logic circuits shown
Write truth table too

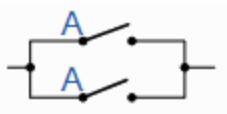


A	B	C	D	AB	BC	$\overline{BC}$	F
0	0	0	0	0	0	1	1
0	0	0	1	0	0	1	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	1
0	1	0	0	0	0	1	1
0	1	0	1	0	0	1	1
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1

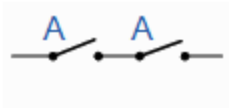
A	B	C	D	AB	BC	$\overline{BC}$	F
1	0	0	0	0	0	1	1
1	0	0	1	0	0	1	1
1	0	1	0	0	0	1	1
1	0	1	1	0	0	1	1
1	1	0	0	1	0	1	1
1	1	0	1	1	0	1	1
1	1	1	0	1	1	0	1
1	1	1	1	1	1	0	1

Boolean Algebra - 1

Recall: "+" – OR operation "$\bullet$" – AND operation "$\overline{A}$" – NOT operation



OR Operation	AND Operation	Law
A + A = A	A · A = A	Idempotent
A + 1 = 1	A · 0 = 0	Annulment
A + 0 = A	A · 1 = A	Identity
$A+\overline{A}=1$	$A \bullet \overline{A}=0$	Complement
A + B = B + A	A · B = B · A	Commutative
A + (B · C) = (A + B) · (A + C)	A · (B + C) = (A · B) + (A · C)	Distributive
A + (B + C) = (A + B) + C	A · (B · C) = (A · B) · C	Associative



Boolean Algebra - 2

De-Morgan's Theorems (2 variables)

$$AB = \overline{\overline{A} + \overline{B}}$$

$$A + B = \overline{\overline{A}\,\overline{B}}$$

Verification of Boolean Expressions - 1

Prove Associative Law for OR operation: $(A + B) + C = A + (B + C)$

$LHS = (A + B) + C$ $\qquad$ $RHS = A + (B + C)$

A	B	C	(A+B)	(B+C)	LHS= (A+B)+C	RHS= A+(B+C)
0	0	0	0	0	0	0
0	0	1	0	1	1	1
0	1	0	1	1	1	1
0	1	1	1	1	1	1
1	0	0	1	0	1	1
1	0	1	1	1	1	1
1	1	0	1	1	1	1
1	1	1	1	1	1	1

Verification of Boolean Expressions - 2

Prove Associative Law for OR operation:

a) $A \cdot (B \cdot C) = (A \cdot B) \cdot C$

b) $A \cdot (B + C) = (A \cdot B) + (A \cdot C)$

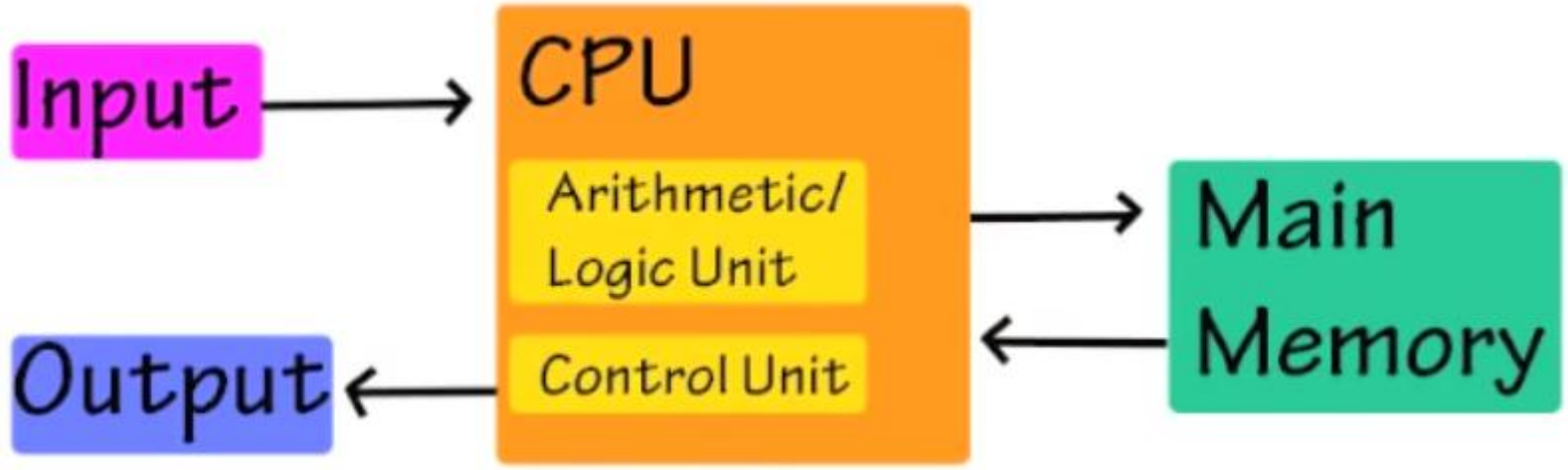
LHS: A.(B.C)

RHS: (A.B).C

A	B	C	(B.C)	(A.B)	LHS= A.(B.C)	RHS= (A.B).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	1	0	0	0
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	0	1	0	0
1	1	1	1	1	1	1

Computer Organization – Intro1

DIGITAL COMPUTER - *Hardware*

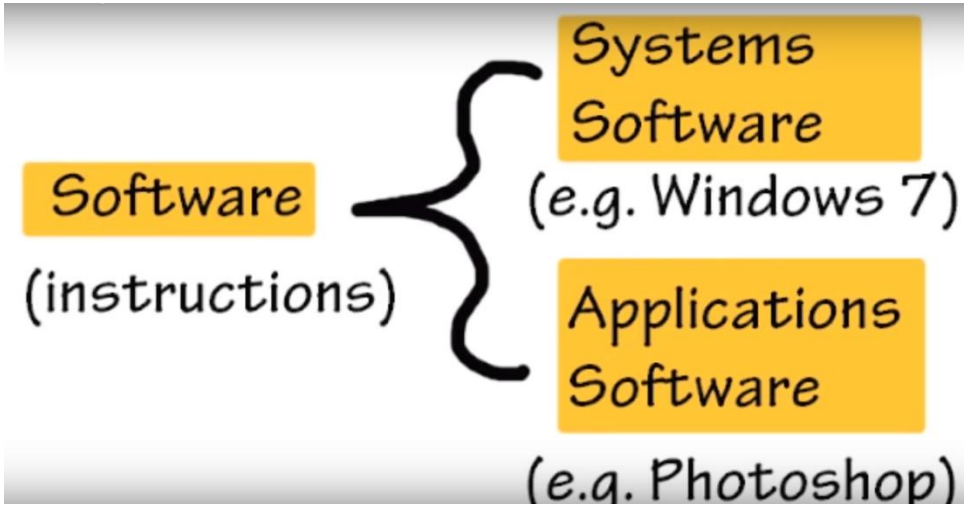


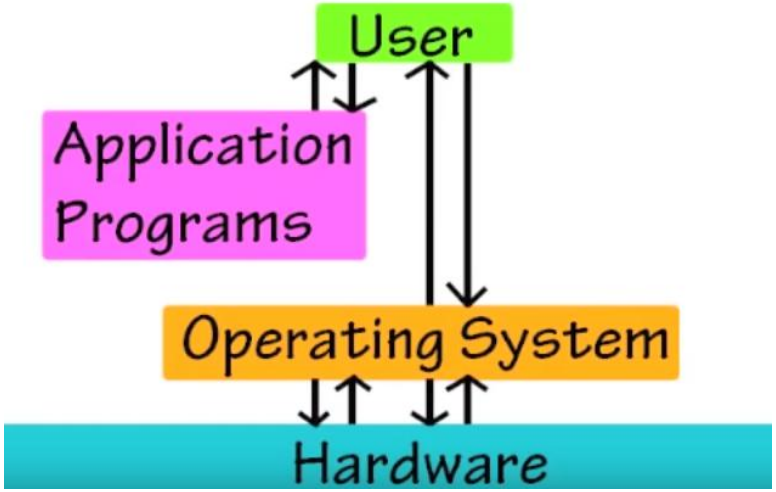
Von Neumann architecture (1945):
Instruction data and program data in same memory

https://www.youtube.com/watch?v=HEjPop-aK_w

Computer Organization - Intro2

DIGITAL COMPUTER - *Software*





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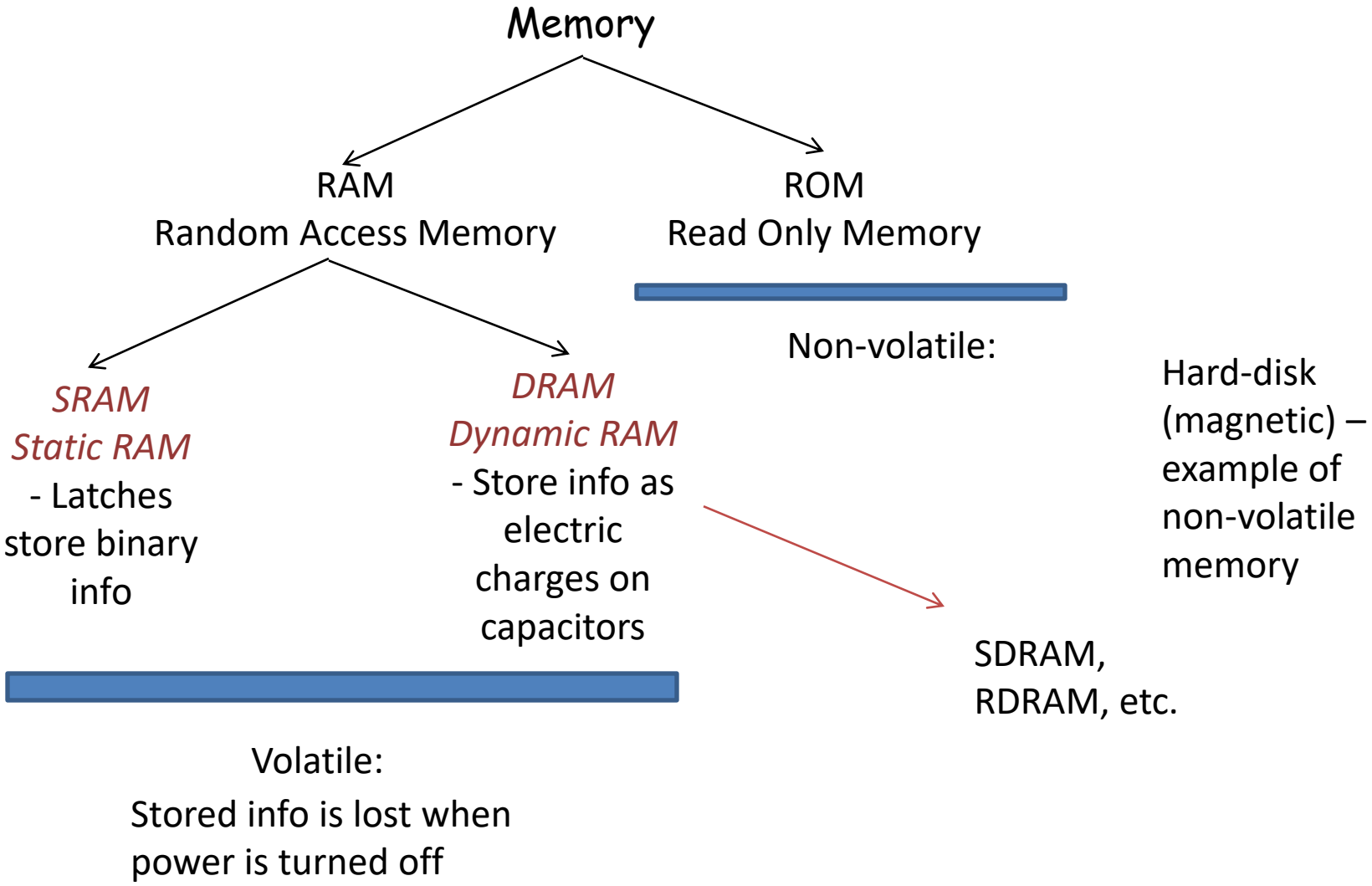
MEMORY Basics



Acknowledgements

1. Allan R. Hambley, 'Electrical Engineering - Principles & Applications, Pearson Education, First Impression, 6/e, 2013
2. M. Morris Mano, Charles R. Kime, 'Digital Design and Computer Organization', Pearson Education, December 1994.
3. https://www.electronics-tutorials.ws/boolean/bool_6.html