TUT-II

14.08.2012

Objectives

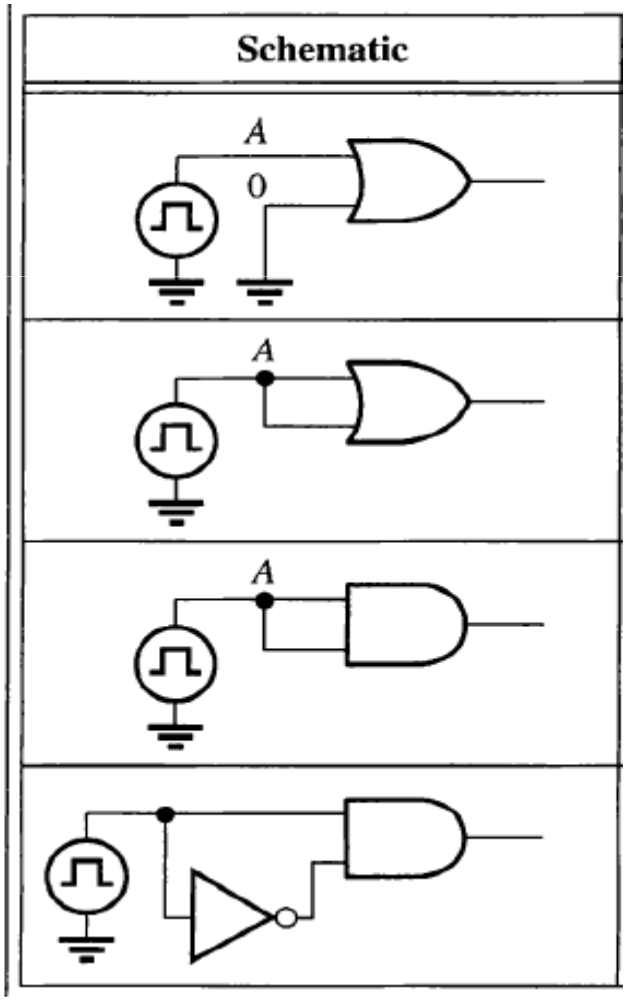
- Demorgan's theorem
- XNOR Logic
- Boolean laws
- Universal gates
- Intro to K-map
- Applications of logic gates:
  - Addition of two bits
  - 4 bit Gray to Binary Code conversion
  - Invalid BCD detector
  - Select one of the two input signals to pass on to output
  - Compare 1 bit

XNOR Logic

- XOR and XNOR logic
  - XOR gate output=Y=A'B+AB'
  - XNOR gate o/p=Y =[A'B+AB']'= AB+A'B'
    - Prove : AB+A'B' = [A'B+AB']'
      - R.H.S. =AB+A'B' = [(AB)' .(A'B')'] = [((AB)')' + ((A'B')')']
        =[(AB)' . (A'B')']' = [(A'+B') . (A''+B'')]'
        = [(A'+B') . (A+B)]' = [A'A+A'B+B'A+B'B]'
        = =[A'B+AB']'=L.H.S.
- Implement XNOR Logic using AND,OR and NOT gates

Boolean Rule

Find out Boolean values at the output of following ckts.



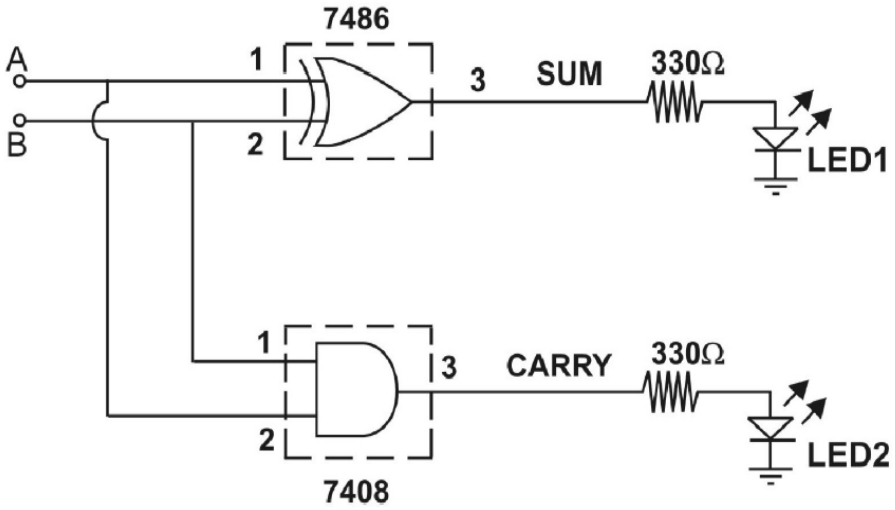
Universal gates& Demorgan's Law

- Implement following logical expression using only NAND gate
  - W=(P+R').T
- Simplify:
  - X=(M+N)(M'+P)(N'+P')
  - [ABC'D']'
- Write logical expression and truth table for the output of the given circuits

Logic circuit to add two bits

0+0=0
0+1=1
1+0=1
1+1=?

i/p		o/p	Logic For 'S'	Observed output (S)	o/p	Logic for 'C'	Observed Output (C)
A	B	S			C		
0	0	0		?	0		?
0	1	1	A'B	?	0		?
1	0	1	AB'	?	0		?
1	1	0		?	1	AB	?
Logical Expression (SOP form) for 'S' = A'B+AB'							
Logical Expression (SOP form) for 'C' =AB							



HALF ADDER

Logic circuit to compare two bits

Input		A>B	A<B	A=B
A	B			
0	0	0	0	1
0	1	0	1	0
1	0	1	0	0
1	1	0	0	1

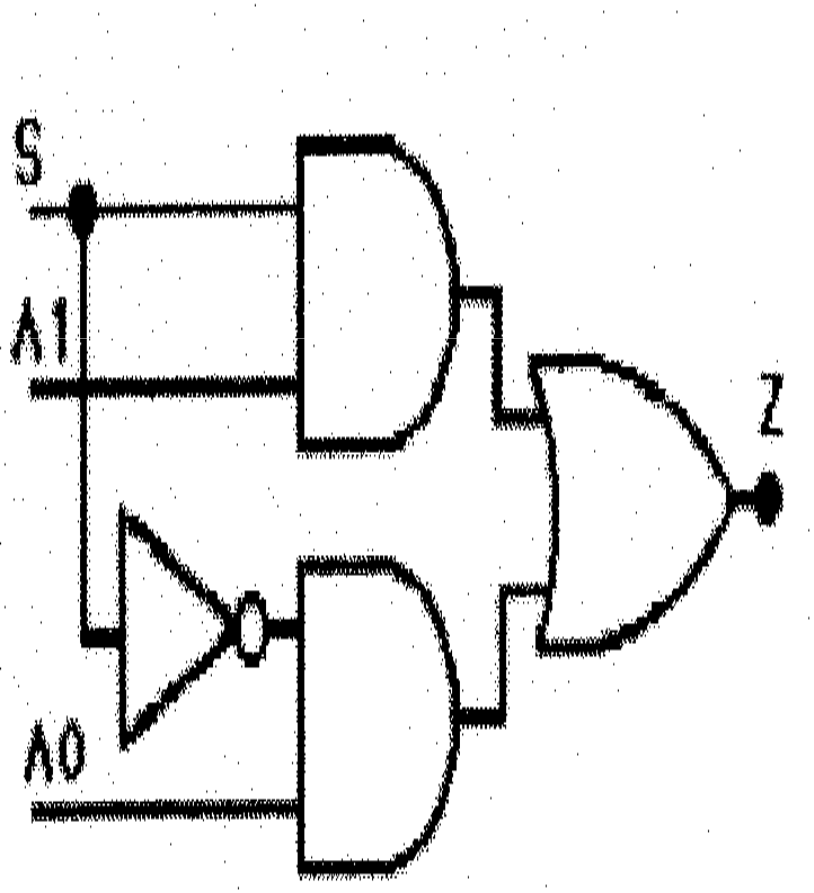
Use K-map to simplify expression for the logic

F1=A>B; F1= AB’
F2=A<B; F2=A’B
F3=A=B; F3=A’B’+AB= [AB’+A’B]’

Select one of the two input signals to pass on to output

Use K-map to simplify expression for the logic

Input			o/p Z
A1	A0	S	
0	0	0	0
0	0	**1**	0
0	1	0	1
0	1	**1**	0
1	0	0	0
1	0	**1**	1
1	1	0	1
1	1	**1**	1

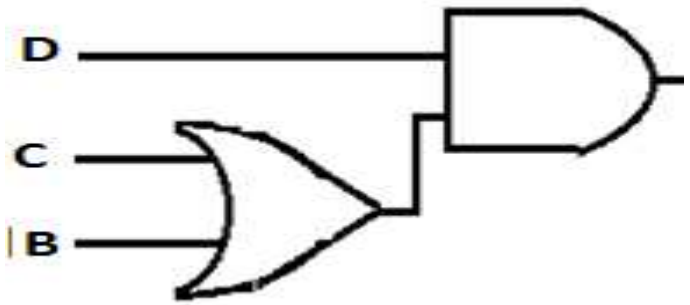


Invalid BCD detector using Logic Gates

Decimal equivalent	DMSB	C	B	ALSB	Valid BCD	Invalid BCD	Observed output
0	0	0	0	0	1	0	
1	0	0	0	1	1	0	
2	0	0	1	0	1	0	
3	0	0	1	1	1	0	
4	0	1	0	0	1	0	
5	0	1	0	1	1	0	
6	0	1	1	0	1	0	
7	0	1	1	1	1	0	
8	1	0	0	0	1	0	
9	1	0	0	1	1	0	
10	1	0	1	0	0	1	
11	1	0	1	1	0	1	
12	1	1	0	0	0	1	
13	1	1	0	1	0	1	
14	1	1	1	0	0	1	
15	1	1	1	1	0	1	

Use K-map to simplify expression

Invalid BCD = D.(C+B)



4 bit Gray to Binary Code conversion

$G_3G_2G_1G_0$	$B_3B_2B_1B_0$ (output)	$G_3G_2G_1G_0$	$B_3B_2B_1B_0$ (output)
0000	0000	1100	1000
0001	0001	1101	1001
0011	0010	1111	1010
0010	0011	1110	1011
0110	0100	1010	1100
0111	0101	1011	1101
0101	0110	1001	1110
0100	0111	1000	1111

4 bit Gray to Binary Code conversion