

1

BOOLEAN LOGIC PROBLEMS

2

DESIGNING LOGIC CIRCUITS

- Desired behavior is summarized in a truth table
- Truth table is then translated into a Boolean expression
- Expression is simplified using Boolean algebra or Karnaugh Maps

3

PROBLEM #1

- Automatic umbrella the opens when either the sun is shining or rain is falling
 - Define the input/output variables
 - Construct the truth table
 - Write the Boolean expression

4

GENERATE A BOOLEAN EXPRESSION

- Method 1 – Sum of Products
 - Form products of variables that create logic value of 1
 - Sum all above products

5

PROBLEM #2

- John won't go to school if it is cold and raining or he has not done his homework.
 - Define the input/output variables
 - Construct the truth table
 - Write the Boolean Expression

6

PROBLEM #3

- Your car has 4 wheel drive, which turns on when the temperature is freezing or when you hit the manual override, but you cannot turn on the override when you are going over 60 km/h.
 - Define the input/output variables
 - Construct the truth table
 - Write the Boolean expression

7

PROBLEM #4

- Schools are given snow days given specific circumstances. If there is ice on the roads, but no salt, then a snow day is given. If there is salt however, then a snow day is not given. Regardless of whether or not there is salt, whenever there is >2 inches of snow, then a snow day is given.
 - Define the input/output variables
 - Construct the truth table
 - Write the Boolean expression

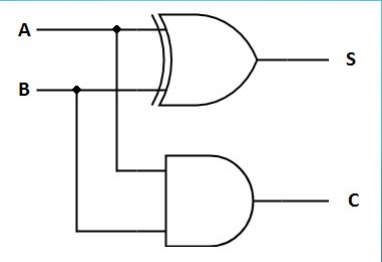
8

PROBLEM #5 – 2 BIT ADDER

- 2 Inputs
 - Bit A
 - Bit B
- 2 Outputs
 - Sum
 - Carry-Out

9

The Half Adder



The diagram illustrates a half adder circuit. It features two input lines labeled 'A' and 'B'. Line 'A' is connected to the top input of an XOR gate and the top input of an AND gate. Line 'B' is connected to the bottom input of both the XOR gate and the AND gate. The output of the XOR gate is labeled 'S', representing the sum bit. The output of the AND gate is labeled 'C', representing the carry-out bit.

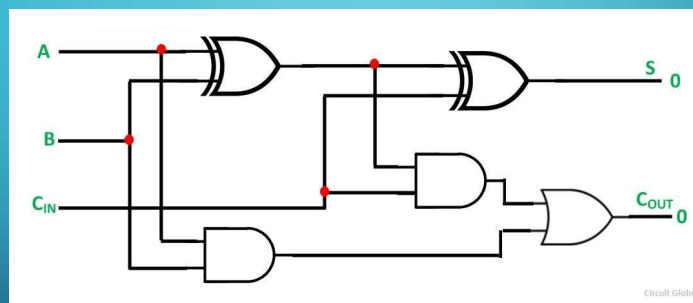
10

PROBLEM #6 – FULL 2 BIT ADDER

- 3 Inputs
 - Bit A
 - Bit B
 - Carry-In
- 2 Outputs
 - Sum
 - Carry-Out

11

The Full Adder



12