**Combinational circuits:**

A combinational circuit consists of logic gates whose output at any time are determined directly from the values of the present inputs.

Combinational

circuit

inputs outputs

**Design procedure:**

The procedure involves the following steps:

1-Determine the required number of inputs and outputs.

2-Drive the truth table.

3-Obtain the simplified Boolean function for each output.

4-Draw the logic diagram.

**Half adder (H.A.):**

To design a circuit that adds two numbers each of one bit for example:

 Two inputs 1 0 1 0

 1 + 0 + 0 + 1 +

 Two output 1 0 0 1 1

A B C S

0 0 0 0

0 1 0 1 S= A B + A B

1 0 0 1 C= A B

 1 1 1 0



S inputs C

 A B

 output

A S

 **H.A.** B C

**Using NAND gates only :**

S = A B + A B

S = A B + A B = A B . A B = X . Y



 C

 S

 A B

 A B A B

  C= C = A B = A B

**Full adder (F. A):**

في حالة جمع عددين كل واحد مكون من 2-bit أي لتصميم دائرة تجمع ال bits في المرحلة الثانية و ما بعدها:

Ci 1

A 0 1

A S

B F.A.

Ci Co

B 1 1 +

1 0 0

Carry sum