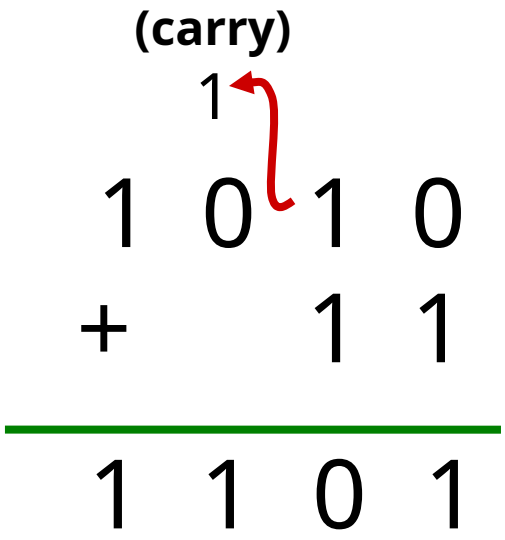
INTRODUCTION

- *Binary Addition*
- *Half & Full Adders*
- *Parallel Adders*

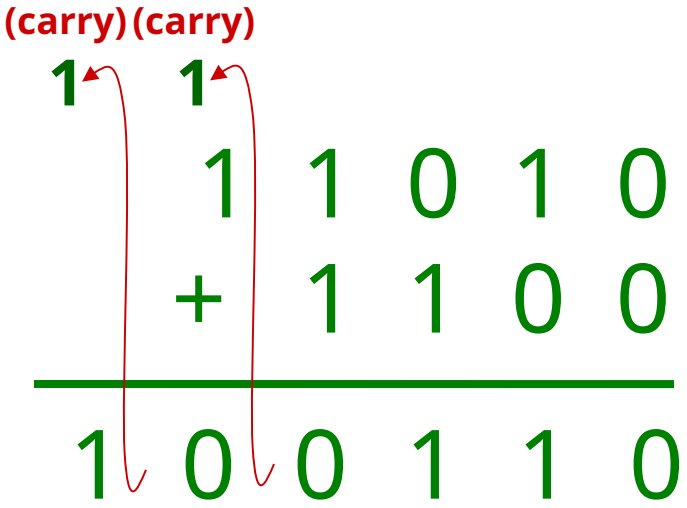
Binary Addition

- **Conceptually similar to decimal addition**
- ***Example:*** **Add the binary numbers 1010 and 11**



QUIZ

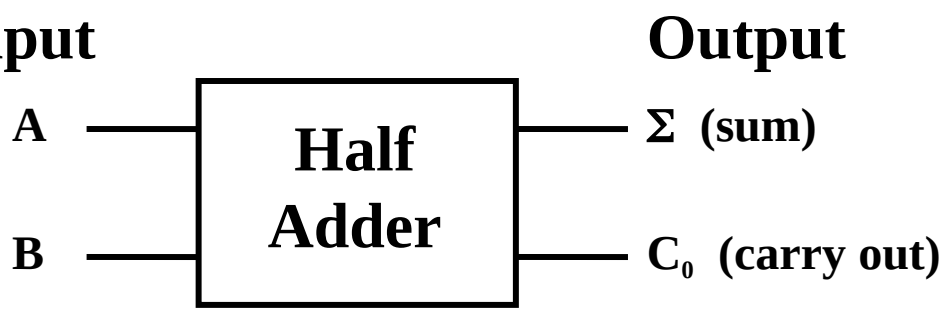
Add the Binary numbers 11010 and 1100



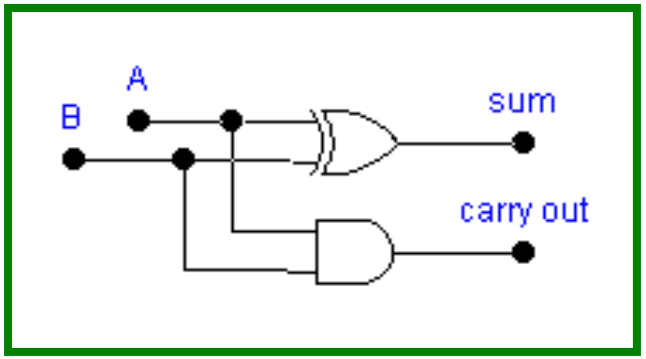
Half Adder

- Logic device that adds two binary numbers
- Only adds Least Significant Digit (LSD) column (1s column) in binary addition

Logic Symbol:



Logic Diagram:



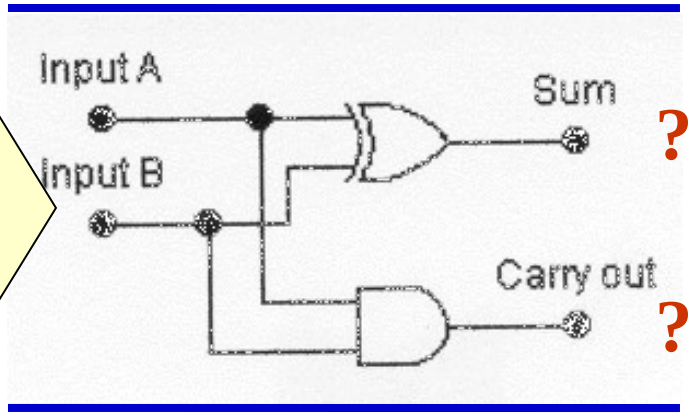
QUIZ

Q#5- What are the sum and carry out outputs from the half adder circuit?

ANS: Sum=1, Carry out=0

A = 1

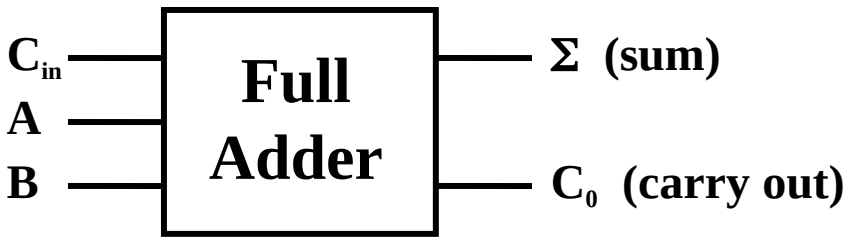
B = 0



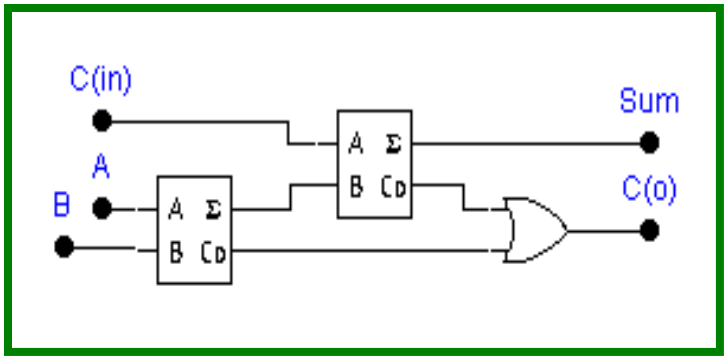
Full Adder

Used for adding binary place values other than the 1s place

Logic Symbol:



Logic Diagram:



QUIZ

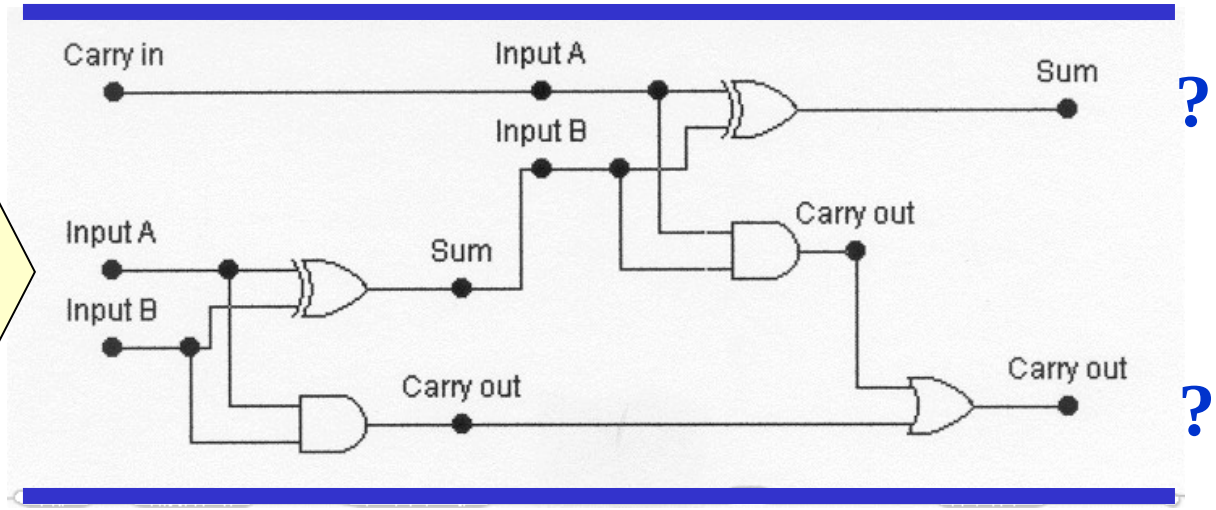
Q#6- What are the sum and carry out outputs of this full-adder circuit?

ANS: Sum=0, Carry out=1

Cin = 0

A = 1

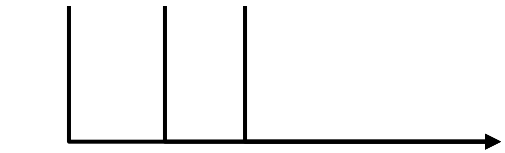
B = 1

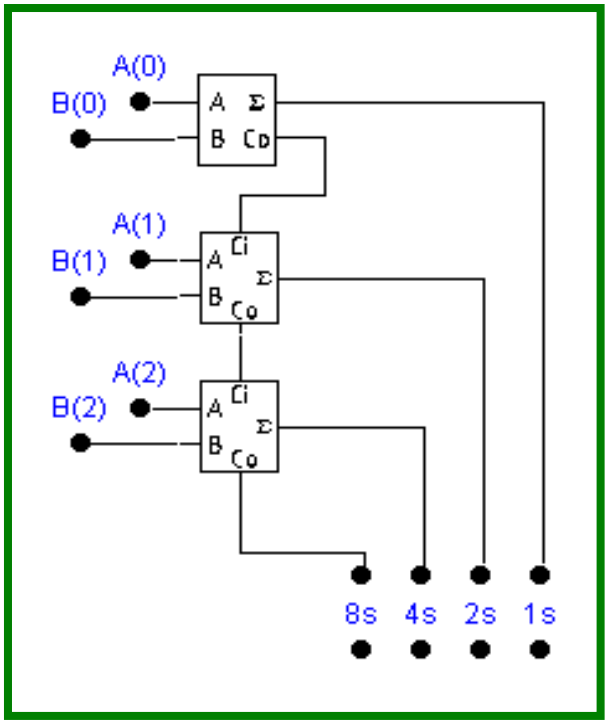


Parallel Adding

- Use half adder for LSD
- Use full adder for other digits

$$\begin{array}{rrr} A_2 & A_1 & A_0 \\ + B_2 & B_1 & B_0 \\ \hline \end{array}$$

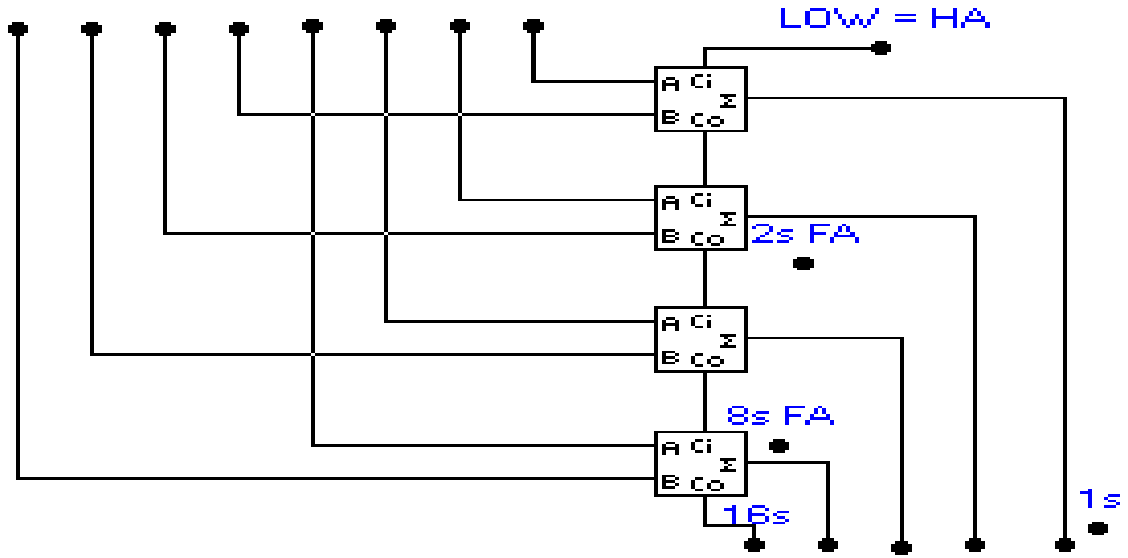




Parallel Adder

Enter binary numbers to be added

1 1 1 0 + 0 1 1 0



1 0 1 0 0

SUM appears here

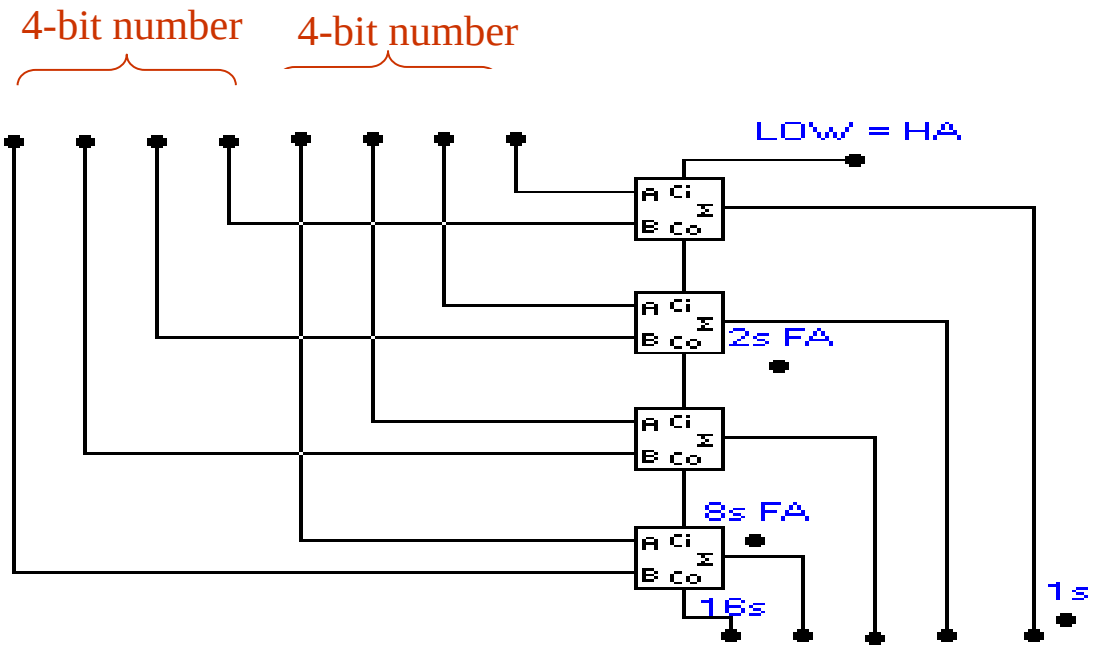
Parallel adders are available in IC form.

1s place uses half-adder

2s, 4s, 8s places use full adders

QUIZ

Q#7- When the 4-bit parallel adder adds binary 1010 and 1001 the sum appearing at the lower right will be ___.



ANS: 10011