# Introduction to Computers Lab
# First Year (2017 – 2018)

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## Lab 6

# Complement Number system

- The word complement in the number system means the difference of the number from the highest number of that digit.
- This definition can be applied to various number systems and they are named differently as well. But in general, if a number has base of N then that is known as (N-1)'s complement. However, if we add one with that value that will give us N's complement.

# Numeric complements (Decimal)

- Complements is the another part of number that complete it to $10^n$ OR $10^n - 1$
- 9's complements
  - if we want to find out the 9's complement of a number x, we can do it by following the following formula,
  - , where n = number of digits in

9's complement of a value $x=(10^n - 1) - x$

  - **Ex :**
    - $25 \rightarrow 10^2 - 1 - 25 = 100 - 1 - 25 = 74$

# Numeric complements (Decimal)

- Complements is the another part of number that complete it to $10^n$ OR $10^n - 1$
- 10's complements
  - it is easy to find out the 10's complement after finding out the 9's complement of that number.
  - We have to add 1 with the 9's complement of any number to obtain the desired 10's complement of that number.
  - Or if we want to find out the 10's complement directly, we can do it by following the following formula,

$$\text{10's complement of a value } x = 10^n - x$$

  - where n = number of digits in the number.
  - **Ex :**
    - 25 → $10^2 - 25 = 100 - 25 = 75$

# Numeric complements (Binary)

- **Complements is the another part of number that complete it to $2^n$ OR $2^n$ -1**
- **1's complements**
  - if we want to find out the 1's complement ,we can do it by following the following formula,

**1's complement of a value x=($2^n$ -1) – x**

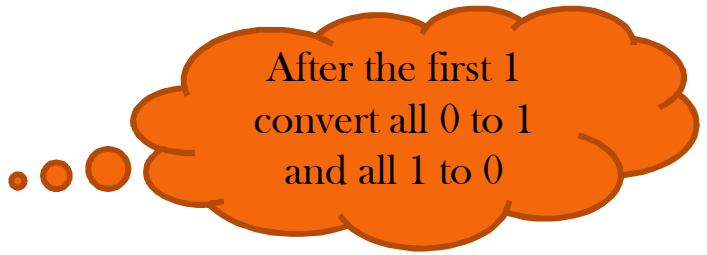
  - ,where n = number of bits in the number.
  - **Ex :**
    - 1001 → $2^4$ – 1 - 1001 =10000 – 1 – 1001 = 0110

# Numeric complements (Binary)

- Complements is the another part of number that complete it to $2^n$ OR $2^n - 1$
- 2's complements
  - it is easy to find out the 2's complement after finding out the 1's complement of that number.
  - We have to add 1 to the 1's complement of any number to obtain the desired 2's complement of that number.
  - Or if we want to find out the 2's complement directly, we can do it by following the following formula,

$$\text{2's complement of a value } x = (2^n) - x$$

  - where n = number of bits in the number.
  - **Ex :**
    - 1001 → $2^4$ -1001 =10000– 1001 = 0111



# Arithmetic Operations in binary system

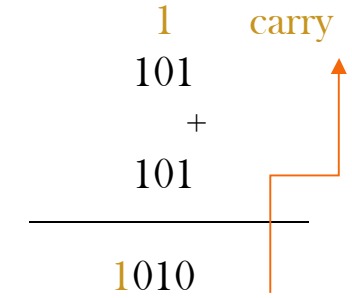
- Arithmetic operations can be performed in all numbering systems
- Arithemetic operations include:
  - Addition
  - Subtraction

# Addition in binary

- Rule:

  0 + 0 = 0
  0 + 1 = 1
  1 + 0 = 1
  1 + 1 = 0 (carry 1)
  1 + 1 + 1 = 1 (carry 1)

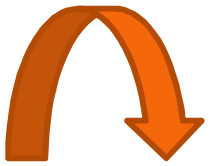
- EX:
  - 101 + 101 = ?



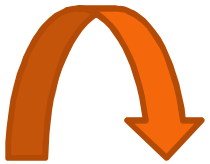

- 1 + 11 = ???
- 1010 + 11 = ???

# Subtraction (use 2's complement)

- Rule:
  1. The size of two number must be the same.
  2. The first number don't change.
  3. Get the 2's complement of the second number.
  4. Add the new 2 numbers.
  5. If the number of digits for result > the number of digits for 2 numbers (carry)
     - Neglect the carry and the result is +ve.
  6. If the number of digits for result = the number of digits for 2 numbers (no carry)
     - Get the 2's complement for the result and the result is –ve.
- EX1: 101 - 1001

0101 - 1001  0101 + 0111 = 1100 No carry ; So result is - 0100

- EX2: 1001 - 101

1001 - 0101  1001 + 1011 = 10100 carry ; So result is + 0100

# Solve

- Addition

  101 + 1110 = ?

  10110 + 100 = ?

  101 + 101 = ?

- Subtraction

  101 - 1100 = ?

  1011 - 100 = ?

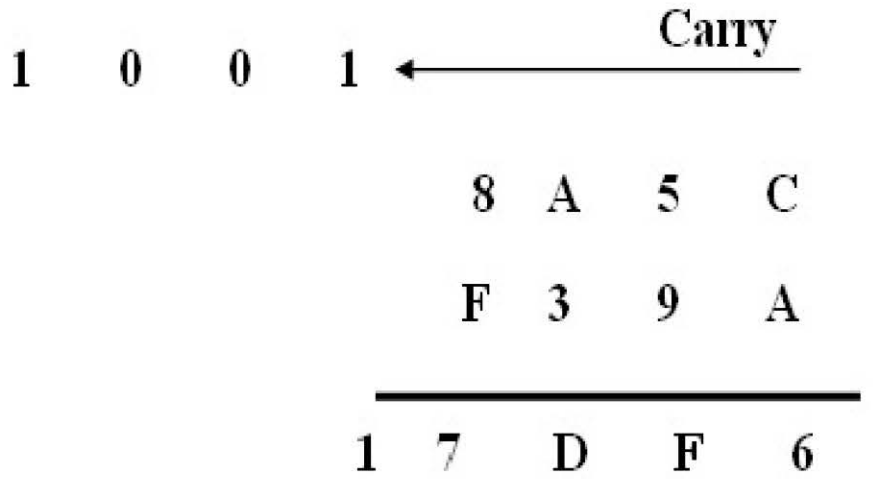
  101 - 101 = ?

# Hexadecimal Addition

1. Add one column at a time.
2. Convert to decimal and add the numbers.
3. If the result of step two is 16 or larger subtract the result from 16 and carry 1 to the next column.
4. If the result of step two is less than 16, convert the number to hexadecimal.

# Hexadecimal Addition(cont.)

- Example:



# Solve

- Exercises:

1. 82CD + 1982
2. E2C + A31

# Thank You