ACT111L, BCS111L, BIT111L
Intro to Computing

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REVIEW

DECIMAL SYSTEM

- 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- The number system that we use in our day-to-day life
- Decimal number system has base 10 as it uses 10 digits from 0 to 9.
- In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

BIT & BYTE

- Computer uses the binary system.
- A binary digit is called a **BIT**.
- There are two possible states in a bit, usually expressed as **0** and **1**.
- A series of eight (8) bits strung together makes a **BYTE**.
- 8 BITS = 1 BYTE

BIT & BYTE

- Also called as base 2 number system.
- Each position in a binary number represents a 0 power of the base (2).
- Each position in a binary number represents a 0 power of the base (2). Example 2^0
- Last position in a binary number represents a x power of the base (2). Example 2^x where x represents the last position - 1.

OCTAL SYSTEM

- Uses eight digits: 0,1,2,3,4,5,6,7
- Also called as base 8 number system
- Each position in an octal number represents a 0 power of the base (8)
- Last position in an octal number represents a x power of the base (8).

HEXADECIMAL SYSTEM

- 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
  Note: A = 10, B = 11, C = 12, D = 13, E = 14, F = 15

- Also called as base 16 number system

- Each position in a hexadecimal number represents a 0 power of the base (16).

- Last position in a hexadecimal number represents a x power of the base (16).

Decimal to Binary

$74_{10} = 1001010_{2}$

74 / 2 = 37 remainder 0

37 / 2 = 18 r. 1

18 / 2 = 9 r. 0

9 / 2 = 4 r. 1

4 / 2 = 2 r. 0

2 / 2 = 1 r. 0

1 / 2 = 0 r. 1

Decimal to OCTAL

$74_{10} = 112_{8}$

74 / 8 = 9 r. 2
9 / 8 = 1 r. 1
1 / 8 = 0 r. 1

Decimal to HEXADECIMAL

$74_{10} = 4A_{16}$

74 / 16 = 4 r. 10 ~ A

4 / 16 = 0 r. 4

BINARY to DECIMAL

$1001010_2 = 74_{10}$

$1 \times 2^6 = 64$

$0 \times 2^5 = 0$

$0 \times 2^4 = 0$

$1 \times 2^3 = 8$

$0 \times 2^2 = 0$

$1 \times 2^1 = 2$

$0 \times 2^0 = 0$

OCTAL to DECIMAL

$112_8 = 74_{10}$

$1 \times 8^2 = 1 * 64 = 64$

$1 \times 8^1 = 1 * 8 = 8$

$2 \times 8^0 = 2 * 1 = 2$

$64+8+2 = 74$

HEXADECIMAL to DECIMAL

$A2C_{16} = 2604_{10}$

$10 \times 16^2 = 10 * 256 = 2560$

$2 \times 16^1 = 2 * 16 = 32$

$12 \times 16^0 = 12 * 1 = 12$

	BINARY	OCTAL	DECIMAL	HEXADECIMAL
BINARY	X	✅	✅	✅
OCTAL		X	✅	
DECIMAL	✅	✅	X	✅
HEXADECIMAL			✅	X

BINARY
to other number systems

- Binary to Decimal
- Binary to Octal
- Binary to Hexadecimal

BINARY to DECIMAL

$1001010_2 = 74_{10}$

$1 \times 2^6 = 64$

$0 \times 2^5 = 0$

$0 \times 2^4 = 0$

$1 \times 2^3 = 8$

$0 \times 2^2 = 0$

$1 \times 2^1 = 2$

$0 \times 2^0 = 0$

BINARY
to other number systems

- Binary to Decimal
- Binary to Octal
- Binary to Hexadecimal

The steps in converting a binary to octal or hexadecimal are as follows:

1. Divide the binary digits into groups (3 for Octal and 4 for Hexadecimal). Fill in with zeros to the left of the first digit of the given number in order to complete the grouping

2. Using the place value of the binary system, add the positions with corresponding 1 digit or bit

BINARY to OCTAL

$1001010_2 = \_\_\_\_\_ _8$

001 001 010

1 1 2

0×2^2

0×2^1

$1 \times 2^0 = 1$

$1001010_2 = 112_8$

1 1 1

4+2+1 = 7

BINARY to HEXADECIMAL

$1001010_2 = \_\_\_\_\_ _{16}$

0100 1010

4 A

$1001010_2 = 4A_{16}$

BINARY to OCTAL

$10010101101_2 = 2255_8$

010	010	101	101
2	2	5	5

$1110010110000_2 = 7130_8$

111	001	011	000
7	1	3	0

BINARY to HEXADECIMAL

100101011101_2 = _____ 16

0100 1010 1101 8 4 2 1

4 A D

1110010111000_2 = _____ 16

1110 0101 1000

E 5 8

from other number systems to BINARY

- Decimal to Binary
- Octal to Binary
- Hexadecimal to Binary

The steps in converting octal or hexadecimal to binary are as follows:

1. Convert each octal digit (3 bit pattern to octal and 4-bit pattern for hexadecimal)

2. the zeroes to the left of the leftmost digit are ignored

OCTAL to Binary

$112_8 = 1001010_2$

1	1	2
001	001	010

4 2 1

$517_8 = \_\_\_\_\__2$

5	1	7
101	001	111

HEXADECIMAL to Binary

$4A_{16}$ = _____ 2

4	A	8 4 2 1
0100	1010	

Octal to Hexadecimal

112_8 = _____ 16

Octal >>> Binary >>> regroup 4digits>>Hexa

112_8

1 1 2
001 001 010
0 0100 1010
4 A

Addition of Number System

BINARY ADDITION

0 + 0 = 0

0 + 1 = 1

1 + 0 = 1

1 + 1 = 10 (0 carry over 1)

```
  11  11
 111011
+  1001
1000100
```

OCTAL ADDITION (0,1,2,3,4,5,6,7)

$$\begin{array}{r} {\scriptstyle 1} \\ 17_8 \\ +\ 1_8 \\ \hline 20_8 \end{array}$$

$$\begin{array}{r} {\scriptstyle 1} \\ 70_8 \\ 34_8 \\ \hline 124_8 \end{array}$$

$$\begin{array}{r} {\scriptstyle 1} \\ 56_8 \\ +\ 12_8 \\ \hline 70_8 \end{array}$$

HEXADECIMAL ADDITION (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F)

$$\begin{array}{r} {\scriptstyle 1} \\ 17_{16} \\ +\ 29_{16} \\ \hline 40_{16} \end{array}$$

in decimal 7+9 = 16, but then, hexadecimal has values 0 to 15 only, that's why, in hexadecimal, 7+9 = 0 carry over 1

$$\begin{array}{r} {\scriptstyle 1} \\ 48_{16} \\ +\ 39_{16} \\ \hline 81_{16} \end{array}$$

in decimal 8+9 = 17 (that is 2 more than 15) but in hexadecimal 8+9 = 1 carry over 1 (what is you need to do is count 2 after 15 starting from 0)