ECE213: Digital Electronics

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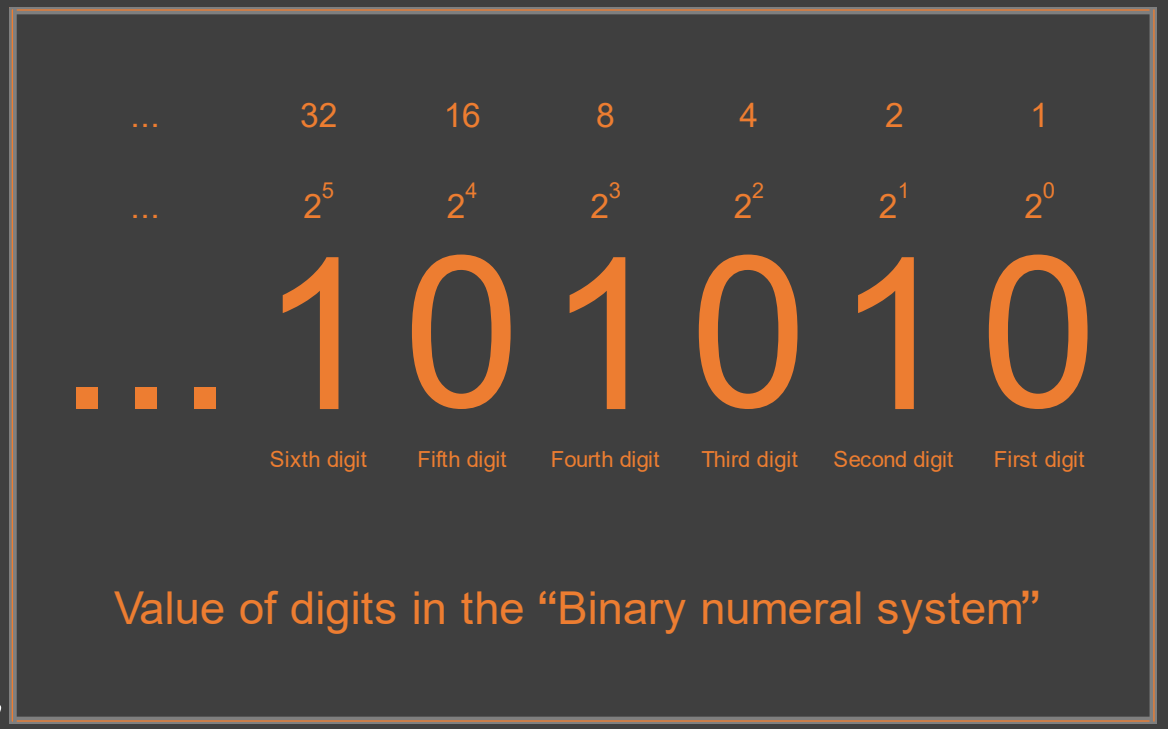
The Course Contents

Unit I

Number Systems : Digital Systems, Data representation and coding, Logic circuits, Implementation of digital systems, Number Systems, Codes- Positional number system, Binary number system, Methods of base conversions, Binary arithmetic, Representation of signed numbers, Fixed numbers, Binary coded decimal codes, Gray codes, Error detection code, Parity check codes, octal number system, Hexadecimal number system, Error correction code, Hamming code, Octal arithmetic, Hexadecimal arithmetic, Floating point numbers



Value of digits in the “Binary numeral system”

Number Systems

Arithmetic - Addition

(+, −, *, /) Dec | Oct | Hex

Ex 97 + 78

```
   1 1
    97
  + 78
  ----
   175
```

0 | 1 | 9

Ex

```
 1 97834
    5698
     978
 +    97
 -------
  104607
```

Ex

```
   (76)8
 + (53)8
 -------
   151
```

( )10 → ( )8 → ( )8

0 → 7

Ex

```
  76532
   5674
    677
     65
 -------
 105412
```

Hex

Ex

```
  A72B1
   985C
   DE2F
     39
 -------
  BE975
```

0 | F

Ex

```
   9
 + B
 ---
  14
```

0 | F

Number Systems

Arithmetic – Addition

Hex

Ex

```
  2A
  4B
  CF
-----
 144
```

Bin

Ex

```
 1101
 1010
-----
10010
```

Ex

```
 1110101
   11011
    1011
     111
--------
10100101
```

Ex

```
 1110101100
 1111011101
   10111111
    1000111
     101011
        110
+       111
-----------
11000111001
```

Number Systems

Arithmetic – Subtraction

Dec

Ex

$$\begin{array}{r} 79 \\ -\,56 \\ \hline 23 \end{array}$$

Ex

$$\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{12}{\cancel{2}} \\ -\,57 \\ \hline 15 \end{array}$$

12
10 10

Oct

Ex

$$\begin{array}{r} 76 \\ -\,52 \\ \hline 24 \end{array}$$

Ex

$$\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{12}{\cancel{2}} \\ 57 \\ \hline 13 \end{array}$$

1 2
8^1 8^0

Ex

$$\begin{array}{r} \overset{6}{\cancel{7}}\,\overset{10}{\cancel{1}}\,\overset{11}{\cancel{2}}\,\overset{12}{\cancel{3}}\,\overset{14}{\cancel{4}} \\ -\,36756 \\ \hline 32256 \end{array}$$

Number Systems

Arithmetic - Subtraction

Hex

Ex

$$\begin{array}{r} A\ 2\ 7 \\ -\ 3\ D\ E \\ \hline 6\ 4\ 9 \end{array}$$

A - 10
B - 11
C - 12
D - 13
E - 14
F - 15

Ex

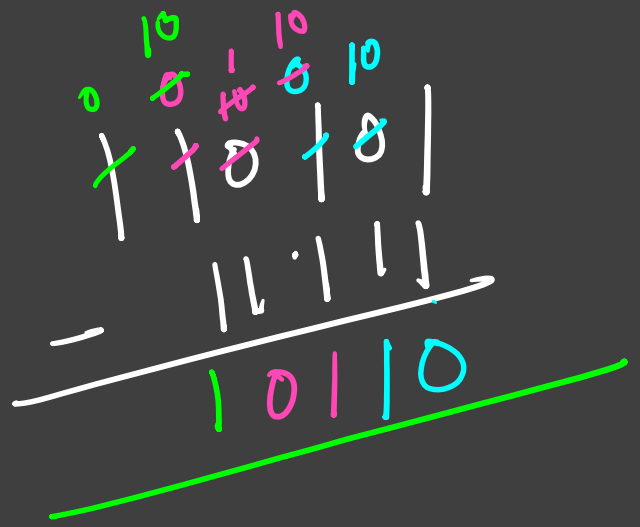
$$\begin{array}{r} A\ 2\ 0\ 0\ 0 \\ -\ 3\ F\ D\ C\ A \\ \hline 6\ 1\ B\ D\ 7 \end{array}$$

Number Systems

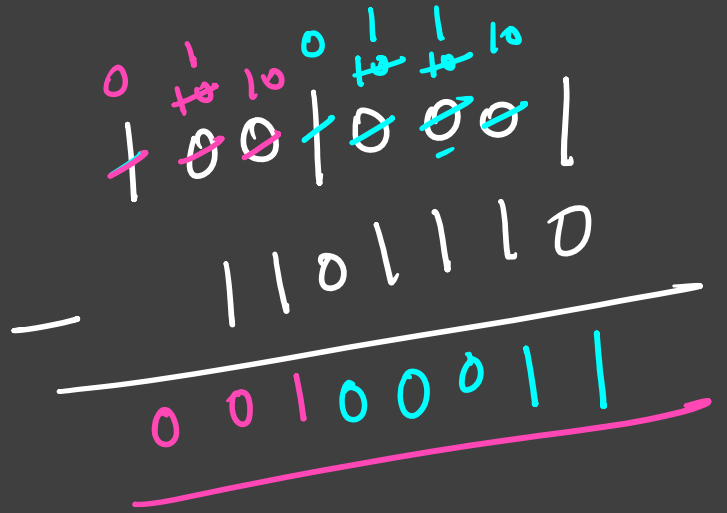
Arithmetic - Subtraction

Bin

Ex



Ex



Number Systems

Arithmetic - Multiplication

Dec

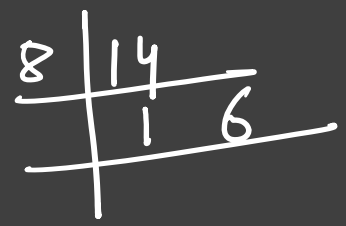
Ex

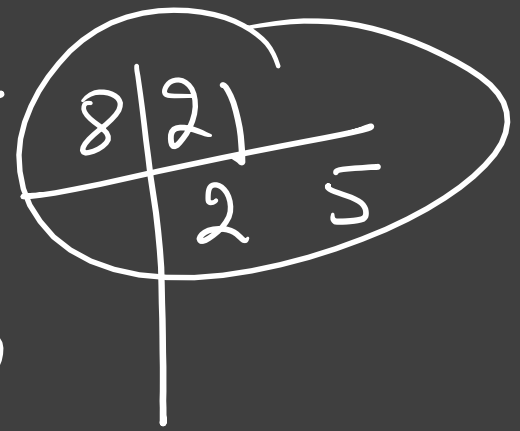
$$\begin{array}{r} {}^{2}271 \\ \times\ 32 \\ \hline 542 \\ 813x \\ \hline 8672 \end{array}$$

Oct

Ex

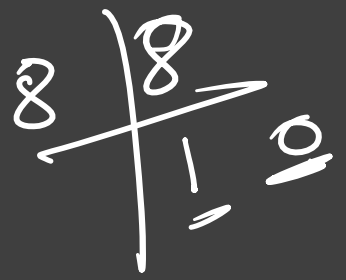
$$\begin{array}{r} {}^{1}{}^{1}271 \\ \times\ 32 \\ \hline 562 \\ 105 3x \\ \hline 11312 \end{array}$$





8

10



Number Systems

Arithmetic – Multiplication

Ex (Oct)

```
      7 5 3
  ×     4 7
  ---------
    6 5 5 5
  3 6 5 4 X
  ---------
  4 5 3 1 5
```

```
   47
 + 47
 ----
  116
```

47×1 = 47

47×2 = 116

47×3 = 165

47×4 = 234

47×5 = 303

47×6 = 352

47×7 = 421