ECE213: Digital Electronics

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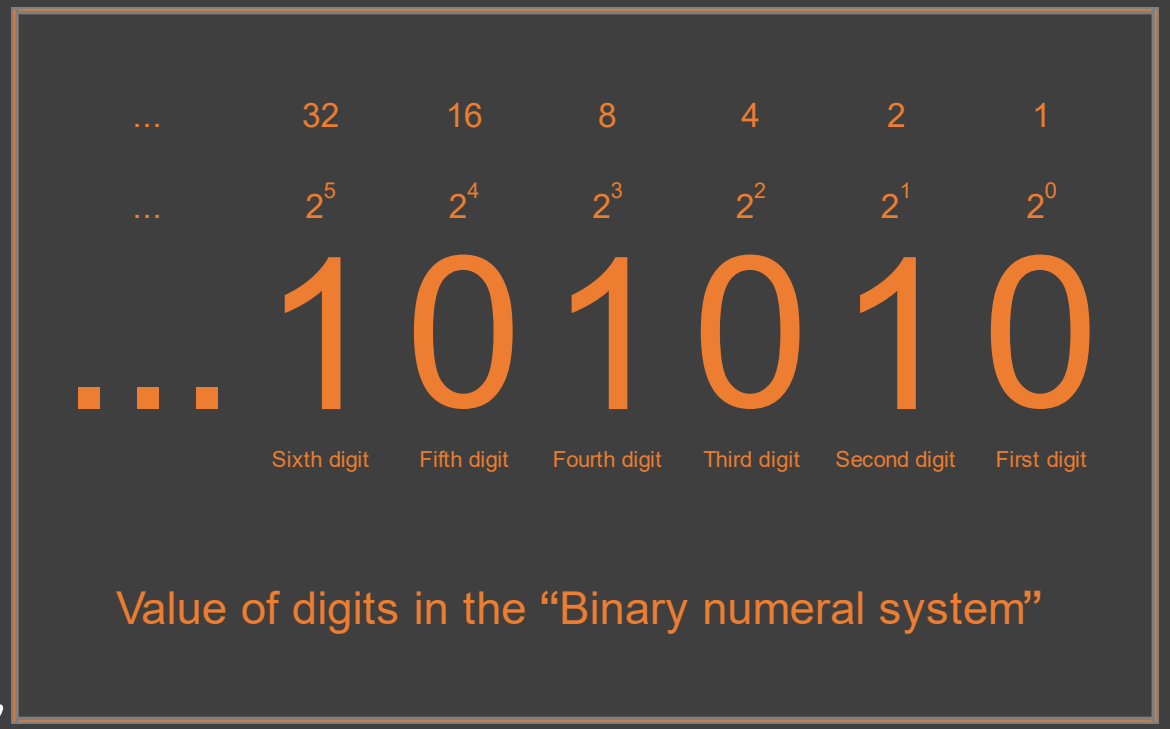
The Course Contents

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



Number Systems

Digital Systems

- ✓ Basically, the 21st era systems uses Silicon wafers, IC's, CMOS etc. in the VLSI technology to build up the large scale electronic devices & machines.
- ✓ The most commonly used devices are the Data servers, GPS systems, Security systems, market products like Bar Code Readers etc. !
- ✓ All these devices are precise and reliable except the user makes his own mistake, i.e. in these devices, system errors are least possible.
- ✓ The Cost : Performance ratio is high, hence these are economically beneficial too !

Number Systems

Analog Vs Digital Systems

- Analog signal are time varying
- Analog devices accepts value across a continuous range
- Digital signal is modeled as accepting only one of two discrete value. High '1' or Low '0'

— ∞ to ∞

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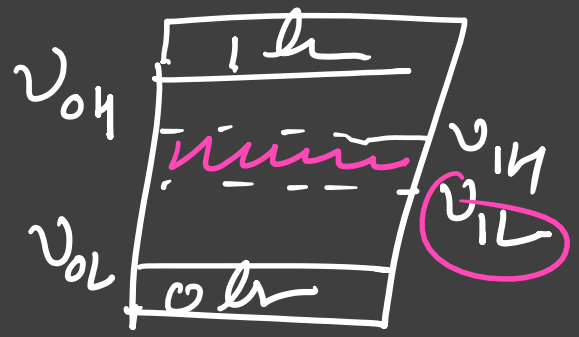
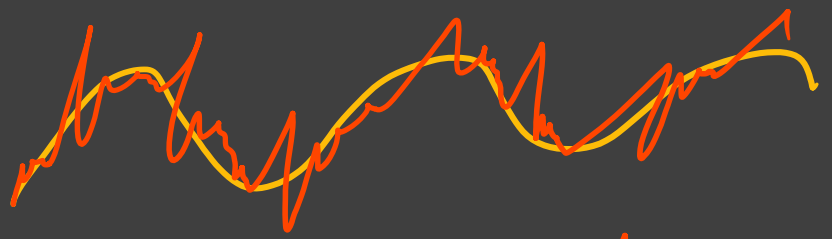
Number Systems

Analog Vs Digital Systems



MCQ



Digital devices preferred over Analog

- Reproducibility of result,
- Ease of design
- Flexibility and Programmability
- Processing speed and Economy
- Predictable accuracy
- Compact storage
- Does not affected by noise as well as analog values

Most common digital devices are Logic gate, Flip Flop

Number Systems

- Dec (10)
- Oct (8)
- Hex (16)
- Bin (2)

} Base of Number system.

fix. number of symbols.

- Dec 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Oct 0, 1, 2, 3, 4, 5, 6, 7
- Hy 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
- Bin 0, 1

Number Systems

Counting - Dec

1
2
3
4
5
6
7
8
9

10
11
12
13
14
15
16
17
18
19

20
21
22
23
24
25
26
27
28
29

30
31
32
33
34
35
36
37
38
39

Allowed Symbols

0
1
2
3
4
5
6
7
8
9

Number Systems

Counting-Oct

1 2 3 4 5 6 7 10 11

0 1 2 3 4 5 6 7

10 11 12 13 14 15 16 17

20 ... 27

30 ... 77

100 ... 777

Allowed Symbols

0 1 2 3 4 5 6 7

Number Systems

Counting

MCQ

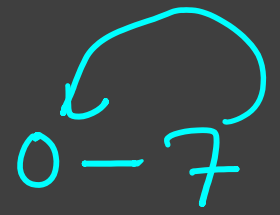
What will be the next number in Octal number system after 76567

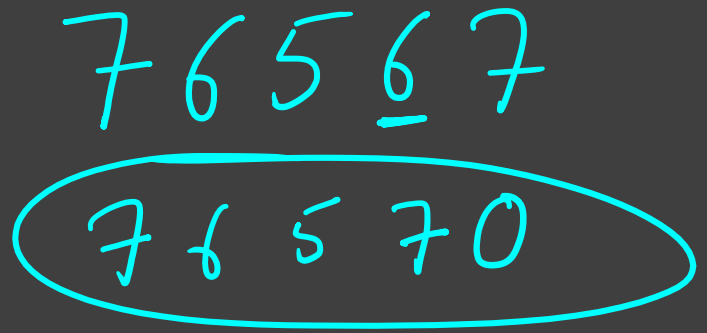
A. 76568

B. 76577

C. 76570

D. 76566





Number Systems

Counting - Hex

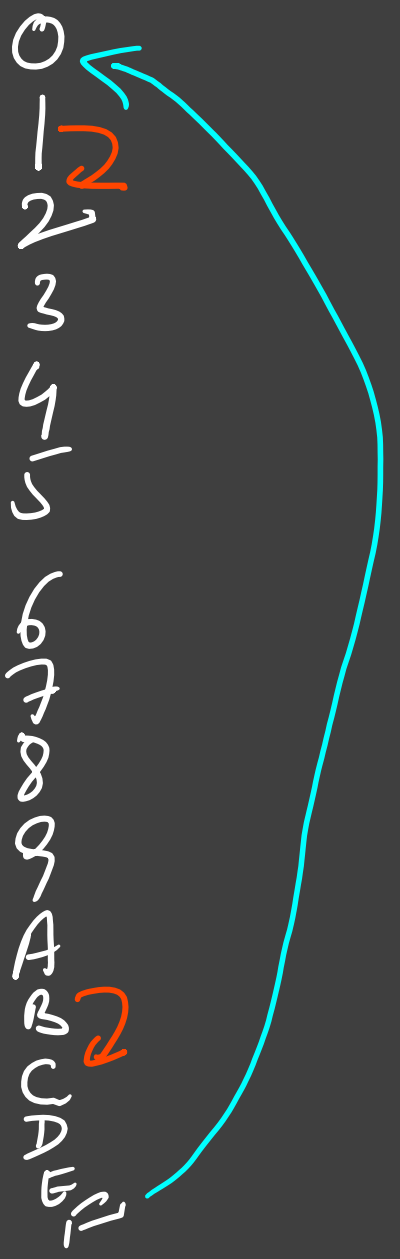
0 1 2 3 ... F

10 11 12 13 ... 1F

20 ... 2F

FEABF + FEAC0

Allows range



Number Systems

Counting - ~~Hex~~ Bin

Allow zero

Bin	Dec	Oct	Hex
0000	0	0	0
0001	1	1	1
0010	2	2	2
0011	3	3	3
0100	4	4	4
0101	5	5	5
0110	6	6	6
0111	7	7	7
1000	8	10	8
1001	9	11	9
1010	10	12	A
1011	11	13	B
1100	12	14	C
1101	13	15	D
1110	14	16	E
1111	15	17	F

Number Systems

Counting

MCQ

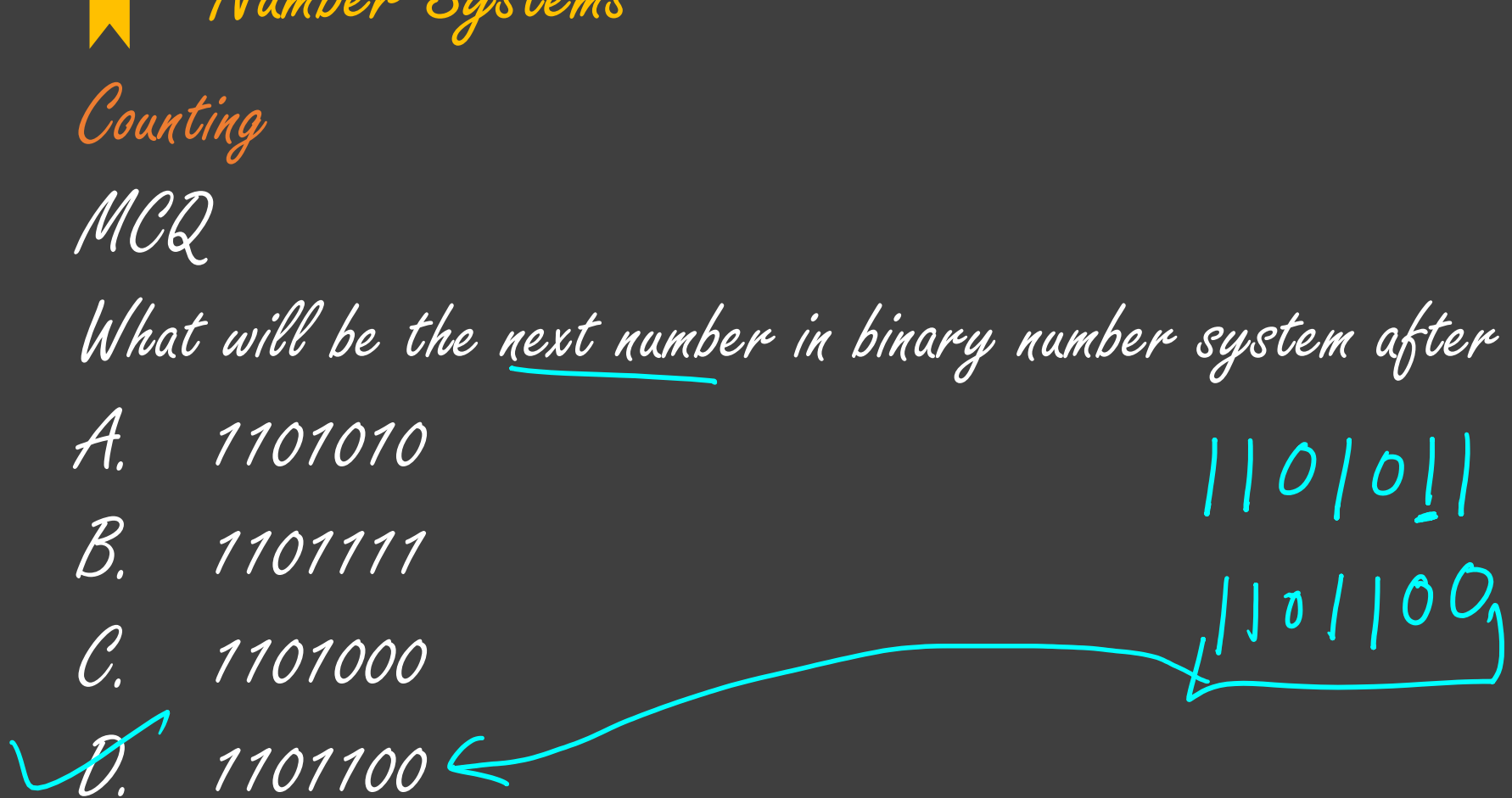
What will be the next number in binary number system after 1101011

A. 1101010

B. 1101111

C. 1101000

D. 1101100



Number Systems

Codes- Positional number system

Bol → Bin (2), oct (8), Hex (16), Dec (10)

$\ldots\ldots\ldots\ldots\ldots\ldots\ b^4\ b^3\ b^2\ b^1\ b^0 . b^{-1}\ b^{-2}\ b^{-3}\ b^{-4} \ldots\ldots\ldots$

Bin $2^4\ 2^3\ 2^2\ 2^1\ 2^0 . 2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4} \ldots\ldots$

$\ldots\ 16\ 8\ 4\ 2\ 1 .\ 0.5\ 0.25\ 0.125 \ldots\ldots$

oct $8^4\ 8^3\ 8^2\ 8^1\ 8^0 . 8^{-1}\ 8^{-2}\ 8^{-3} \ldots\ldots$

Hex $\ldots\ 16^3\ 16^2\ 16^1\ 16^0 . 16^{-1}\ 16^{-2}\ 16^{-3} \ldots\ldots$

Dec. $\ldots\ 10^3\ 10^2\ 10^1\ 10^0 . 10^{-1}\ 10^{-2}\ 10^{-3} \ldots\ldots$

Number Systems

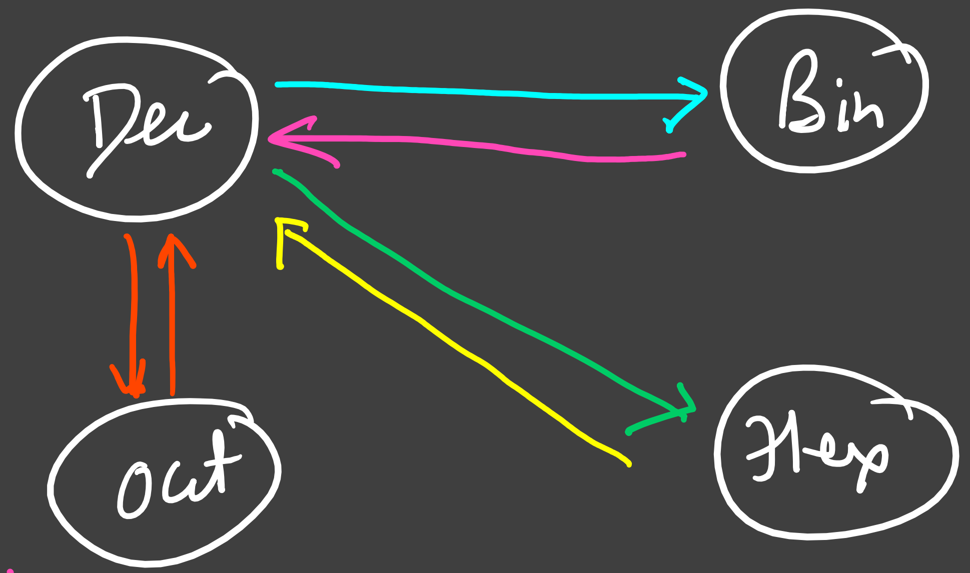
Methods of base conversions

Ex $(37)_{10} \rightarrow (\quad)_2$

S| inter part

$$
\begin{array}{r|ll}
2 & 37 & \\
\hline
2 & 18 & 1 \\
\hline
2 & 9 & 0 \\
\hline
2 & 4 & 1 \\
\hline
2 & 2 & 0 \\
\hline
 & 1 & 0
\end{array}
$$

$(100101)_2$



1	0	0	1	0	1
2^5	2^4	2^3	2^2	2^1	2^0
32	16	8	4	2	1

$32 + 4 + 1 = (37)_{10}$

Number Systems

Methods of base conversions

$(37)_{10} \rightarrow (\ )_{16}$

16	37
	2 | 5

$(25)_{16}$

$(25)_{16} \rightarrow (37)_{10}$

$2 \quad 5$

$16^1 \quad 16^0$

$16 \quad 1$

$32 + 5 = 37$

Number Systems

Methods of base conversions

$(100101)_2 \longrightarrow$ Hex $(\quad)_{16}$

00 | 00 | 10 |

$(2 \quad 5)_{16}$

Dec $\leftarrow$ 0080

8000 $\rightarrow$ X