Logic Design

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Numbering System

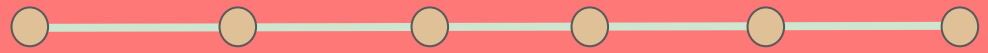
Numbering System

1. Binay : 0,1
2. Octal : 0,1,2,3,4,5,6,7,8
3. Decimal : 0,1,2,3,4,5,6,7,8,9
4. Hexadecimal : 0,1,2,3,4,5,6,7,8,9,A=10,B=11,C=12,D=13,E=14,F=15

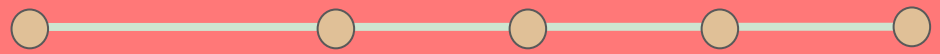
Numbering System Conversion

1. Any System → Desimal :

Binary : 32 16 8 4 2 1



Octal : 4069 512 64 8 1



Decimal : 4069 256 16 1

Examples :

A. $(011010)_2 \rightarrow (\ \ )_{10}$

Solution :

32	16	8	4	2	1
0	1	1	0	1	0

$(16) + (8) + (2) = (26)_{10}$

Other examples for you

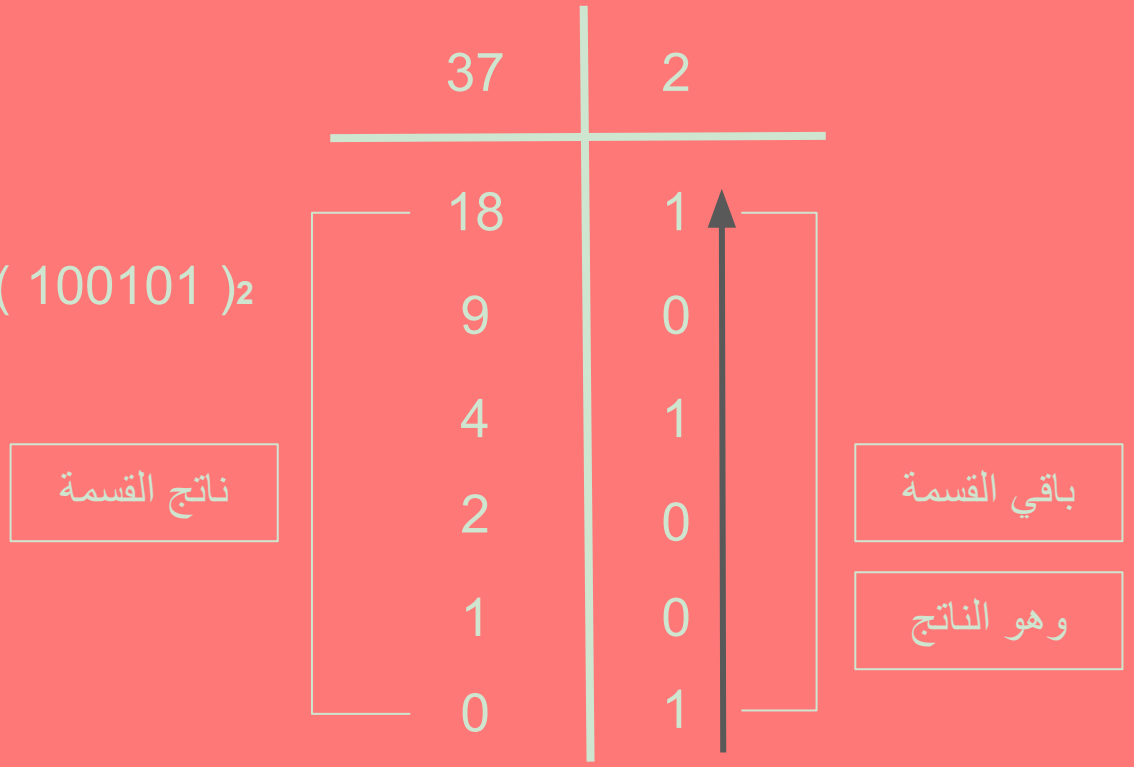
A. $(35)_8 \rightarrow (\quad)_{10}$

B. $(A5)_{16} \rightarrow (\quad)_{10}$

2. Desimal → Any System :

الرقم/ رقم النظام المراد التحويل اليه = (الناتج - العدد الصحيح) x رقم النظام المراد التحويل اليه

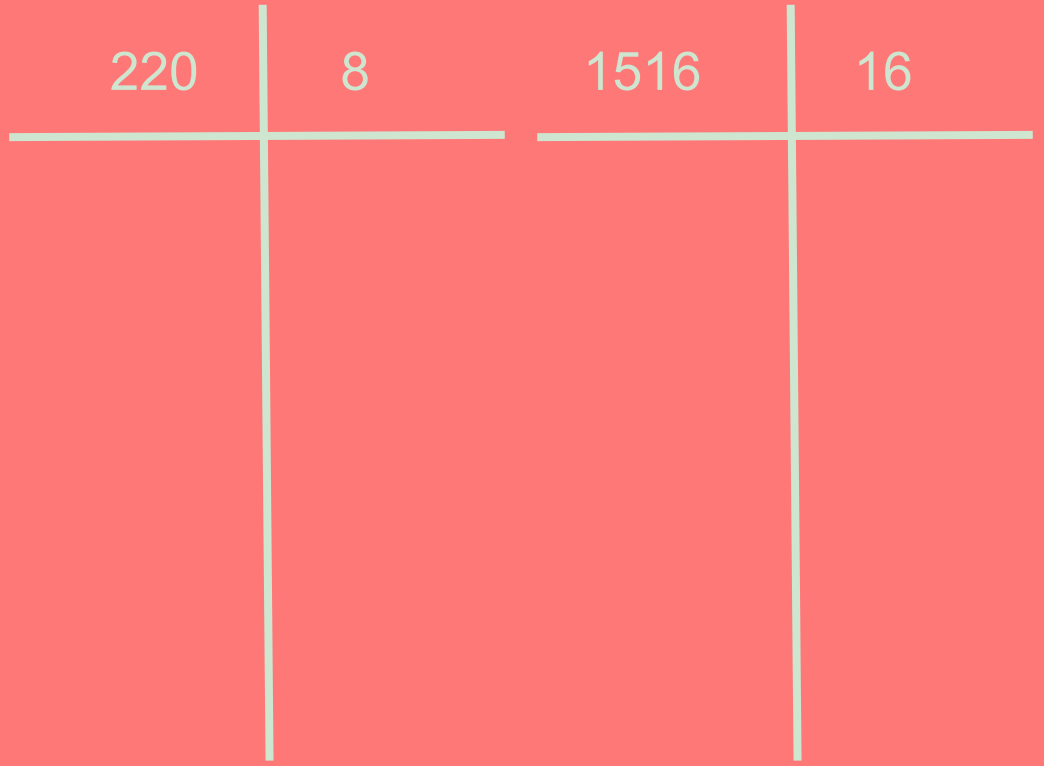
Example : $(37)_{10}$ → (100101)$_2$



Other examples for you

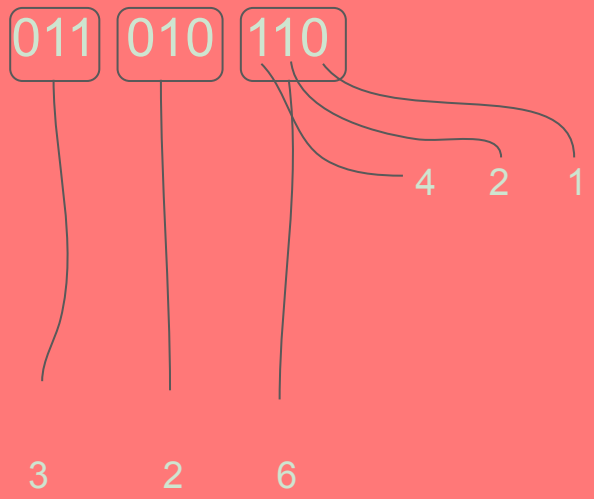
A. $(220)_{10} \rightarrow (\quad)_8$

B. $(1516)_{10} \rightarrow (\quad)_{16}$



3. Binary → Any System :

A. $(011010110)_2 \rightarrow (\quad)_8$



Note :

Binary → Octal = 3 digits

Binary → Hexadecimal = 4 digits

110 in binary = 4 + 2 + 0 = 6 in decimal

4. Octal $\overset{2}{\rightleftarrows}$ HexaDecimal :

A. $(64)_8 \rightarrow (\quad)_{16}$

First : $(64)_8 \rightarrow (\quad)_2$

Second : $(\quad)_2 \rightarrow (\quad)_{16}$

$(64)_8 \rightarrow (\ 110100\ )_2$

00 $(\ 110100\ )_2 \rightarrow (\ 34\ )_{16}$

نزيد اصفار لليسار لإكمال المجموعة

Octal to Binary (3 digits)

HexaDecimal to Binary (4 digits)

Note :

Binary → Octal = 3 digits

Binary → Hexadecimal = 4 digits

	16	8	4	2	1
4 =			1	0	0
6 =			1	1	0
4 =		0	1	0	0
3 =		0	0	1	0

Other examples for you

A. $(B21)_{16} \rightarrow (\quad)_8$

B. $(D21)_{16} \rightarrow (\quad)_8$

5. Decimal fractions → Binary fractions

A. $(0.345)_{10} \rightarrow (\quad)_2$

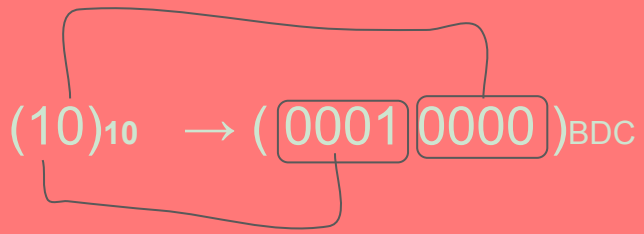
عند وجود عدد 1 صحيح نضعه بالجواب ثم نضرب الكسر فقط ب 2 (بدون العدد الصحيح)

0.345 x 2 = 0.69
0.69 x 2 = 1.38
0.38 x 2 = 0.76
0.76 x 2 = 1.52

$(0.0101)_2$

5. Decimal → Binary Decimal Code

A. $(10)_{10}$ → ( )$_{BDC}$



Each number represented by 4 digits in BDC :
0 =0000
1=0001

6. Binary → Gray

A. $(0110110)_2 \rightarrow (\quad)_{Binary}$

Note :

0 + 0 =0
1 + 1 = 0
1 + 0 = 1
0 + 1 = 1

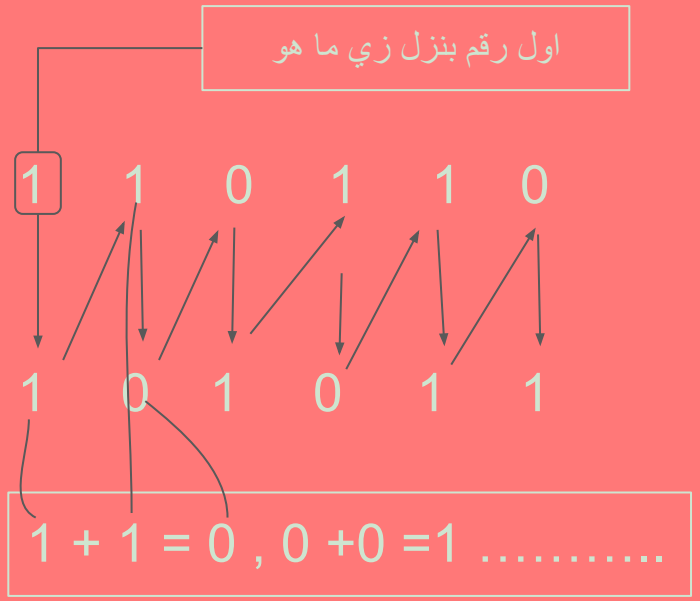
$(0110110)_2 \rightarrow (\ 0110110\ )_{Gray}$

6. Gray → Binary

A. $(110110)_{Gray} \rightarrow (\quad)_{Binary}$

Note :

0 + 0 =0
1 + 1 = 0
1 + 0 = 1
0 + 1 = 1



$(110110)_{Gray} \rightarrow (\ 101011)_{Binary}$

2’s Complement

A. 1000

0111 +

1

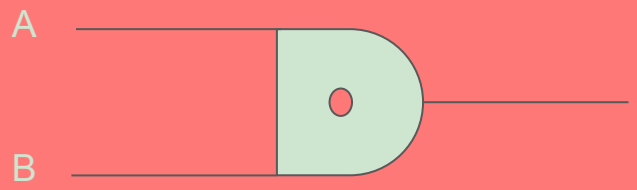
1’s Complement

2’s Complement

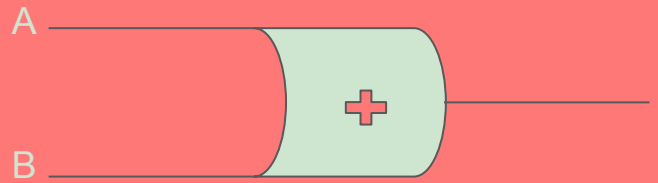
1000 = 8

Logic Gates

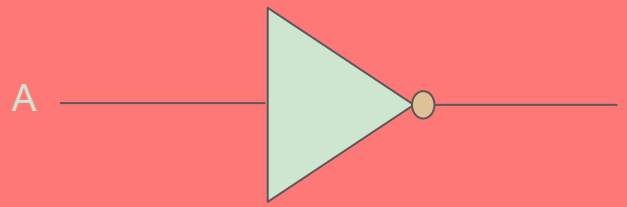
Logic Gates



A ^ B / A and B / A . B



A U B / A or B / a + b



$\overline{A}$ / not A

Note :

XOR :
0= متشابهين
1 = مختلفين

NAND : Not and

NOR : Not or

Boolean Algebra

Boolean Algebra

Rules of boolean algebra

- $A + 0 = A$
- $A + 1 = 1$
- $A \cdot 0 = 0$
- $A \cdot 1 = 1$
- $A + A = A$
- $A + \overline{A} = 1$

- $A \cdot A = A$
- $A \cdot \overline{A} = 0$
- $\overline{\overline{A}} = A$
- $A + AB = A$
- $A + \overline{A}B = A + B$
- $(A + B)(A + C) = A + BC$

DeMorgan Theorem → $\overline{x + y} = \overline{x} \cdot \overline{y}$ // $\overline{x} \cdot \overline{y} = \overline{x + y}$

Karnaugh Map

Karnaugh Map

F after simplification = المتغيرات التي بقيت ثابتة في جميع الخلايا

1 = A
0 = $\overline{A}$

A. $F = \overline{W}XYZ + \overline{W}XY\overline{Z} + WXYZ + WXY\overline{Z}$

4 variables → 2^4 = 16 (Cells)

F after simplification = xy

التجميع كل 16 اذا مافي 8 اذا ما في 4 و هكذا

Sum of F = (0111 + 0110 + 1111 + 1110)
= (6 + 7 + 14 + 15) = 42