UNIT 1 : LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN

Today's Target

- BINARY ARITHMATIC OPERATIONS
- Binary Addition, Subtraction, Multiplication, Division
- DPP

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BINARY ARITHMATIC OPERATIONS

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- Binary Addition
- Binary Subtraction
- Binary Multiplication
- Binary Division

Binary Addition

A	B	S	Carry
0	0	0	
0	1	1	
1	0	1	
1	1	0	1
1	1	1	1

```
  1 1 1
  1 0 1 1 0
+ 0 1 1 1 1
-------------
1 1 0 0 1 0 1
```

Result = 100101

Binary Subtraction

$0 - 0 = 0$

$1 - 0 = 1$

$1 - 1 = 0$

$0 - 1 = 1$ | 1 = Borrow

$$\begin{array}{r} {\scriptstyle 1} \\ 2\,17 \\ -\;\;9 \\ \hline \end{array}$$

Ex:

$$\begin{array}{r} {\scriptstyle 0\;\;\;0\;\;\;1} \\ 1\,0\,1\,1\,1\,0 \\ -\;0\,1\,0\,1\,0\,0\,1 \\ \hline 0\,1\,1\,0\,0\,1\,1 \end{array}$$

Binary Multiplication

$0 \times 0 = 0$

$0 \times 1 = 0$

$1 \times 0 = 0$

$1 \times 1 = 1$

$$
\begin{array}{r}
123 \\
\times\ 52 \\
\hline
246 \\
+615x \\
\hline
6396
\end{array}
$$

$$
\begin{array}{r}
1011010 \\
\times\ \ \ 0110 \\
\hline
0000000 \\
1011010x \\
1011010xx \\
+\ 000000xxx \\
\hline
1000011100
\end{array}
$$

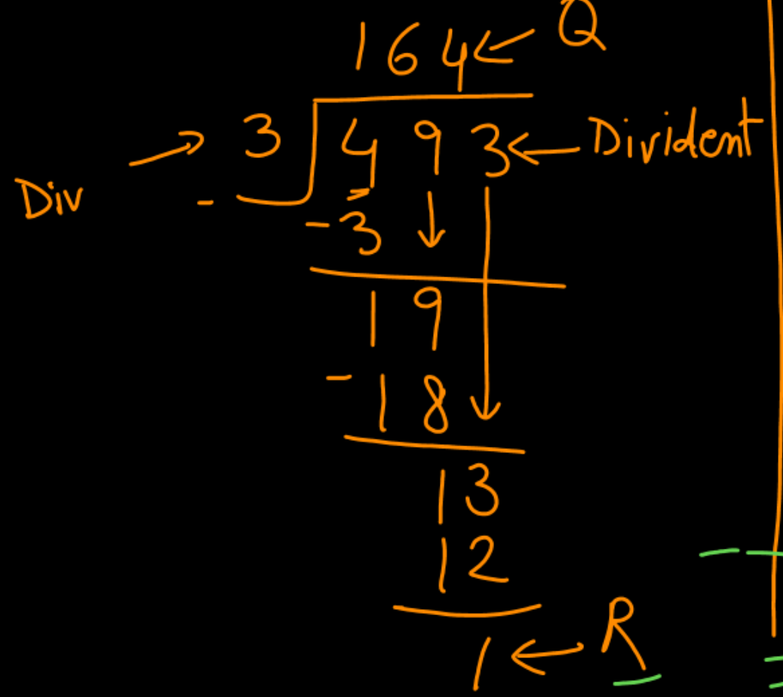
Binary Division

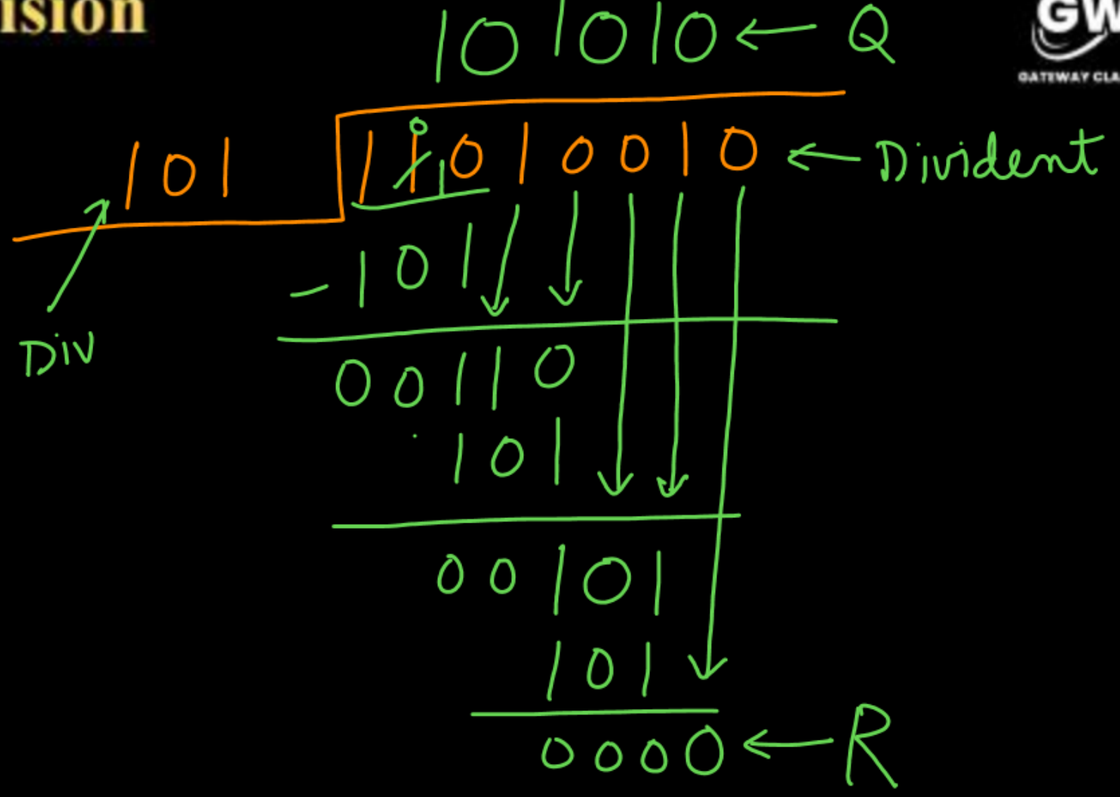
$0 \div 0 = 0$

$0 \div 1 = 0$

$1 \div 0 = ND$

$1 \div 1 = 1$





$$
\begin{array}{r}
{\scriptstyle 1} \\
(3\ 3)_6 \rightarrow (\quad)_{10} \\
+\,(4\ 5)_6 \rightarrow (\quad)_{10} \\
\hline
(1\ 2\ 2)_6
\end{array}
\qquad
\begin{array}{c}
\\
\\
\\
\hline
\\
\downarrow \\
(\quad)_6
\end{array}
$$

$6 \rightarrow 10$

$7 \rightarrow 11$

$8 \rightarrow 12$

0 1 2 3 4 5 10 11 12 13 14 15 20 21 ⋮ 25

0 1 2 3 4 ⋮ 9 10 11 12 13 ⋮ 19 20

99

100

UNIVERSITY QUESTIONS

YEAR	QUESTIONS	MARKS
22-23	Convert $(454.523)_{10}$ to an Hexadecimal number	2 marks
20-21	Convert the following: (i) Hexadecimal equivalent of decimal number 256 (ii) Decimal equivalent of $(123)_9$ (iii) $(378.93)_{10}$ to octal (iv) Convert A3BH and 2F3H into binary	10 marks
19-20	The solution to the quadratic equation $k^2 - 11k + 22 = 0$ are k=3 and k=6. What is the base of the number system?	2 marks
18-19	Determine the value of base x, if $(193)_x = (623)_8$	2 marks
17-18	What is (33)6 + (45)6	2 marks
17-18	Convert the following (i) $(562.13)_7 = (?)_{10}$ (ii) $(467.342)_8 = (?)_{10}$	2 marks

$(256)_{10} = (\quad)_H$

$(123)_9$

$1\times9^2 + 2\times9^1 + 3\times9^0 = 81 + 18 + 3$

$= (102)_{10}$

1010 0011 1011

$$K^2 - 11K + 22 = 0 \Rightarrow (K = 3, K = 6)$$

Suppose base = B

For $K = 3$

$$3^2 - (1 \times B^1 + 1 \times B^0)3 + (2 \times B^1 + 2 \times B^0) = 0$$

$$9 - (B + 1)3 + (2B + 2) = 0$$

$$9 - 3B - 3 + 2B + 2 = 0$$

$$-B + 8 = 0$$

$$\boxed{B = 8}$$

For $K = 6$

$$6^2 - (1 \times B^1 + 1 \times B^0)6 + (2B^1 + 2B^0) = 0$$

$$36 - (B + 1)6 + (2B + 2) = 0$$

$$36 - 6B - 6 + 2B + 2 = 0$$

$$(15)_6$$

$$1 \times 6^1 + 5 \times 6^0$$

$$32 - 4B = 0$$

$$4B = 32$$

$$\boxed{B = 8}$$

$(454.523)_{10} = (\quad)_4$

16	454	6
16	28	12=C
16	1	1
	0	

$0.523 \times 16 = 8.368$ → 8

$0.368 \times 16 = 5.888$ → 5

$0.888 \times 16 = 14.208$ → 14(E)

$(1C6.85E)_{16}$

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Convert :

a) $(1011)_2 + (11010)_2$

b) $(1011010)_2 - (1001001)_2$

c) $(10110)_2 \times (1010)_2$

d) $(1101101)_2 \div (1011)_2$

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Thank You

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