Lecture 2

08 Jan, 2023

Binary to Octal:

eg: $(011001)_2$ to $(?)_8$

$\{0, 1, 2, 3, 4, 5, 6, 7\}$

$2^3 = 8$

8 4 2 1

2^3 2^2 2^1 2^0

0 0 0 1 → 1

0 0 1 1 → 3

0 1 0 1 → 5

0 1 1 0 → 6

$\underline{0\ 1\ 1}\ \underline{0\ 0\ 1}$

3 1

$\therefore (011001)_2 = (31)_8$

eg: $(0.110101)_2 = (?)_8$

$0.\underline{1\ 1\ 0}\ \underline{1\ 0\ 1}$

6 5

$\therefore (0.110101)_2 = (0.65)_8$.

Divisibility Rules:

1. 2 if its last digit is even.

eg: 2168, 1213456, etc.

2. 3 if the sum of the digits is divisible by 3

eg: 123

$1+2+3 = 6$

$$3\overline{)6}\quad 2,\ -6,\ 0$$

123 is div. by 3

eg: 1231

$1+2+3+1 = 7$

$$3\overline{)7}\quad 2,\ -6,\ 1$$

∴ 1231 is not div. by 3.

3. 4 : if the last two digits of a no. are divisible by 4

eg: 2624

$$4\overline{)24}\quad 6,\ -24,\ 0$$

∴ 2624 is div by 4

eg: 1321

$$4\overline{)21}\quad 5,\ -20,\ 1$$

∴ 1321 is not div. by 4

4. 5 : if the last digit is either 0 or 5

eg: 216295 , 1234010 , etc.

5. 6 : if the no. is divisible by both 2 and 3.

eg: 36

$$2\overline{)36}\quad 18,\ -2,\ 16,\ -16,\ 0$$

$$3\overline{)36}\quad 12,\ -3,\ 06,\ -6,\ 0$$

36 is div. by 6.

eg: 78

78 is div. by 2 ∵ even no. in units place

7+8 = 15 $\quad 3\overline{)15}\quad 5,\ -15,\ 0$ ∴ 78 is div. by 3

∴ 78 is div by both 2 & 3, we conclude 78 is div. by 6

6. 7 if the last digit of the no. is doubled & subtracted from the rest of the no. & this difference is divisible by 7

eg: 154

Last Digit = 4

Double the last digit = 4 × 2 = 8

Remaining no = 15

Subtract : 15 − 8 = 7 is the difference

$$\begin{array}{r} 1 \\ 7\overline{)7} \\ -7 \\ \hline 0 \end{array}$$

∴ the difference is divisible by 7, the no 154 is divisible by 7.

eg: 4172

2 × 2 = 4

417 − 4 = 413

$$\begin{array}{r} 59 \\ 7\overline{)413} \\ -35 \\ \hline 63 \\ -63 \\ \hline 0 \end{array}$$

∴ 4172 is div. by 3.

7. 8 if the last three digits of a no. are div. by 8

eg. 4768

$$
\begin{array}{r}
96 \\
8\overline{)768} \\
-72 \\
\hline
48 \\
-48 \\
\hline
0
\end{array}
$$

∴ 4768 is div. by 8

Home Work: Check if foll. no. is div by 8: 477496

477448

4732

64

8. 9 if the sum of digits is div. by 9

eg: 4122

4+1+2+2 = 9

$$
\begin{array}{r}
1 \\
9\overline{)9} \\
-9 \\
\hline
0
\end{array}
$$

∴ 4122 is div. by 9

eg: 412965

4+1+2+9+6+5 = 27

$$
\begin{array}{r}
3 \\
9\overline{)27} \\
-27 \\
\hline
0
\end{array}
$$

∴ 412965 is div by 9.

9. 10 if no ends with 0

eg: 0, 10, 20, 12340, ...

10. 11 if the difference of the alternating sum of digits is a multiple of 11

eg: 3784 ✓

No. of digits = 4

Alt pair 1: 3, 8

Alt pair 2: 7, 4

3+8 = 11

7+4 = 11

11−11 = 0

eg: 82907

8+9+7 = 24

2+0 = 2

24−2 = 22

✓

eg: 9647

H/w:

11 12 if no. is divisible by both 3 & 4.

Remainder.

$13 / 6 = 2$

$13 \% 6 = 1$

$$\begin{array}{r} 2 \\ 6\overline{)13} \\ -12 \\ \hline 1 \end{array}$$

2 — Quotient

1 — Remainder

$$\begin{array}{r} 0 \\ 3\overline{)0} \\ -0 \\ \hline 0 \end{array} \qquad \begin{array}{r} 0 \\ 3\overline{)1} \\ -0 \\ \hline 1 \end{array} \qquad \begin{array}{r} 0 \\ 3\overline{)2} \\ -0 \\ \hline 2 \end{array} \qquad \begin{array}{r} 1 \\ 3\overline{)3} \\ -3 \\ \hline 0 \end{array} \qquad \begin{array}{r} 1 \\ 3\overline{)4} \\ -3 \\ \hline 1 \end{array} \qquad \begin{array}{r} 1 \\ 3\overline{)5} \\ -3 \\ \hline 2 \end{array} \qquad \begin{array}{r} 2 \\ 3\overline{)6} \\ -6 \\ \hline 6 \end{array}$$

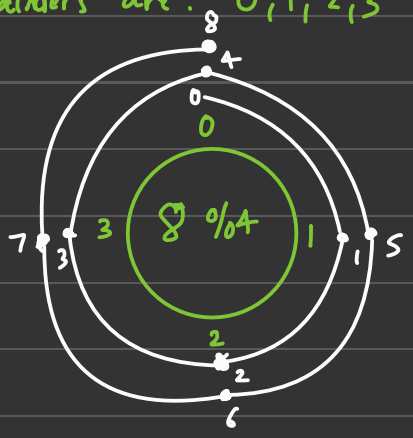
Div. by 3: → 0, 1, 2 (Rem)

Clock Mtd: $8 \% 4 = ?$

Div. by 4: Possible remainders are: 0, 1, 2, 3

$$\begin{array}{r} 2 \\ 4\overline{)8} \\ -8 \\ \hline 0 \end{array}$$

$\therefore 8 \% 4 = 0$

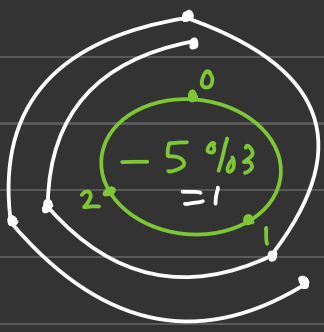


$9 \% 3 = ?$

Div. by 3: Remainders 0, 1, 2

$-5 \% 3 = ?$

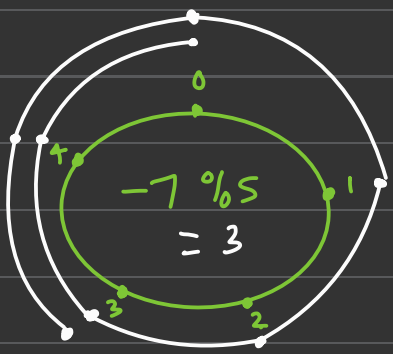
Div. by 3: Rem : 0, 1, 2



$\therefore -5 \% 3 = 1$

$-7 \% 5 = ?$

Div. by 5! Rem r $0, 1, 2, 3, 4$



Clock Problems:

1. A watch gains 5 mins in one hour & was set right at 8am What time will it show at 8 pm on the same day?

Soln:

$12\,hr \times 5 = 60\,min$

8 pm + 1hr = 9pm.

2 HW

A watch loses 5 seconds in one hour & was set right at 7am What time will it show at 2pm on the same day?

HW

Decimal to Binary: 20

120

0.61

20.62

Decimal to Octal: 217

2556

0.39

12.93

Octal to Decimal: 746

0.123

Decimal to Hexa decimal: 2338

0.132

12.48

Binary to Octal: 010010

1010.01010

110101.10111110

Binary to Hex: 11000110

1100101011.1110