



Subject: DLCA

SEM: III

Binary Coded Decimal (BCD)

→ Numbers from 0 to 9 are valid BCD no.
4 no. greater than 9 are invalid BCD no.

* BCD Addition

- Rules → 1) Add two no's using binary addition
2) if four bits are equal to or less than 9, then it is valid BCD
3) if Larger than 9 then, invalid BCD, so add 6 i.e. $(0110)_2$ to the sum.
4) if $\text{sum} \leq 9$ (less or equal), $\text{Carry} = 0$ then valid
5) if $\text{sum} > 9$; $\text{Carry} = 0$, then invalid, add $(0110)_2$
6) if $\text{sum} \leq 9$, $\text{Carry} = 1$, then sum is valid but carry is invalid \therefore invalid BCD again add $(0110)_2$

Ex 1] $(67)_{10} + (23)_{10}$ in BCD

$$(67)_{10} \rightarrow \begin{array}{cc} \overline{11} & \overline{111} \\ 0110 & 0111 \end{array}$$

$$(23)_{10} \rightarrow \begin{array}{cc} 0010 & 0011 \end{array}$$

$$\begin{array}{cc} \hline 1000 & 1010 \\ \hline \underbrace{}_{8} & \underbrace{}_{\text{Invalid}} \end{array} \quad 10$$



Subject: DLCA

SEM: III

Add $(0110)_2$ to invalid

$$\begin{array}{r}
 \begin{array}{cccc}
 & 1 & & \\
 1 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 \\
 \hline
 1 & 0 & 0 & 1
 \end{array}
 \quad
 \begin{array}{cccc}
 & 1 & 1 & \\
 1 & 0 & 1 & 0 \\
 0 & 1 & 1 & 0 \\
 \hline
 0 & 0 & 0 & 0
 \end{array}
 \end{array}$$

$\underbrace{\quad\quad\quad}_9 \qquad \underbrace{\quad\quad\quad}_0$

$$\therefore (67)_{10} + (23)_{10} = (90)_{10}$$

Ex 2] $(709)_{10} + (698)_{10}$ in BCD

$$(709)_{10} \rightarrow \begin{array}{ccccccc} & 1 & & & & & \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \end{array}$$

$$(698)_{10} \rightarrow + \begin{array}{ccccccc} & 1 & & & & & \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccccccc}
 1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1
 \end{array}$$

13
invalid

10
invalid

1 but carry = 1
 \therefore invalid

→

$$\begin{array}{r}
 110110100001 \\
 + 011001100110 \\
 \hline
 0001 \underbrace{0100}_4 \underbrace{0000}_0 \underbrace{0111}_7 = (1407)_{10}
 \end{array}$$