

# BCD Subtraction:

13

2024

Tuesday

FEBRUARY

2024

FEBRUARY

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		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										

One of the methods for performing BCD subtraction is the addition of the 9's complement of the subtrahend to the minuend. EAC (end-around carry) indicated by the arrow) is added as shown below -

Ex 1 Subtract 748 from 983 using 9's complement method.

$$\begin{array}{r}
 999 \\
 - 748 \\
 \hline
 251
 \end{array}$$

~~Add This~~ Add this to minuend:

$$\begin{array}{r}
 983 \\
 + 251 \\
 \hline
 1234
 \end{array}$$

Then add this carry:

$$\begin{array}{r}
 983 \\
 + 251 \\
 \hline
 1234 \\
 \leftarrow \text{EAC}
 \end{array}$$

235 ← Answer

1) We shall show it through BCD numbers. Remember, where there is invalid BCD number we shall add 0110. We shall add EAC.

$$983 \rightarrow 1001 \quad 1000 \quad 0011$$

$$251 \rightarrow 0010 \quad 0101 \quad 1000$$

$$\begin{array}{r}
 1011 \\
 0110 \\
 + \\
 \hline
 \end{array}$$

(Add 6 to invalid BCD Number)







Ex 3

Carry out the following BCD Subtraction using 10's Complement.

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Thursday

FEBRUARY

2024 FEBRUARY

M	T	W	T	F	S	S	M	T	W	T	F	S	S
			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										

Note: in 10's Complement method ignore EAC.

68	68	minuend
- 61	+ 39	10's Complement of
07	107	Subtrahend 61
	↑	
	ignore this carry	

We can show it as follows:

68	→	0110	1000
+ 39	→	0011	1001
		+ 1001	0001
		1	Carry
		0110	Add 6
		1010	
		0110	Add 6
ignore	→	10000	0111

This carry 0000 0111 = 7

Ex 4

Carry out the following BCD Subtraction.

24	BCD of 24	=	0010	0100
- 6	BCD of 9's complement of 6 (93)	=	1001	0011
18	Complement			

1	Add	1101	0111
Add (6)		0110	0000
1		10001	0111
		Carry	
			1 Add EAC

6001 1000 = 18 of BCD

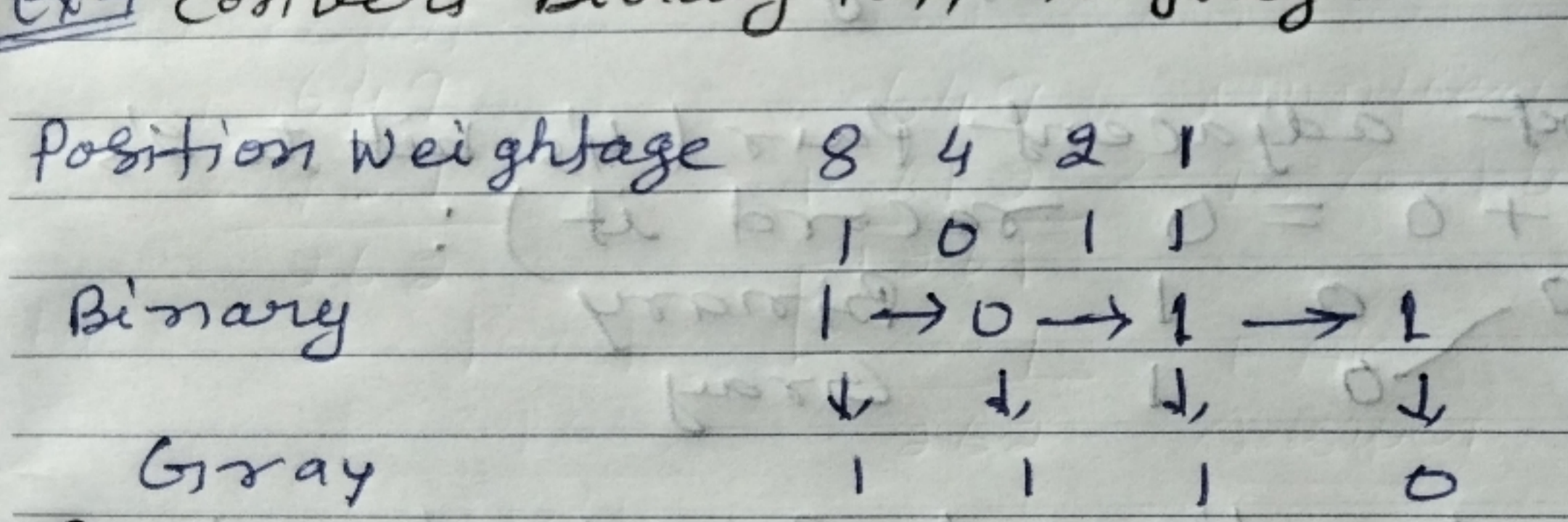


# Gray Code

Another code used is the Gray Code. In binary system we find that all four bits are changed when going from 7 to 8 (0111 to 1000), in Gray code only one bit changes at a time. Following is the procedure to change a binary number to its Gray code equivalent:

- (i) Record the most significant bit (MSB)
- (ii) Add this bit to the next position, record the sum and neglect the carry.
- (iii) Record successive sums until completed.

Ex Convert binary 1011 to Gray Code



## Gray Code

Decimal	Gray
0	0000
1	0001
2	0011
3	0010
4	0110
5	0111
6	0101
7	0100
8	1100
9	1101
10	1111
11	1110
12	1010
13	1011
14	1001
15	1000
16	11000

### Procedure:

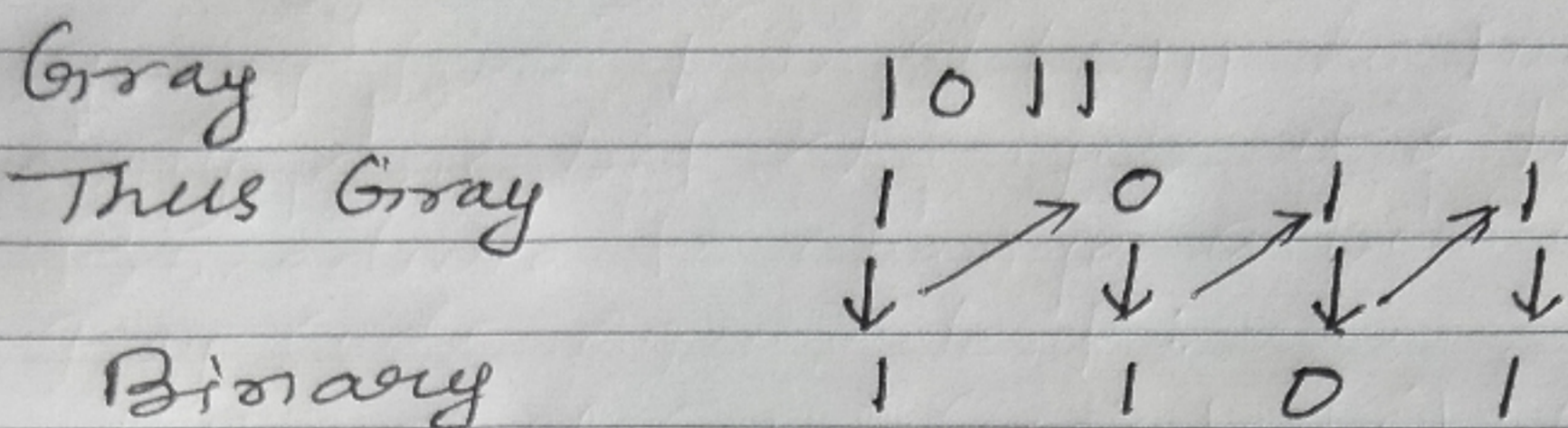
- 1) First record the 8's bit which is most significant
- 2) Now add 8's bit to 4's bit,  $1+0=1$ , Record it
- 3) Then add the 4's bit to the 2's  $0+1=1$ , Record it
- 4) Then add the 2's bit to the 1's bit,  $1+1=10$  (0 with a carry) Record 0 and ignore carry







Ex Convert the Gray Code 1011 to binary:



Procedure:

- 1) First record MSB. it is 1.
- 2) Then add MSB to 4's bit of the Gray Code number  $(1 + 0 = 1)$ . Record it.
- 3) Then add the 4's bit of the binary number to the 2's bit of the Gray Code  $(1 + 1 = 10)$ ; record 0, ignore carry. Record it.
- 4) Finally, add the 2's bit of the binary code to the 1's bit of the Gray Code  $(0 + 1 = 1)$  and record.

