BCD Subtraction :

2024
13 Tuesday
FEBRUARY

FEBRUARY 2024

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.

9's Complement of Subtrahend 748 = 999
− 748
251

~~Add This~~ Add This to minuend: 983
+ 251
1234

Then add this Carry :

983
+ 251
1234
1 ← EAC
235 ← Answer

) We Shall Show it Through BCD numbers. Remember, where there is invalid BCD number we shall add 0110. we shall add EAC.

983 → 1001 1000 0011
251 → 0010 0101 0001
+
1011 1101 0100
0110 0110 0000 (Add 6 to invalid BCD Numbers)
+

10001 0011 0100
Carry Carry
+ 1
10010 0011 0100
→ 1 EAC
0010 0011 0101 = 235

Ex-2 Carry out the following BCD subtraction using 9's complement.

649 649 minuend
− 387 + 612 ← 9's complement of Subtra-
262 1261 hend 387
1 EAC
262 Answer

We can show it as follows:

649 → 0110 0100 1001
+ 612 → 0110 0001 0010
+
1100 0101 1011
+ 0110 0000 0110 (Add 6 to
10010 0101 0001 invalid
Carry 0001 Carry BCD No.)
+
0010 0110 0001
→ 1 EAC
0010 0110 0010 = 262

Ex 3 Carry out the following BCD Subtraction using 10's Complement.

2024 FEBRUARY

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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

07

We can Show it as follows:

68 →	0110	1000
+ 39 →	0011	1001
	+ 1001	0001
	1 ↗ Carry	
	0110	Add 6
	1010	0110
	0110	1 0000 Add 6
ignore →	1 0000	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 of 6 (93)	= 1001	0011
18	Complement		
	Add	1011	0111
	Add (6)	0110	0000
	1	0001	0111
	Carry		
			1 Add EAC
	0001	1000 = 18 of BCD	

2024
Friday
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MARCH 2024
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 30 31

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-1 Convert binary 1011 to gray code

Position Weightage	8	4	2	1
	1	0	1	1
Binary	1	→ 0	→ 1	→ 1
	↓	↓	↓	↓
Gray	1	1	1	0

Procedure:
1.) Fist 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

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

2024

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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

Ex-2 Convert bincery 1001 to gray code:

Binary 1001 position weightage 8 4 2 1

1 0 0 1 =

Procedure:

1.) First record the most significant digit (left-most

1 0 0 1 : Binary

↓

1 Gray

2.) Add the left-most binary digit to the adjacent one (1+0 = 1 record it)

1 0 0 1 Binary

1 1 Gray

3.) Add the next adjacent pair (4's bit to 2's bit; 0+0 = 0 record it):

1 0 0 1 Binary

1 1 0 1 Gray

4.) Add the next adjacent pair (2's bit to 1's bit: 0+1 = 1, record it there is no carry)

18 Sunday

1 0 0 1 Binary

Final result → 1 1 0 1 Gray

In adding this pair record 0 and ignore if there is any carry. In our case there is no carry.

The above procedure can be extended to any number of bits.

Gray Code

Ex Convert the Gray Code 1011 to binary:

Gray	1	0	1	1
Thus Gray	1	0	1	1
	↓	↗ ↓	↗ ↓	↗ ↓
Binary	1	1	0	1

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