Digital Systems

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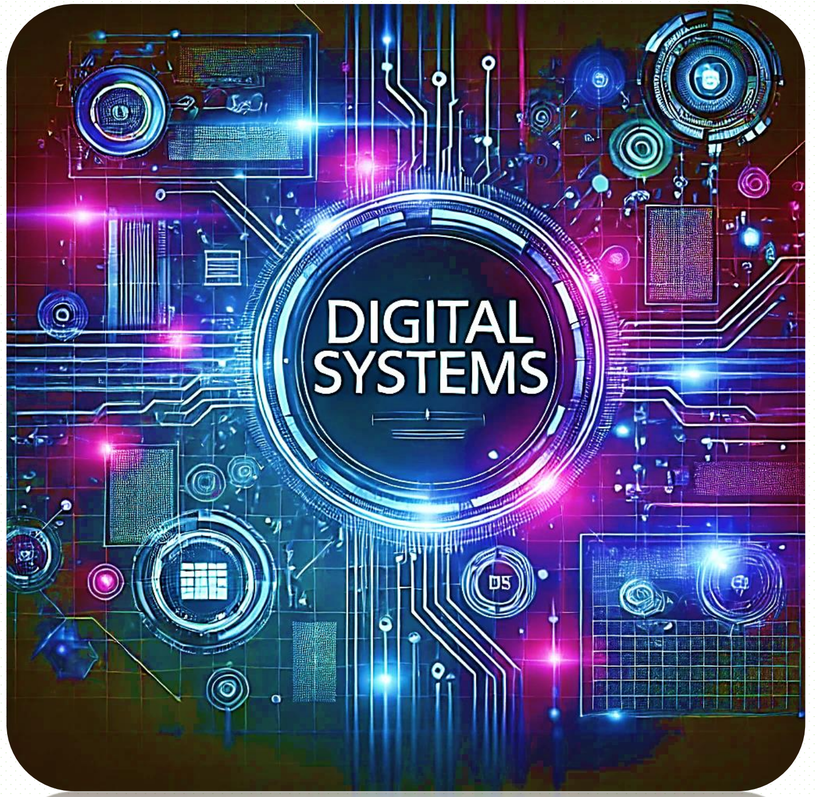

Computer Techniques Engineering Department

1's complement subtraction

- 1. At first, find 1's complement of the B(subtrahend).
  2. Then add it to the A(minuend).
  3. If the final carry over of the sum is 1, then it is dropped and 1 is added to the result.
  4. If there is no carry over, then 1's complement of the sum is the final result and it is negative.

1's complement subtraction

- **Find Subtraction of 110 and 101 using 1's complement method**

  Here A = 110, B = 101.
  Find A - B = ? using 1's complement
  First find 1's complement of B = 101

  Note : 1's complement of a number is obtained by subtracting all bits from 111.
  1's complement of 101 is

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

Now Add this 1's complement of B to A

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

The left most bit of the result is called carry and add it to the rest part of the result **000**.

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

So answer is 001

1's complement subtraction

- **Find Subtraction of 10110 and 11101 using 1's complement method**

  Here A = 10110, B = 11101.
  Find A - B = ? using 1's complement
  First find 1's complement of B = 11101

1's complement of a number is obtained by subtracting all bits from 11111.
1's complement of 11101 is

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

Now Add this 1's complement of B to A

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

Here there is no carry, answer is - (1's complement of the sum obtained 11000).

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

So answer is -00111

2's complement subtraction

- 1. At first, find 2's complement of the B(subtrahend).
  2. Then add it to the A(minuend).
  3. If the final carry over of the sum is 1, then it is dropped and the result is positive.
  4. If there is no carry over, then 2's complement of the sum is the final result and it is negative.

2's complement subtraction

- Find Subtraction of 110 and 101 using 2's complement method
- Here A = 110, B = 101.
- Find A - B = ? using 2's complement
- First find 2's complement of B = 101

Note : 2's complement of a number is 1 added to it's 1's complement number.
1's complement of 101 is

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

Now add 1 : 010 + 1 = 011

Now Add this 2's complement of B to A

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

The left most bit of the result is called carry and it is ignored.
So answer is 001

2's complement subtraction

- **Find Subtraction of 10110 and 11101 using 2's complement method**

  Here A = 10110, B = 11101.
  Find A - B = ? using 2's complement
  First find 2's complement of B = 11101

  Note : 2's complement of a number is 1 added to it's 1's complement number.
  1's complement of 11101 is

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

Now add 1 : 00010 + 1 = 00011

Now Add this 2's complement of B to A

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

Here there is no carry, answer is - (2's complement of the sum obtained 11001)
Note : 2's complement of a number is 1 added to it's 1's complement number.
1's complement of 11001 is

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

Now add 1 : 00110 + 1 = 00111
So answer is -00111

Subtraction example

(-9)		1	0	1	1	1
+(+4)	+	0	0	1	0	0
		1	1	0	1	1

(-9)		1	0	1	1	1
+(-4)	+	1	1	1	0	0
	1	1	0	0	1	1 (sum= -13)

+9		0	1	0	0	1
-(-4)	+	0	0	1	0	0
+13		0	1	1	0	1

-9		1	0	1	1	1
-(+4)	+	1	1	1	0	0
-13	1	1	0	0	1	1

+8		0	1	0	0	0
-(-4)	+	0	0	1	0	0
+12	0	0	1	1	0	0

-7		1	1	0	0	1
-(-3)	+	0	0	0	1	1
-4	1	1	1	0	0	