

## Quadrant II- Notes

Paper Code: ELC 102

Module Name: Binary, octal and hexadecimal arithmetic addition

Module Number:12

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### Binary, Octal and hexadecimal arithmetic; addition

Binary Arithmetic

Addition

A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

1)  $1100 + 100$

1<-carry

$1100 \Leftrightarrow 12_{10}$

$+ 0100 \Leftrightarrow 4_{10}$

$10000 \Leftrightarrow 16_{10}$

2)  $10111 + 111$

arry -> 1 1 1

$10111 \Leftrightarrow 23_{10}$

$+ 111 \Leftrightarrow 7_{10}$

$11110 \Leftrightarrow 30_{10}$

3)  $101.11 + 11.01 = 1001.00$

Carry-> 1 1 1 1

$101.11 \Leftrightarrow 5.75_{10}$

$+ 11.01 \Leftrightarrow 3.25_{10}$

$1001.00 \Leftrightarrow 9.00_{10}$

### Octal Addition:

The rules for octal addition are similar to that of decimal or binary addition. Addition operation can be performed by converting the octal numbers to binary numbers and performing the binary addition.

Numbers in Octal number system in sequence:

0,1,2,3,4,5,6,7,10,11,12,13,14,15,16,17,20,21,22,23,24,25,26,27,30.....77, 100

$23_8 + 12_8$

Carry:

1

0 1 0 0 1 1	$\Leftrightarrow 23_8$	$\Leftrightarrow 19_{10}$
<u>0 0 1 0 1 0</u>	$\Leftrightarrow 12_8$	$\Leftrightarrow 10_{10}$
0 1 1 1 0 1	$\Leftrightarrow 35_8$	$\Leftrightarrow 29_{10}$

Following octal addition table will help you to handle octal addition.

+	0	1	2	3	4	5	6	7	A
0	0	1	2	3	4	5	6	7	Sum
1	1	2	3	4	5	6	7	10	
2	2	3	4	5	6	7	10	11	
3	3	4	5	6	7	10	11	12	
4	4	5	6	7	10	11	12	13	
5	5	6	7	10	11	12	13	14	
6	6	7	10	11	12	13	14	15	
7	7	10	11	12	13	14	15	16	
B									

To use this table, simply follow the directions used in this example: Add  $6_8$  and  $5_8$ . Locate 6 in the A column then locate the 5 in the B column. The point in 'sum' area where these two columns intersect is the 'sum' of two numbers.

$456_8 + 123_8$

Carry    1   1

4   5   6  $\Leftrightarrow 302_{10}$

+1   2   3  $\Leftrightarrow 83_{10}$

6   0   1  $\Leftrightarrow 385_{10}$

$3_8 + 5_8$

Carry : 1  
 0 1 1  
+1 0 1  
 1 0 0 0  
 001 000  $\Leftrightarrow$  10

### Hexadecimal addition

The rules for hexadecimal addition are similar to that of decimal, octal and binary addition. Addition operation can be performed by converting the hexadecimal numbers to binary numbers and performing the binary addition.

0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F,10,11,12...19,1A,1B,...,1F,20,21,22...2A,2B,...,2F,30,31...39,3A,3B...3F,...

$32_{16} + 48_{16}$

$32 \Leftrightarrow 0011\ 0010 \Leftrightarrow 50_{10}$

$48 \Leftrightarrow \underline{0100\ 1000} \Leftrightarrow 72_{10}$

$0111\ 1010 \Leftrightarrow 7A_{16}$

$32_{16} = 3 \times 16 + 2 \times 1 = 48 + 2 = 50_{10}$

$48_{16} = 4 \times 16 + 8 \times 1 = 64 + 8 = 72_{10}$

$50_{10} + 72_{10} = 122_{10}$

$7A_{16} = 122_{10}$