Adding Decimal Numbers – Base 10

Since we have been adding base 10 numbers since grade 1, the carrying process is done automatically in our heads

An algorithm can be written to show the full process

(carry)	1	1		
		6	4	
	+	8	7	
	1	(15)	(11)	
	-	10	10	(subtract value of carry)
	1	5	1	

Please note that the value of the carry is always 1

$9706_{10} + 463_{10}$

$135.4_{10} + 72.68_{10}$

Adding Octal Numbers – Base 8

As with the base 10 system, a similar type of algorithm can be used to add octal numbers...just keep in mind there are only 8 possible numbers available (0,1,2,3,4,5,6,7)

(carry)	1		1		
		7	3	6	
	+	2	1	5	
	1	(9)	5	(11)	
	-	8		8	(subtract value of carry)
	1	1	5	3	

Please note that the value of the carry is always 1

$764_8 + 414_8$

$437.6_8 + 16.75_8$

Adding Hexadecimal Numbers – Base 16

As with the base 8 system, a similar type of algorithm can be used to add hexadecimal numbers...just keep in mind there are only 16 possible digits available (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F)

(carry)		1	1		
		7	A	F	
	+	5	7	9	
		13	(18)	(24)	
	-		16	16	(subtract value of carry)
		13	2	8	= $D28_{16}$

Please note that the value of the carry is always 1

$789_{16} + C47_{16}$

$B74.C5_{16} + F9.8_{16}$

Dec	Hex
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

Adding Binary Numbers – Base 2

For the base 2 system...just keep in mind there are only 2 possible numbers available (0,1)

(carry)	1	1	1	
		1	1	1
	+	1	0	1
	1	(3)	(2)	(2)
	-	2	2	2
	1	1	0	0

(subtract value of carry)

Some observations from the algorithm,

$0 + 0$ always equal $0 \ldots . 0_n + 0_n = 0_n$

$0 + 1$ always equal $1 \ldots . 0_2 + 1_2 = 1_2$

$1 + 1$ always equal $0 +$ carry $\ldots . 1_2 + 1_2 = 10_2$

$1 + 1 +$ carry always equal 1 and a carry

Please note that the value of the carry is always 1

$1010.11_2 + 111.1_2$

$11100_2 + 01010_2$

Adding More than 2 Rows of Binary Numbers – Base 2

For the base 2 system...just keep in mind there are only 2 possible numbers available (0,1)

(carry)	1	1			
(carry)		1	1	1	
			1	1	1
			1	0	1
	+		1	1	1
	1	0	0	1	1

For every two 1's that are added, a 10 is generated where the 1 is carried over to the next place value and the 0 stays behind

Some observations from the algorithm,

0 + 0 always equal 0…..$0_n + 0_n = 0_n$

0 + 1 always equal 1….$0_2 + 1_2 = 1_2$

1 + 1 always equal 0 + carry….$1_2 + 1_2 = 10_2$

1 + 1 + carry always equal 1 and a carry

Summary of Addition Algorithms – Base n

For base 8, add the 2 digits in each column, write down the sum under each column, if the sum is 8 or larger, then add a carry of 1 to the next column, repeat until you have added all the columns.

Subtract 8 from each sum whose value is 8 or larger

For base 16, add the 2 digits in each column, write down the sum under each column, if the sum is 16 or larger, then add a carry of 1 to the next column, repeat until you have added all the columns.

Subtract 16 from each sum whose value is 16 or larger

For base 2, add the 2 digits in each column, write down the sum under each column, if the sum is 2 or larger, then add a carry of 1 to the next column, repeat until you have added all the columns.

Subtract 2 from each sum whose value is 2 or larger

Note: The addition algorithms discussed here for any base number system only works with 2 rows of numbers being added. This algorithm will not work with more than 2 rows of numbers being added.

Review Questions

Review question set 5