

SchoolNova, Math 5c
Homework 11
Binary and Base-4 Representation of Numbers
January 7, 2018

Please provide sufficient details about how you solved the problem. More difficult problems are marked with a *. If unable to solve a problem, please present your thoughts and any partial solution.

A Binary Numbers

In binary or *base-2* number system, we only use 2 digits, namely 0 and 1. So for example, the binary number 11001 equals $1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 25$. We also write this as $11001_2 = 25_{10}$. The computers use binary numbers for internal representation and processing. Each digit in a binary number is referred to as a *bit*. Here are some decimal numbers and their equivalent binary numbers:

Decimal	Binary
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

A.1 Addition of Binary Numbers

The addition of binary numbers is done very similar to the decimal numbers, where one-digit numbers are added as follows:

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 0, \text{ carry } 1.$$

So for example, we add the numbers 25 and 3 as follows:

B Assignment

- Write all numbers from 0 through 30 in base-2 and base-4.
- Convert each of the following binary numbers to its equivalent decimal number:
 (a) 1001 (b) 11111 (c) 101010 (d) 11110000 (e) 100001
- Find the base-2 representation of each of the following decimal numbers:
 (a) 17 (b) 64 (c) 75 (d) 222 (e) 1049
- Perform the following binary additions:
 (a) $1+1001$ (b) $1001+1001$ (c) $101010+10101$ (d) $101010+10101$
- The duration of your class is 90 minutes. Write this number in base-2, and in base-4.
- Add the following base-4 numbers together: (a) $222 + 333$ (b) $123 + 123$
 (c) $123 + 321$
- If you put one grain of wheat on the first square of the chessboard, two on the second, then four, eight,..., approximately how many grains of wheat will there be? You can use $2^{10} = 1024 \approx 10^3$.
- Can you use all five fingers of one hand and the binary numbers to count from 0 to 31?
- * In the following Sudoku, fill in the grid so that every row, every column, and every 3×3 box contains the digits 1 through 9, each digit appearing once. The Sudoku below was taken from <http://www.dailysudoku.com>

		3	8					9
			3	4				7
					6	3		
1						5	7	2
	3	2				9	8	
7	9	5						6
		1	2					
5				6	1			
	6				5	1		

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hard

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