

SchoolNova, Math 5c
Homework 12
Binary and Base-4 Representation of Numbers
January 5, 2020

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

1. Write all numbers from 0 through 50 in base-2 and base-4.
2. Convert each of the following binary number to its equivalent base-10 number:
(a) 1001 (b) 11111 (c) 101010 (d) 11110000 (e) 100001
3. Convert each of the following base-4 number to its equivalent base-10 number:
(a) 32 (b) 302 (c) 3002 (d) 2 (e) 20 (f) 200
4. Find the base-4 representation of each of the following base-10 numbers:
(a) 17 (b) 64 (c) 75 (d) 222 (e) 1049
5. Clarence runs each day for 55 minutes. Write this number in base-2, and in base-4.
6. **Using results from algebra**, find the prime factorization of the following number: $99^2 - 9^2$.
7. * The notation $a|b$ means a divides b , with a remainder 0. Show that if $a|b$ and $b|c$, then $a|c$.
8. The tower in the picture is made up of five horizontal layers of cube with no gaps. How many individual cubes are in the tower?

