

# SP12-CSE20 Discrete Mathematics

## Homework 1 Solution

April 17, 2012

### 1 Boolean Functions and Computer Arithmetic

#### 1.1 Problem 2.8

Compute the difference of the two base two numbers:  $1110100_2 - 10111_2$ .

The result is  $1011101_2$ . There are two ways of approaching it as follows.

- Since the former number is larger than the latter, we can have directly obtain the result by doing arithmetic operation of subtraction, as a result, we have  $1110100_2 - 10111_2 = 1011101_2$ .
- We can also convert the latter number into its 8-bit two's complement, by first add zeros at the remaining high-end bits then add the two numbers together. Notice that any carry bits will be discarded here. As a result, we have  $01110100_2 - 00010111_2 = 01110100 + 11101001 = 01011101$ .

#### 1.2 Problem 2.9

Convert  $1011011111000101_2$  from binary to hexadecimal (i.e., base 16) and octal (i.e., base 8).

Since both 16 and 8 are power of 2, we need to split the binary digits into subgroups of 4 and 3 digits, respectively.

- **Base-16**  $1011011111000101_2 \rightarrow (1011)(0111)(1100)(0101)_2 \rightarrow (11)(7)(12)(5)_{16} \rightarrow B7C5_{16}$
- **Base-8**  $1011011111000101_2 \rightarrow (001)(011)(011)(111)(000)(101)_2 \rightarrow 133705_8$

### 1.3 Problem 2.10

Convert the following as indicated.

- Convert  $61502_8$  to decimal  
 $61502_8 = 6 \times 8^4 + 1 \times 8^3 + 5 \times 8^2 + 0 \times 8^1 + 2 \times 8^0 = 29506$
- Convert  $EB7C5_{16}$  to octal  
 $EB7C5_{16} = (1110)(1011)(0111)(1100)(0101)_2 = (011)(101)(011)(011)(111)(000)(101)_2 = 3533705_8$

### 1.4 Problem 2.11

Let  $b, m, l, f, , z, k, a, n, y, e, x, j, w, d, v, o, u, c, g, t, p, h, s, q, i, r$  be the digit symbol list for base 27. Let  $n, m, k, j, f, s, q, h, z, p, c, x, y, e, d, w$  be the digit symbol list for base 16.

- Convert *hi-there* from base 27 to base 16.  
 This is computation intensive. We can first convert it into a decimal number,  $hithere = 22 \times 27^7 + 25 \times 27^6 + 4 \times 27^5 + 20 \times 27^4 + 22 \times 27^3 + 10 \times 27^2 + 26 \times 27^1 + 10 \times 27^0 = 239881748167$ . Then we iteratively divide this decimal number by 16 and set each digit (from lowest to highest) to be the remainder. The result turn out to be  $37DA10FEC8_{16}$ , thus *jhecmmwdyh*.
- Convert *cfemxysnnjnq* from base 16 to base 27.  
 Similar as above, we convert it backwards, and the result is *study-hard*.