

CSSE2010 / CSSE7201 – Introduction to Computer Systems
Exercises – Week One
Bits, Bytes & Binary; Intro to Logic Gates

Exercises

Many of the problems below are taken from or based on questions in Tanenbaum, Structured Computer Organisation, 5th edition, Appendix A and Appendix B.

1. Convert the following decimal numbers to binary (unsigned representation): 1984, 4000, 8192.
2. What is 1001101001 (binary, unsigned) in decimal? In octal? In hexadecimal?
3. How many different positive integers can be expressed in k digits using radix r numbers?
4. One of the earliest computers (the Manchester Mark 1, 1949) was programmed with a radix-32 number system. Suppose such a number system has digits represented by the characters 0, 1, ... 9, A, B, ... U, V.
 - (a) Describe how a binary number can be converted into a radix-32 number.
 - (b) Describe how a decimal number can be converted into a radix-32 number.
 - (c) Convert the decimal numbers 1300 and 2300 to radix-32 representations.
5. What's the largest unsigned integer that can be represented in
 - (a) 10 bits
 - (b) 9 decimal digits
 - (c) 8 hexadecimal digits
6. What's the largest number that can be counted to on ten fingers, if each finger can be considered to have two positions? Compare your answer to that in 5(a).
7. For each of the following decimal numbers, write down the 8-bit binary representation using signed magnitude, one's complement, two's complement and excess 128 formats.
 - (a) -1
 - (b) -16
 - (c) -99
8. What are the smallest and largest integers that can be represented in the following binary representations:
 - (a) 16 bit two's complement
 - (b) n bit one's complement
 - (c) excess 2^{m-1}
9. Draw the logic symbol, write the Boolean function and write down the truth table for:
 - (a) a 4 input NOR gate
 - (b) a 3 input XOR gate (i.e. the odd function)