Introduction to Computer Science-102

Quiz_1

1. Convert the following hexadecimal numbers to decimal without using a calculator, showing your work. (10%)

   a. $(273)_{16}$ 627

   b. $(17.7)_{16}$ $23\frac{7}{16}$

2. Convert the following binary numbers to hexadecimal without using a calculator, showing your work. (10%)

   a. $(01101101)_2$ 6D

   b. $(1011110.0110)_2$ 5E.6

3. 32 bits are used to represent an address, eight bits for each symbol in dotted decimal notation. For example, the address 10.200.14.72 can also be represented as 00001010 11001000 00001110 01001000. Show the bit representation of the following Internet addresses. (10%)

   a. 124.54.234.56 01111100 00110110 11101010 00111000

   b. 140.120.13.78 10001100 01111000 00001101 01001110

4. Answer the following question about floating-point representation of real numbers: (10%)

   a. Why is normalization necessary?(3%)

      Normalization is necessary to make calculations easier.

   b. What is the mantissa? (3%)

      Mantissa is the bit sequence to the right of the decimal point after normalization.

   c. After a number is normalized, what kind of information does a computer store in memory? (4%)

      The computer stores the sign of the number, the exponent, and the mantissa.

5. A company has decided to assign a unique bit pattern to each employee. If the company has 1000 employees, what is the minimum number of bits needed to create this system of representation? How many patterns are unassigned? If the company hires another 200 employees, should it increase the number of bits? Explain your answer. (10%)

$2^n = 1000 \rightarrow n \approx 10 \rightarrow 10$. With n = 10 we can uniquely assign $2^{10} = 1024$ bit pattern. Then 1024 − 1000 = 24 patterns are unassigned. These unassigned patterns are not sufficient for extra 300 employees. If the company hires 200 new employees, it is needed to increase the number of bits to 11.

6. Change the following decimal numbers to 16-bit unsigned integers. (10%)

   a. 35 $(0000\ 0000\ 0010\ 0011)_2$

   b. 1435 $(0000\ 0101\ 1001\ 1011)_2$

7. Change the following 8-bit two's complement numbers to decimal. (10%)

   a. 0111 1111 +127

   b. 1111 1000 -8

8. If a small cheap computer can do the same thing as a large expensive computer, why do people need to have a large one? [5%]

Any problem that can be solved by a big computer can also be solved by a small computer but a big computer can probably solve the problem faster.

9. Why is it easy to convert from binary to hexadecimal and vice versa? [5%]

Conversion is easy because there is a direct relationship between the two systems, which four bits in binary is one hexadecimal digit.

10. Convert the following numbers in 32-bit IEEE format. (10%)

    a. 9.1875

S = 0

E = 3 + 127 = 130 = $(10000010)_2$

M = 0010011 (plus 16 zero at the right)

→ 0 10000010 00100110000000000000000

    b. -3.375

S = 1

E = 1 + 127 =128 = $(10000000)_2$

M = 1011 (plus 19 zero at the right)

→ 1 10000000 10110000000000000000000

11. What is the function of the ALU subsystem in a computer? (5%)

The arithmetic/logic unit (ALU) is where calculations and logical operations take place.

12. What is the feature of the excess system?(5%)

In the Excess system, both positive and negative integers are stored as unsigned integers.