1. (1) Given a data string, BBBBFFFFGGGGGBKKKKHH. Write the encoded codeword by applying the Run-length encoding. (5%)
(2) Explain the term “lossy data compression” and give two examples. (5%)
(3) What is the meaning of MP3? Give the name of encoding technique. (5%)

2. Given the probabilities of occurrence of symbols B, F, G, H, K, and I are 0.19, 0.13, 0.31, 0.2, 0.07, and 0.1, respectively.
(1) Construct the encoding tree for Huffman encoding. (8%)
(2) Given an encoded binary string “111010001011”. Using the Huffman encoding tree designed in (1) to decode the binary string. (5%)

3. Answer the following questions.
(1) Find the 16’s and 15’s complement for the number (69CB.481)₁₆. (5%)
(2) Using the IEEE single-precision floating-point representation (as shown in Fig. 1) to represent the number (65.A)₁₆. (5%)
4. Answer the following questions.
   (1) What are the clock rate and the number of bits of the PCI interface standard? (4%)
   (2) What is the maximum data transmission rate of USB 2.0 standard? (4%)
   (3) What is the meaning of superscalar processor? (4%)
   (4) What is the read/write data rate for a 32X CD-ROM drive? (4%)
   (5) What is the meaning of DVD-SuperMulti? (4%)

5. (1) Explain the term “UML”. (4%)
   (2) Transfer the infix expression \(a \times 3 + b - c \times e - d / a\) into prefix and postfix expressions, respectively. (6%)
   (3) Compare the differences between the two parameters propagation schemes: call-by-value and call-by-reference. (4%)
   (4) Consider the C-code program as shown in Fig. 2. What are the values for \(x\) and \(y\) after running the program? According to the parameter propagation shown, is it a call-by-value or call-by-reference? (6%)

```c
#include <stdio.h>
int main(void) {
    int x = 250, y = 400;
    swap(&x, &y);
    printf("%d %d\n", x, y);
    return 0;
}

void swap(int *i, int *j) {
    int temp;
    temp = *i;
    *i = *j;
    *j = temp;
}
```

Fig. 2 A C-code program.
6. (1) What are the data rate and maximum distance of the 100baseTX and 10broad36? (4%)  
(2) Pick up the invalid ones from the following IP addresses: 140.123.17.65, 224.0.0.1, and 10.11.12.13 and explain the reason. (4%)  
(3) What is the maximum data rate for IEEE 802.11g? What is the IEEE standard for WiMAX? (4%)  

7. Design a self-initialization counter with the counting sequence: 101→001→000→111→010→101→001→...  
(1) Plot the state transition diagram of the counter. (5%)  
(2) Derive the input equations for all flip-flops. (5%)