Answer the questions in the spaces provided on the question sheets. If you run out of room for your answer, continue on the back of the page.

Name: _____

Date: _____

Question:	1	2	3	4	Total
Points:	25	10	10	20	65
Score:					

1. A text is writtten in a 6-letter alphabet and has the following letter frequencies.

Letter	Frequency
A	0.05
B	0.10
C	0.15
D	0.20
E	0.24
F	0.26

   (a) (15 points) Construct Huffman encoding for the text. Show your work in the space above. Present your result in the table below.

Letter	Binary representation	No. of bits
A		
B		
C		
D		
E		
F		

   (b) (5 points) What is the length, in bits, of a 100-letter text fragment, after it is compressed?

   _____

   (c) (5 points) What is the compression ratio, defined as the ration of the length (in bits) of the ASCII-encoded text and the length (in bits) of its Huffman encoding?

   _____

2. (a) (5 points) Evaluate $01100001 \oplus 00111001$, where $\oplus$ is xor operation.

   (b) (5 points) What are the decimal, the octal, and the hexadecimal values of the result?

3. (10 points) Mark the statements about IEEE Standard for Floating-Point Arithmetic, IEEE 754, which are correct.

   ☐ there are at least two different floating point numbers that represent zero

   ☐ there is a floating point number that represents positive infinity

   ☐ there are at least two different floating point numbers that officially are called 'Not a Number'.

   ☐ the following code fragment

   ```
   float x = 0.3, y = 0.4, z = 0.7;
   if (x + y == z) printf("Equal!\n");
   ```

   prints the text string `Equal!`.

4. You are developing a new standard for floating point arithmetics for microchips. It proposes to store floating point numbers in 12 bits, in a manner similar to IEEE754 standard: one bit for the sign, four bits for the exponent, and (one plus) seven bits for the fractional part of the number. You are **not** reserving special values of the exponent for zero, infinity, and NaN.

   (a) (5 points) What is the smallest positive floating point number in your system?

   (b) (5 points) What is the largest floating point number?

   (c) (5 points) Approximately, how many floating point numbers are in your system?

   (d) (5 points) What is machine ϵ in your system?