

NAME: _____

1. Consider the following two 7-bit floating-point representations based on the IEEE floating point format. Neither has a sign bit – they can only represent nonnegative numbers.

a. Format A:

There are $k = 3$ exponent bits. The exponent bias is 3.

There are $n = 4$ fraction bits.

b. Format B:

There are $k = 4$ exponent bits. The exponent bias is 7.

There are $n = 3$ fraction bits.

Given bit patterns in Format A, convert them to the closest values in Format B. If necessary, apply the round-to-even rounding rule. Also, give the values of numbers represented by Format A and Format B (e.g., 17/64).

Format A		Format B	
Bits	Value	Bits	Value
101 1110		1001 111	
010 1001		0110 100	
110 1111		1011 000	

2. Consider the following 5-bit floating point representation based on the IEEE floating point format. The most significant (i.e., the leftmost) bit represents the sign (0 for + and 1 for -). The next three bits represent the exponent, with a bias of 3. The final bit represents the fraction used to compute M below. The floating-point format encodes numbers in a form:

$$V = (-1)^s \times M \times 2^E$$

Where $M = 1.f$ (in binary, where f is the final bit) is the significand and $E = e_1e_2e_3 - \text{Bias}$ (in binary, where e_1, e_2 , and e_3 are the exponent bits) is the exponent.

Fill in the missing entries in the table below, where each column is described as follows.

Binary: The 5-bit representation. **M:** The value of the Mantissa written in **decimal** format. **E:** The integer value of the exponent written in **decimal**. **Value:** The numerical value represented, written in decimal format. Recall that the IEEE format rounds by default to the nearest even number. **Hint:** Remember the implicit leading '1' in M before the fraction bit.

Description	Binary	M	E	Value
-0				
	01101			
One				1.0

4.0-0.75				
2.0+3.0				

3. Consider a 5-bit floating point representation based on the IEEE floating point format with one sign bit, followed by two exponent bits (with an exponent bias of 1), and ending with two fraction bits. Fill in the table below. For column M and Value, your answer must be expressed as a fraction of the form $x/4$. (Remember that M starts with an implicit '1' followed by the two fraction bits).

Bits	M	E	Value
0 01 00			
0 01 01			
0 01 10			
0 01 11			
0 10 00	4/4	1	8/4
0 10 01			
0 10 10			
0 10 11			