1. **Finish your homework independently**
2. **Convert this docx to pdf: “stuID\_name\_csapp2.pdf”**

**Example: ”2017010000\_zhangsan\_csapp2.pdf”**

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**2.82 ◆◆**

Consider numbers having a binary representation consisting of an infinite string

of the form 0*.y y y y y y . . .*, where *y* is a *k*-bit sequence. For example, the binary

representation of is 0*.*01010101 *. . .* (*y* = 01), while the representation of is

0*.*001100110011 *. . .* (*y* = 0011).

A. Let that is, the number having binary representation *y*. Give

a formula in terms of *Y* and *k* for the value represented by the infinite string.

Hint: Consider the effect of shifting the binary point *k* positions to the right.

Formula:

Y = m/(2^k – 1),m is the integer represented in binary form by y(for example, when it comes to 1/5, y = 0011, m = 3, k = 4, Y = 1/5 = 3/(2^4-1)

B. What is the numeric value of the string for the following values of *y*?

(a) 001

1/7

(b) 1001

0.6

(c) 000111

1/9

**2.85** ◆

Intel-compatible processors also support an “extended precision” floating-point

format with an 80-bit word divided into a sign bit, *k* = 15 exponent bits, a single

*integer* bit, and *n* = 63 fraction bits. The integer bit is an explicit copy of the

implied bit in the IEEE floating-point representation. That is, it equals 1 for

normalized values and 0 for denormalized values. Fill in the following table giving

the approximate values of some “interesting” numbers in this format:

|  |  |  |
| --- | --- | --- |
|  | Extended precision | |
| Description | Value | Decimal |
| Smallest positive denormalized | 2^(-61-2^14) | 3.645\*10^-4951 |
| Smallest positive normalized | 2^(2-2^14) | 3.362\*10^-4932 |
| Largest normalized | 2^(2^14-1)\*(2-2^-63) | 1.1897\*10^4932 |

**2.87** ◆◆

Consider the following two 9-bit floating-point representations based on the IEEE

floating-point format.

**1.** Format A

There is one sign bit.

There are *k* = 5 exponent bits. The exponent bias is 15.

There are *n* = 3 fraction bits.

**2.** Format B

There is one sign bit.

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

There are *n* = 4 fraction bits.

Below, you are given some bit patterns in Format A, and your task is to convert

them to the closest value in Format B. If rounding is necessary, you should *round*

*toward* +∞. In addition, give the values of numbers given by the Format A and

Format B bit patterns. Give these as whole numbers (e.g., 17) or as fractions (e.g.,

or).

|  |  |  |  |
| --- | --- | --- | --- |
| Format A | | Format B | |
| Bits | Value | Bits | Value |
| 1 01110 001 |  | 1 0110 0010 |  |
| 0 10110 101 | 208 | 0 1110 1010 | 208 |
| 1 00111 110 | -7/1024 | 1 0000 0111 | -7/1024 |
| 0 00000 101 | 5/131072 | 0 0000 0000 | 0 |
| 1 11011 000 | -4096 | 1 1111 0000 | -∞ |
| 0 11000 100 | 768 | 0 1111 0000 | +∞ |