|  |  |  |
| --- | --- | --- |
| |  | | --- | | Lab7–Floating Point Practice CPSC 2311- Fall 2021 | |  |

# Introduction

The goal of this lab is to introduce/practice Floating Point conversion. We will also cover this concept in class this week along with working examples.

**Due:**

Sunday, October 17, 2021, midnight.

Submit to Canvas

# Lab Instructions

While I know this would be much easier to do by hand. I have found grading to be easier when your answers are typed. Therefore, you **must** type your answers in RED on this document and submit the document through canvas as a **PDF**. Please read the entire document. Points will be deducted if you do not follow directions.

Part 1:

Watch the following videos pertaining to Floating Point conversion from decimal to binary and binary to decimal.

https://www.youtube.com/watch?v=tx-M\_rqhuUA

https://www.youtube.com/watch?v=4DfXdJdaNYs

Part 2:

Following the instructions in the first video above. Convert the following floating-point number to binary.

76.48

76/2= 38 r0 // using 1 /2 method to make whole number binary representation

38/2= 19 r0. // using 1 /2 method to make whole number binary representation

19/2= 9 r1 // using 1 /2 method to make whole number binary representation

9/2= 4 r1.

4/2= 2 r0.

2/2= 1 r0.

1/2= 0 r1

Working upwards we see 76 is 1001100 in binary.

0.48 \*2= 0.96 // using \*2 method to make decimal into binary

0.96\*2= 1.92

0.92\*2= 1.84

0.84\*2= 1.68

0.68\*2= 1.36

0.36\*2= 0.72

0.72\*2= 1.44

0.44\*2= 0.88

0.88\*2= 1.76

0.76\*2= 1.52

0.52\*2= 1.04

0.04\*2= 0.08

0.08\*2= 0.16

0.16\*2= 0.32

0.32\*2= 0.64

0.64\*2= 1.28

0.28\*2= 0.56

0.56\*2= 1.12

0.12\*2= 0.24

0.24\*2= 0.48

Working downwards from the 1s digit of the product we get 01111010111000010100

Putting it together: 76.48= 1001100.01111010111000010100

1.00110001111010111000010100 = \* 26 // put into scientific notation with respect to base 2

// identifying specific values

Sign= 0

Exponent= 1000 0101

Mantissa= 00110001111010111000010100

// defining values from 32 bit value

= **0100 0010 1001 1000 1111 0101 1100 0010 100** // full binary representation

Sign= 0

Exponent= 1000 0101= 133-127= 6

Mantissa= 0011 0001 1110 1011 1000 0101 00

2-3+2-4+2-8+2-9+2-10+2-11+2-13+2-15+2-16+2-17+2-22+2-23+2-24= 0.1950001121 // adding bits

-10\*(1+0.1950001121)\*26 // IEEE formula

1.1950001121\*26= 76.48

Show your work. Also, explain what you are doing each step of the way. Your explanation does not have to be a long explanation. Only enough to let your TA know you understand what you are doing. If you do not show and explain your work, you will receive a 0 for the question.

Now convert the binary back to decimal, showing and explaining each step of the process.

Again, your explanation does not have to be a long explanation. Only enough to let your TA

know you understand what you are doing. If you do not show and explain your work, you will receive a 0 for the question.

Part 3:

Following the instructions in the above video. Convert the following floating-point numbers to binary.

-165.56

165/2= 82 r1 // using 1 /2 method to make whole number binary representation

82/2= 41 r0

41/2= 20 r1

20/2= 10 r0

10/2= 5 r0

5/2= 2 r1

2/2= 1 r0

½=0 r1

Working upwards we see 165 is 10100101 in binary.

0.56\*2= 1.12 // using \*2 method to make decimal into binary

0.12\*2= 0.24

0.24\*2= 0.48

0.48\*2= 0.96

0.96\*2= 1.92

0.92\*2= 1.84

0.84\*2= 1.68

0.68\*2= 1.36

0.36\*2= 0.72

0.72\*2= 1.44

0.44\*2= 0.88

0.88\*2= 1.76

0.76\*2= 1.52

0.52\*2= 1.04

0.04\*2= 0.08

0.08\*2= 0.16

0.16\*2= 0.32

0.32\*2= 0.64

0.64\*2= 1.28

0.28\*2= 0.56

Working downwards from the 1s digit of the product we get 10001111010111000010

Putting It together we see 10100101.10001111010111000010

1.010010110001111010111000010

Sign= 1

Exponent= 7

Mantissa= 010010110001111010111000010

1.010010110001111010111000010\* 27 // put into scientific notation with respect to base 2

= **1100 0011 0010 0101 1000 1111 0101 1100 0010** // full binary representation

Sign= 1

Exponent= 10000110= 134-127=7

Mantissa= 010010110001111010111000010

2-2+2-5+2-7+2-8+2-12+2-13+2-14+2-15+2-17+2-19+2-20+221+2-26= 0.2934374958// adding bits

-11\*(1+0.2934374958)\* 27=

-1. 2934374958\*27= -165.56

Show your work. Also, explain what you are doing each step of the way. Your explanation does not have to be a long explanation. Only enough to let your TA know you understand what you are doing. If you do not show and explain your work, you will receive a 0 for the question.

Now convert the binary back to decimal, showing and explaining each step of the process. Again, your explanation does not have to be a long explanation. Only enough to let your TA know you understand what you are doing. If you do not show and explain your work, you will receive a 0 for the question.

The following link is a nifty tool you can use to check your work. You should understand that sometime online tools like this one will round which could change the last one or two bits on the tool. So, if your answer has a different bit on the end that is perfectly fine. I am not saying this will be the case only letting you know this could happen.

https://evanw.github.io/float-toy/

Also, remember the discussion on the rounding that may occur when using the online converter.

Submission:

You should submit your document to Canvas. Please make sure your answers are in RED. If you do not, a substantial number of points will be deducted.