

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](http://www.youtube.com/watch?v=tx-M_rqhuUA) https://[www.youtube.com/watch?v=4DfXdJdaNYs](http://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

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.

First Convert left side (76) to binary:

76 = 38 \* 2 remainder 0

38 = 19 \* 2 remainder 0

19 = 9 \* 2 remainder 1

9 = 4 \* 2 remainder 1

4 = 2 \* 2 remainder 0

2 = 1 \* 2 remainder 0

1 = 0 \* 2 remainder 1

76 is 1001100 in binary (we take the remainders from bottom to top)

Next, convert right side (0.48) to binary:

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

0.56 \* 2 = 1.12

0.12 \* 2 = 0.24

0.24 \* 2 = 0.48. -> repeats after this

0.48 \* 2 = 0.96

0.96 \* 2 = 1.92

Take the ones place of each result from top to bottom to get binary bits.

Binary form of right-hand side is 01111010111000010100 repeating.

Put both binary sides together to get.

1001100. 01111010111000010100

Now put in scientific notation in binary (in terms of powers of 2).

Begin: 1001100. 01111010111000010100



Move binary point left 6 spaces (2^6): 1.00110001111010111000010100

The mantissa will be everything after the binary point up to 23 bits or 00110001111010111000010

* This has been truncated because there was more than 23 bits.

Our exponent is 6 when we moved the binary point, so we need to add 6 to 127 (our bias) for the exponent section of the representation. This leaves us with 133, which we need to convert to binary. 133 in binary is 10000101, which is our exponent bits.

The number is positive, so our first sign bit is 0.

Putting together all bits in order of sign bit followed by exponent followed by mantissa we get:

0 10000101 00110001111010111000010

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.

* 0100 0010 1001 1000 1111 0101 1100 0010
  + is the binary number we are trying to convert.
* The first bit will represent the sign. It is 0 in this case so the number will be positive.
* The next 8 bits represent the exponent.
  + Those 8 bits are 1000 0101
* This leaves the mantissa which is the remaining bits or:
  + 001 1000 1111 0101 1100 0010

Part 3:

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

-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.