Due: Friday, October 6, 9AM EST

This assignment is worth 15% of the final grade. Each question is worth a multiple of 5 points. If you have no idea how to answer a question (or part of a question), you will receive 20% of the credit for that question (or subquestion) by leaving the question (or subquestion) blank. If your answer makes no sense, you will not receive any credit. Any answer that shows some understadning of the question will receive some credit.

- 1. This exercise pertains to the simplified floating point representations (where we use a sign bit for the sign of the exponent) as described in the class and on slide 9 of the Week 2 slides. Assume each such number is 8 bits with one bit for the sign of the number, 4 bits for the exponent (including the exponent sign bit) and 3 bits for the significand.
 - (5 points) Show how to represent the decimal number 20 as a simplified 8 bit floating point number.
 - (10 points)

Explain why the decimal number 15 is the largest odd integer that can be represented exactly by such an 8 bit simplified floating point number.

2. (10 points)

We presented the ChatGPT 3.5+ response to the query "Will Chat-GPT make Wikipedia obsolete?"

Now suppose you ask the same question to the latest version of ChatGPT that you can access in 5 years from now. (Let's assume that some version of ChatGPT will still be available.) Which of the responses returned by ChatGPT do you think presents the most compelling argument for why Wikipedia will not be obsolete. Explain your answer in one or two paragraphs. A possible answer to this question can be "Wikipedia will be obsolete" but you still must provide an explanation. One way to answer this question is to make up an example of a question and see how Wikipedia and ChatGPT deal with this question now. And then say how you think ChatGPT would change or not change the specific reasons given.

- 3. Consider a perfectly balanced binary search tree (with all the leaves at the same level) for searching in a dictionary having n identifiers/keys. (You can assume the keys are integers.) What is the asymptotic worst case time (e.g. O(1) = constant time, $O(\log n), O(n)$) required to answer the following queries:
 - (10 points) Assuming that $n = 2^k 1$ for some integer $k \ge 3$, what is the value of the 4^{th} smallest key in the dictionary?
 - (10 points) Assuming $n = 2^k 3$ for some interger $k \ge 3$. What is the median value key in the dictionary?

You need to provide a short explanation for your answers. You do not have to worry as to how the tree is stored but just think of the tree edges as pointers that can be followed.