Due: Monday September 29, beginning of tutorial.

This assignment is worth 10% of final grade

1. Write down the initial of your first name and the first three letters of your last name. For example, for Allan Borodin, you would be writing abor. Encode this shortened name (e.g. abor) by encoding a as 01, b as 02, ..., z as 26. If your last name has less than three letters, then use a blank encoded by 00. That is, abor would be encoded as 01021518 and Allan Bo would be shortened to abo encoded as 01021500.

2. Let ID denote the encoded version of your shortened name. That is, ID is a 7 or 8 digit decimal number. (Given the class list I believe this is a unique identifier for every student in the class.) How many possible values can there be for an ID assuming that every name is possible?

3. Now we want to introduce an an example of an important idea (maybe a great idea) called hashing. Let $h(ID) = ID \bmod 83$. By "mod 83", I mean divide by 83 and take the remainder. For example, using my ID, we would get $1021518 \bmod 83 = 37$. That is, my unique ID (in this class) is being hashed or mapped on to a much smaller number (i.e. a number between 0 and 82). We will discuss why hashing is a very useful idea in our seminar.

4. We have approximately 20 students (each having a unique ID) and 83 possible hash values. How likely do you think it is that there will be two students with the same hash value? I am not (necessarily) asking for a detailed probabilistic analysis, just your intuitive explanation of how likely this is.

5. Give the binary representation for your individual $h(ID)$. In the case of my hashed ID of 37 (in decimal notation), the binary representation would be "100101".

6. Let $m = h(ID)$ be your hashed ID. Represent the fractional number $m + \frac{1}{m}$ in the 12 digit decimal floating point representation discussed in class. Namely, there is one sign "digit", 3 decimal exponent digits (using bias 500) and 8 decimal significand digits.

7. (BONUS worth an additional 1% of final grade) Represent the fractional number $m + \frac{1}{m}$ in the 32 bit binary floating point representation discussed in class.