CS41 Homework 3

This homework is due 10AM Thursday February 12. Write your solution using \LaTeX. Submit this homework using handin41. This is an individual homework. It’s ok to discuss approaches at a high level. In fact, I encourage you to discuss general strategies. However, you should not reveal specific details of a solution, nor should you show your written solution to anyone else. The only exception to this rule is work you’ve done with a lab partner while in lab. In this case, note who you’ve worked with and what parts were solved during lab. If there are questions about academic integrity, please visit the section on Academic Integrity on the course website (www.cs.swarthmore.edu/~brody/cs41/s15/expectations.php). If you still have questions, please contact me.

Note: Make sure your homework has your name on it. Also, make sure it lives in your cs41/hw/xx directory. This is where handin41 will grab files from.

1. Rank the following functions in ascending order of growth. You do not need complete proofs for this problem, but show your work if you want partial credit.

   - \( f_1(n) = 4n(\log n)^4 \)
   - \( f_2(n) = n^{5\log n} \)
   - \( f_3(n) = 2^{\log n} \)
   - \( f_4(n) = 2^n \)
   - \( f_5(n) = 2^{n^3} \)
   - \( f_6(n) = 10n^{4/3} \)
   - \( f_7(n) = 2^{2^n} \)

   Hint: Remember the facts we saw in class. Ordering these functions is easier by combining known results/facts than deriving each comparison from scratch.

2. The Barbarian Horde Hoard. A horde of seven barbarians has recently returned from pillaging the countryside, looting a hoard of 343 gold coins in the process. Now, they would like to divide their treasure. Being the enlightened barbarians they are, they have decided to vote on how to best divide the treasure.

   The barbarians’ voting process is as follows. First, the strongest barbarian proposes a scheme for dividing the treasure. For example, she might propose to keep 163 gold coins for herself and give the six remaining barbarians 30 coins each. However, being the barbarians they are, if the majority vote against this scheme, then the rest of the barbarians kill the strongest. In this case, the strongest of the remaining six barbarians proposing a way to divide the treasure, risking death if more than half of the barbarians vote against him.

   The process repeats in a similar fashion (strongest remaining barbarian proposes a way to divide the hoard, barbarians vote, and the strongest remaining barbarian dies if they reject his suggestion) until a division is accepted.

   How should the strongest barbarian divide the hoard? You can assume that all barbarians are greedy and care only about how much treasure they receive.