CISC320 Algorithms, Homework set 1
Due Wednesday, March 3, 2010

1. Suppose the maximum of 8 numbers (a, b, c, d, e, f, g, h) is found tournament style. In the first round (the quarter-finals) the matchups (comparisons) are
$$(a, b), (c, d), (e, f), (g, h)$$
In the second round (the semi-finals) the winners matchup thus:
$$(a, c), (f, g)$$
(with the losers being implicitly b, d, e, h). Finally the winners there compete in the championship
$$(c, f)$$
from which c emerges as the overall winner (maximum) of our competing numbers.

   (a) Which of the numbers can be the second largest?
   (b) Which of the numbers can be the third largest?

   Food for thought: How many elements could be third largest in a larger tournament style competition? Do not hand anything in on this food for thought item. It is not part of the homework set.

2. DPV (our textbook) Exercise 0.2. (*Hint:* Show that
$$\sum_{i=0}^{n} c^i = (c^{n+1} - 1)/(c - 1), \text{ if } c \neq 1.)$$

3. Exercise 1.4.

4. Show that
$$\sum_{i=1}^{n} 1/i = \Theta(\lg(n)).$$
(*Hint:* To show an uper bound, decrease each denominator to the next power of 2. For a lower bound, increase each denominator to the next power of 2.)

5. Do any three of exercises 1.10, 1.11, 1.12, 1.13.

6. Exercise 1.16. But find a $b > 11$. Explain the multiplications used. You may optionally use the notation of addition chains.