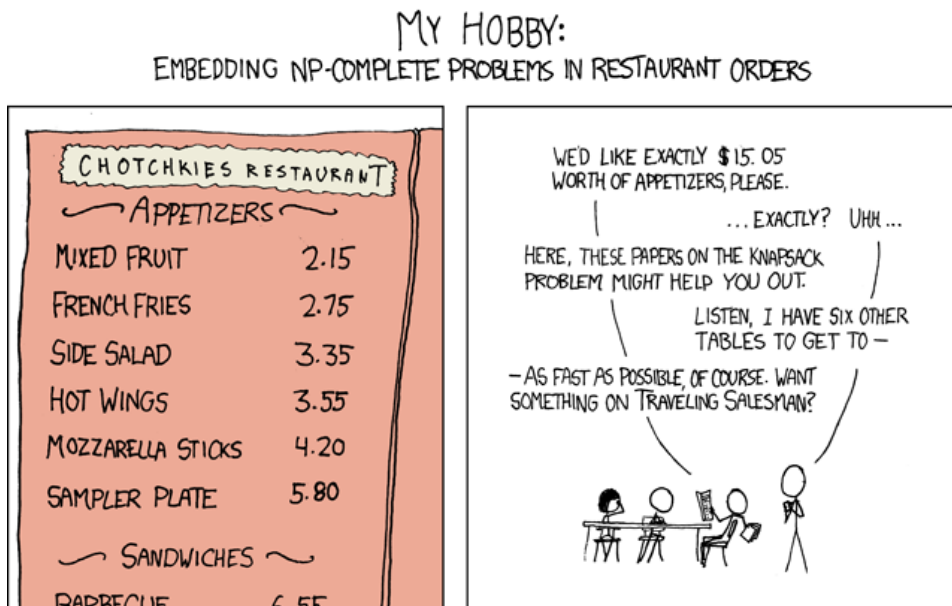# HOMEWORK 11
## DISCRETE MATHEMATICS II
### DUE 03-04

(1) (a) Describe how to solve the Towers of Hanoi problem for 3 discs.

  (b) Describe how to solve the Towers of Hanoi problem for 4 discs.

(2) Consider the following XKCD comic:



(http://xkcd.com/287). Let $p_n$ be the price of the $n$th menu item, in cents. Thus, for example, $p_1 = 215$ and $p_2 = 275$. Let $a(n, p)$ be the number of ways of ordering from the first $n$ items on the menu so that the total price is exactly $p$ cents.

  (a) We make the following slightly unusual choice of initial conditions:
   - $a(0, 0) = 1$,
   - $a(0, p) = 0$ for all $p \neq 0$, and
   - $a(n, p) = 0$ for all $p < 0$.

  Explain why these are sensible.

  (b) Fill out a table of the non-0 values of $a(1, p)$ and $a(2, p)$ with $p \leq 1505$. Explain. Note that you may order more than one of each item.

  (c) Write down a recurrence for $a(n, p)$ in terms of $a(n - 1, q)$, where $p$ and $q$ do not have to be the same. (HINT: Your formula will be a sum of terms, depending on how many of the $n$th item you order. It will involve the price $p_n$.)

(3) Show that the generating function of the finite sequence $(1, 1, \ldots, 1)$ is $\dfrac{x^m - 1}{x - 1}$ for some $m$. How is $m$ related to the number of terms in the sequence?

- **Two** book problems: #8.1.38, #8.4.30.