SOAR Math Course Homework One Winter, 2003

These homework problems are meant to expand your understanding of what goes on during class. Any you turn in will be graded and returned to you. Answers may or may not be posted on the web, depending on demand.

1. (a) In tic-tac-toe, the best first move for **X** is a corner. Is there a best first move for **X** in C-tic-tac-toe?
   (b) In tic-tac-toe, the best first movie for **O** is the center (in response to the best first move for **O** in (a)). Is there a best first response for **O** in C-tic-tac-toe?
   (c) Tic-tac-toe usually ends in a draw. Is it possible for C-tic-tac-toe to end in a draw?

2. Repeat the previous question for T-tic-tac-toe.
   (a) Is there a best first move for **X** in T-tic-tac-toe?
   (b) Is there a best first response for **O** in T-tic-tac-toe?
   (c) Is it possible for T-tic-tac-toe to end in a draw?

3. Recall from class that an n-sided regular polygon has all n interior angles equal to $\theta_n = 180^\circ - \dfrac{360^\circ}{n}$.
   (a) Show that a vertex of type $(n_1, n_2, \ldots, n_k)$ must satisfy the equation
   $$\left(\frac{1}{2} - \frac{1}{n_1}\right) + \ldots + \left(\frac{1}{2} - \frac{1}{n_k}\right) = 1$$
   or, equivalently,
   $$\frac{n_1 - 2}{n_1} + \ldots + \frac{n_k - 2}{n_k} = 2.$$
   (b) There is only one vertex type where two of the ns are at least 12. What is this vertex type?
   (c) Show that at most one of the ns in a vertex can be greater than 12. (You're showing that your answer to the previous part is the *only* possible answer.)
   (d) What is the largest possible value of k for a vertex type $(n_1, n_2, \ldots, n_k)$? That is, what is the largest number of regular polygons that can meet at a vertex?
   (e) Write a short computer program to determine all possible vertex types.