CIS 32 Spring 2009, Homework 2

1. For each of the following activities, say (with justification), whether or not they require intelligence:

   (a) cracking an egg into a bowl to make an omlette;
   (b) riding a bicycle;
   (c) solving differential equations;
   (d) writing a computer program;
   (e) playing table tennis.

   (5 points)

2. Classify each of the environments in which each of the following agents operates:

   (a) robot that delivers mail around the office;
   (b) program that sorts my mail, based on things like subject line and sender.
   (c) a neural network that controls the simulated robot we discussed in Lecture 3.

   as

   - Accessible *vs* inaccessible
   - Deterministic *vs* non-deterministic
   - Episodic *vs* non-episodic
   - Static *vs* dynamic
   - Discrete *vs* continuous

   As part of your answer, you should explain *why* you classify each environment in the way you do.

   (15 points)

3. Design by hand a neural network to implement the exclusive-or function of two inputs x_1 and x_2. This means decide the connections between TLUs (you will need more than one) and the weights on inputs and on connections.

   Your network should have a *hidden* layer of TLUs (that is a set of TLUs that are not connected to the output) which each have inputs x_1 and x_2, and an output TLU with inputs from the output of the hidden layer (and no direct input from x_1 or x_2).

   (10 points)

4. The following training set is linearly separable:

input	output
1 0 0	1
0 1 1	0
1 1 0	1
1 1 1	0
0 0 1	0
1 0 1	1

   By hand, train a TLU using this training set.

   (a) Using the Widrow Hoff procedure
   (b) Using the error-correction procedure.

   You will need to have four inputs (including the one which implements the threshold). Start training with all weights equal to 0 and $c = 0.5$, and train once on each example in the training set.

   Show the set of weights after each example.

   (20 points)