HOMEWORK #6: Binary Decision Diagrams

This homework is due electronically by midnight on Thursday, October 22, 1998.

1. **Programming exercise 4** (100 points)
   In this assignment, you will be using the CUDD binary decision diagram package to solve the unate covering problem. Documentation for this package can be found on the class webpage. However, an example which includes all the function calls that you will need is provided on the CADE machines in ~/cmyers/cc5740/cuddex/*. To run this example, copy the files, type “make” followed by “bddex”. CUDD has a C++ interface wrapper (see cuddObj.hh). It can also be used in C-style and with PERL.

   Recall that a covering problem can be set up as a POS form. For example, the astronaut and the cookies problem was of the form: \((p_1 + p_3)(p_1 + p_2 + p_4)(p_2 + p_3)(p_5)\). To solve such a covering problem using BDDs, one simply needs to convert the POS form into a BDD and find the shortest path through the BDD. In other words, the shortest path in a BDD is the fewest variables that need to be set to one to get to the TRUE leaf node.

   Your code should read a covering problem in the following form:

   ```plaintext
   .rows 4
   .cols 5
   .names p1 p2 p3 p4 p5
   1 0 1 0 0
   1 1 0 1 0
   0 1 1 0 0
   0 0 0 1
   .e
   ```

   It should translate the covering problem into a BDD representing the POS form of the problem and find the shortest path through this BDD. It should output the solution as a vector of the column names:

   ```plaintext
   p1 p2 p5
   ```