CS 517
Due: Wednesday, 4 May

Homework #5
Satifiability
Davis-Putnam

```
FUNCTION DP(E): E is a Boolean expression in clause form
  IF  E  =   Λ
       THEN Return(TRUE)
  IF  E contains an empty clause
       THEN Return(FALSE)
  IF  E contains a unit clause
       THEN  drop every clause which contains this literal
             and remove the complement of this literal from every clause
             Return( DP(modified E) )
       ELSE  pick a variable x
             and let ET be the new expression formed by dropping each
             clause containing  x and removing ~x from every clause
             IF  DP(ET)
                 THEN Return(TRUE)
                 ELSE let EF be E with each clause containing ~x dropped
                      and with x removed from each clause
                      Return(  DP(EF) )
```

1. Program the Davis-Putnam procedure in your favorite programming language. Make sure that you have some method for timing your program.

2. Run some test data to verify that your program is giving the correct results.

3. **NOTE:** This for information only. You do not have to take any action.
   For 3-SAT on n variables there are $4/3\ n(n-1)(n-2)$ possible different clauses. If an instance contains no clauses then it is satisfiable. While, if an instance contains all of these clauses, it is not satisfiable.

4. Set up a method to generate random 3-SAT instances (over n variables) with a specified density, i.e. the number of clauses divided by n.

5. Use you procedures to generate data to plot the probability of being satisfiable as a function of the density. You should do this for several values of n and compare these functions as n increases.

6. For the same test data as above plot the run time of you DP procedure as a function of density, and figure out some way for comparing this data across various values of n.