**Homework 01, MORALLY Due Feb 5 at 10:00AM**
**DEAD-CAT DAY Feb 7, 10:00AM**

1. (20 points) Give a Propositional Formula on four variables that has exactly three satisfying assignments. Give the satisfying assignments.

2. (20 points) Use truth table so show that

$$(x \vee y) \wedge z$$

is not equivalent to

$$x \vee (y \wedge z).$$

INDICATE which rows they differ on.

3. (30 points) $n$ has the *emily property* if there is a formula on $n$ variables with exactly $n^2 + 100$ satisfying assignments.

   (a) (15 points) Fill in the BLANK in the following sentence

   $n$ has the emily property IFF BLANK($n$).

   The condition BLANK has to be simple, for example, $n$ is divisible by 5 (thats not the answer).

   (b) (15 points) Prove the statement you made in the first part. Note that this means you have to show that

   If BLANK($n$) then $n$ has the emily property

   and

   If NOT(BLANK($n$)) then $n$ DOES NOT have the emily property

4. (30 points) (NOTE: 0 and 1 are NOT prime. You will need that for this problem.)

   (a) (15 points) View the input $x, y, z$ as the number in binary $xyz$ which we denote $(xyz)$. For example, 100 is 4.

   Write a Truth Table for the following function with 3 inputs $x, y, z$ and 1 output $a$.

$$f(x, y, z) = \begin{cases} 0 & \text{if } (xyz) \text{ is NOT PRIME.} \\ 1 & \text{if } (xyz) \text{ is PRIME.} \end{cases}$$

   (b) (15 points) Convert your truth table into formulas. DO NOT SIMPLIFY.

   (c) (0 points- DO NOT HAND IN) Draw a circuit that computes that truth table.