Introduction to Computer Engineering (E114)

Harris Spring 1999

Problem Set 4 **Due: Friday, February 26**

1) Fixed Point 2's Complement Numbers

a) Convert the following base 10 numbers to two's complement binary fixed point number with four integer bits and four bits of fraction:

-6 =

5.625 =

-3.125 =

b) Convert the following two's complement binary fixed point numbers to base 10:

0101.1000 =

1111.1111 =

1000.0000 =

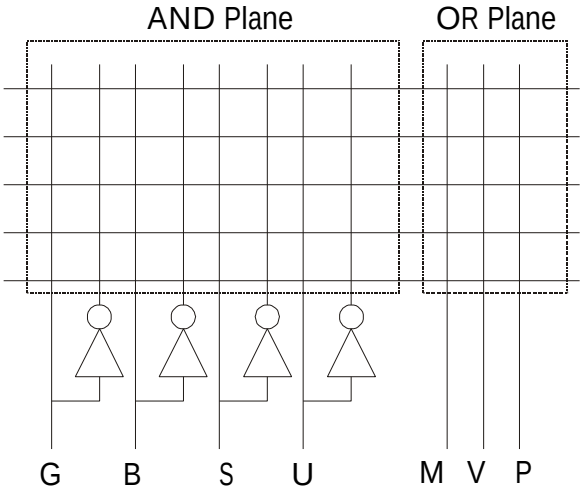
2) ROMs and PLAs

The extraterrestrial life clinic team has just discovered aliens living on the bottom of Mono Lake. They need to construct a circuit to classify the aliens by potential planet of origin based on measured features available from the NASA probe: greenness, brownness, sliminess, and ugliness. Careful consultation with xenobiologists leads to the following conclusions:

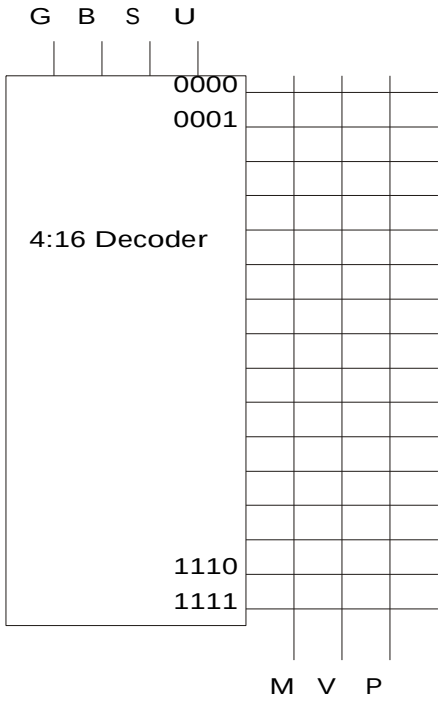
- If the alien is green and slimy or ugly, brown, and slimy, it may be from Mars.
- If the critter is ugly, brown, and slimy, or green and neither ugly nor slimy, it may be from Venus.
- If the beastie is brown and neither ugly nor slimy or is green and slimy, it may be from Pluto.

Note that this is an inexact science; for example, a life form which is mottled green and brown and is slimy but not ugly might be from either Mars or Pluto.

a) Program a PLA to identify the alien by placing dots on appropriate nodes of the following blank PLA. Refer to the textbook for an example.



b) Program a ROM to identify the alien by placing dots on entries of the following blank ROM which should contain 1's.



3) Division

Compute 111001.000_2 / 001100.000_2 in binary using the standard division algorithm from elementary school. Show the steps.

4) Time

Please indicate how many hours you spent on this problem set. This will not affect your grade, but will be helpful for calibrating the workload for next semester's class.