COT 6315/CIS 4930 Sample Test 1 (Solutions)

1. (a) The set EQUAL is not regular since the intersection of EQUAL with a^*b^* is $a^n b^n$ which is not regular (pumping lemma example in class). But a^*b^* is regular and regular languages are closed under intersection, so this implies that EQUAL couldn't have been regular.

   (b) The set WEIRD is regular. It can be represented as $L_1 \cap L_2 \cap L_3$ where $L_1 = (1^*01^*01^*)^*$ is a regular language of strings that have even number of zeroes, $L_2 = \overline{(0^*10^*10^*10^*10^*10^*)^*}$ is a regular language of strings that have a number of 1's that is not a multiple of 5, and $L_3 = ((0^*1^*)^*1)^*(00)^*000$ is a regular language of strings that end with an odd number of 0's (atleast 3). Since set of regular languages is closed under intersection, set WEIRD is regular.

   (c) The language VERYDIFFERENT(L) is regular if L is regular, since VERYDIFFERENT(L)$= \overline{\Sigma^* \circ L \circ \Sigma^*}$ and set of regular languages is closed under operations of complement and concatenation.

   (d) The set BALANCED is not regular because BALANCED $\cap a^*b^* = a^n b^n$ is not a regular language (proof using pumping lemma done in class), and set of regular languages is closed under intersection.