Homework 5–CSC 320 Spring 2017
Due by submission to conneX August 3 11:55pm

1. Let L be a language in P. Prove it is reducible to any language in NP which contains at least one string and doesn't contain all the strings.

   HINT: Use the fact that for such a language L' in NP, there are two strings u, v such that $u \in L'$ and $v \notin L'$.

   For the next two problems, prove that the problem is NP-complete. Use a problem known to be NP-complete which has been discussed in the class notes or in the homework.

2. **3SAT-2ta**
   INPUT: A Boolean formula in CNF with exactly 3 literals per clause
   OUTPUT: Yes if there are at least two satisfying truth assignments.

   HINT: For NP-hardness, the reduction takes a CNF ϕ and produces a CNF ϕ' that is obtained from ϕ by adding one more clause (you need to figure out what this clause should look like.)

3. **SHOPPING BAG**
   INPUT: Set of m items and their weights in grams, two numbers B and T
   OUTPUT: Can we put the m items into T bags, if each bag hold up to B grams?

   HINT: Use a reduction from **PARTITION**. You need to figure out how to set B and T. You can use the same setting for T regardless of the input instance of **PARTITION**.