

## CMP 132 Homework 3

To be done in groups of 2. Please work with different partners than in the other assignments  
4 problems, 15 pts, due Thursday February 2.

1. (3 pts) Show that the set  $T = \{(i, j, k) | i, j, k \in \mathcal{N}\}$  is countable.
2. (5 pts) Prove that a language is Turing Decidable if and only if there is a TM enumerating it in canonical order. (Hint: You may want to treat the finite languages separately.)
3. (4 pts) Use diagonalization to define a language  $L$  such that neither  $L$  nor its complement  $\bar{L}$  is recursively enumerable. (Hint, you need to show that each TM accepts neither  $L$  nor  $\bar{L}$ ).
4. (3 pts, tricky) Will the countable union of Turing recognizable languages always be Turing recognizable? Prove your answer.

Several other problems (not to be handed in) are good exercises and might make a good exam problem.

- Show that the Turing recognizable languages are closed under (pairwise) union and intersection.
- 4.5 in the text
- 4.10 in the text
- 4.12 in the text