1. (3 pts) Show that the set $T = \{(i, j, k)|i, j, k \in \mathbb{N}\}$ 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 $\overline{L}$ is recursively enumerable. (Hint, you need to show that each TM accepts neither $L$ nor $\overline{L}$.)

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