Total marks: 20   November 14, 2005   **Duration:** 1 hour

Roll No: ——————————   **Name:** ————————————————————

Answer all questions in the respective spaces provided.
Use extra sheets for rough work. Any such extra sheet will not be corrected.

1. (a) Let M be a Turing machine with $\mathcal{L}(M) = L$ and with exactly one accept state and exactly one reject state. Construct a Turing machine N by swapping the accept and reject states of M. Prove or disprove: $\mathcal{L}(N) = \overline{L}$. **(5)**

(b) Prove or disprove: The language recognized by the Turing machine shown below is Turing-decidable. **(5)**
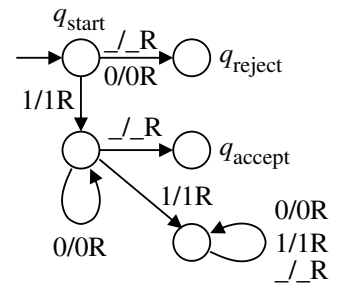
2. (a) Prove that Turing-recognizable languages are closed under union. **(5)**

(b) Let $L_1, L_2, \ldots, L_n$ be pairwise disjoint Turing-recognizable languages over the same alphabet Σ. Suppose that $\bigcup_{i=1}^{n} L_i = \Sigma^*$. Prove that each L_i is Turing-decidable. **(5)**