Problem Set 8 — Due Wednesday, March 11, 1998

Problem 1. Classify the following languages as **decidable**, **acceptable** (but not decidable), **co-acceptable** (but not decidable), or **neither** acceptable nor co-acceptable. Prove all your answers, giving decision procedures or reductions.

A. $L = \{\langle M \rangle : M \text{ accepts some even-length string}\}$.

B. $L = \{\langle M \rangle : M \text{ accepts some palindrome}\}$.

C. $L = \{\langle M \rangle : L(M) \text{ is Turing-decidable}\}$.

D. $L = \{\langle M \rangle : L(M) \text{ is Turing-acceptable}\}$.

E. $L = \{\langle M \rangle : M \text{ never prints a "0" (regardless of the input)}\}$.

F. $L = \{\langle \phi \rangle : \phi \text{ is a Boolean formula which has } no \text{ satisfying assignment}\}$.

G. $L = \{\langle G_1, G_2 \rangle : G_1 \text{ and } G_2 \text{ are CFGs which generate the same CFL.}\}$.

H. $L = \{\langle \alpha \rangle : \alpha \text{ is shortest regular expression for } L(\alpha)\}$.

Problem 2. Suppose you are given a polynomial time algorithm which, on input of a Boolean formula ϕ, decides if ϕ is satisfiable. Describe an efficient procedure which finds a satisfying assignment for ϕ.

Problem 3. Show that the following 100 SOLN SAT problem is NP-complete:

`Instance`: A boolean formula ϕ.
`Question`: Does ϕ have at least 100 satisfying assignments?