Math 166 You may use one sheet of notes. 31 May 2000

Name _____ ID No. _____

There are 125 points total. (At 5 pts. = 1%, the first exam is 20% and this is 25%.)

1. (40 pts.) Indicate whether true or false. Beware of guessing:

   correct answer +5pts. incorrect answer −3pts. no answer 0pts

   (a) ____ Every finite set of strings is a regular language.

   (b) ____ If L is a Turing-recognizable language, so is $\overline{L}$.

   (c) ____ There are CFLs that Turing machines cannot recognize.

   (d) ____ A nondeterministic Turing machine can recognize more languages than a standard Turing machine can.

   (e) ____ A 2-stack PDA can recognize more languages than a standard 1-stack PDA can.

   (f) ____ A 2-tape Turing machine can recognize more languages than a standard 1-tape Turing machine can.

   (g) ____ There exists a Turing machine that can decide if two context free grammars generate the same language.

   (h) ____ There exists a Turing machine which can decide if two DFAs recognize the same language.

2. (25 pts.) Prove: If L is decidable, then $L^{\mathcal{R}}$ is decidable
   Hint: Make use of the Turing machine that decides L.

MORE

3. (36 pts.) Give an example of a language which satisfies each of the following. If it is in the text (including Exercises and Problems), or is a simple modification of one of these, no proof is needed. Otherwise, give a proof.

   (a) A CFL which is NOT regular.

   (b) A decidable language which is NOT a CFL.

   (c) A Turing-recognizable language which is NOT decidable.

4. (24 pts.) Let $L = \{ww^{\mathcal{R}} | w \in \{0,1\}^*\}$. Construct *either*

   (i) a context free grammar to generate L *or*

   (ii) a PDA to recognize L.

END