



CSE 322: The Last Homework Assignment



Due Date: Friday, June 4 (at the *beginning* of class)

Solutions for these problems will be up on

the class website on Friday, June 4

Note: Finals on Monday, June 7, 8:30-10:20 am in class

1. (40 points) In the previous homework, you showed that $L = \{w\#x \mid w, x \in \{0,1\}^* \text{ and } w \text{ is a substring of } x\}$ over the alphabet $\Sigma = \{0,1\}$ is not a context-free language. Show that L is decidable. Give the *implementation level description* of your Turing machine (in the format: $M = \text{“On input } w: \dots\text{”}$) and a *formal description with a state diagram* as in [Example 3.4](#) in the textbook (see also [Example 3.5](#)).
2. (40 points) Closure properties
 - a. (15 each) Show that decidable languages are closed under:
 - i. complement
 - ii. concatenationGive *implementation level details* of the necessary Turing machines in each case.
 - b. (10 points) Can you apply your proof in (i) above to show that the class of Turing-recognizable languages is closed under complement? Explain why/why not.
3. (20 points) Let $FINITE_{TM} = \{ \langle M \rangle \mid M \text{ is a TM and } L(M) \text{ is finite} \}$. Show that $FINITE_{TM}$ is undecidable by giving a reduction from A_{TM} to $FINITE_{TM}$. Hint: See pages 171-176 in the text. Use a reduction similar in spirit to the one used in Theorem 5.2.

Bonus question (no points!): Is the question “Does God exist?” decidable? (Hint: See Problem 3.19 in the textbook)