

# CS 360 Assignment 3

**Due Date** Tuesday, March 20nd, at the beginning of class.

All questions are worth the same amount. Please ensure that your name and student number appear, in ink, on each page of your assignment.

Work is to be done individually.

## Assignment Questions

- 1 (See Sipser 2.45.) Show that  $\{wtw^R \mid w, t \in \{0, 1\}^* \text{ and } |w| = |t|\}$  is not a CFL.
- 2 (See Sipser 2.22.) Show that  $\{x\#y \mid x, y \in \{a, b\}^*, x \neq y\}$  is a CFL.
- 3 Informally, but clearly, describe a multi-tape Turing machine that accepts the language  $\{a^n b^n c^n \mid n \geq 1\}$ .
- 4 Describe a Turing Machine that accepts the language  $\{ww^R \mid w \in \{0, 1\}^*\}$ , where  $w^R$  is the reverse of  $w$ .
- 5 Let  $A$  and  $B$  be two languages, subsets of  $\Sigma^*$ . (i) If  $A$  and  $B$  are decidable then is the union of the two languages,  $A \cup B$ , a decidable language? Explain your answer. (ii) If  $A$  and  $B$  are Turing-recognizable is  $A \cup B$  Turing-recognizable? Explain your answer.