

CS580 Homework 9**Due November 1, 2023, at the beginning of class**

1. What is the first string in each of the following languages?
 - a. L_d
 - b. $\overline{L_d}$
 - c. L_u
 - d. $\overline{L_u}$
 - e. L_e
 - f. $\overline{L_e}$

2. Determine whether each of the following languages is decidable (recursive). If the language is decidable, informally describe an algorithm to decide it. If the language is undecidable, show that if it were decidable then we could decide another undecidable problem such as L_u or L_e .
 - a. $L = \{\langle M, w \rangle \mid M \text{ halts on } w\}$
 - b. $L = \{\langle M, w \rangle \mid M \text{ moves left on } w\}$
 - c. $L = \{\langle M, w \rangle \mid M \text{ moves left three times in a row } w\}$
 - d. $L = \{\langle M \rangle \mid M \text{ accepts } \lambda\}$
 - e. $L = \{\langle M_1, M_2 \rangle \mid L(M_1) = L(M_2)\}$