CS 181 Homework 8

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Problem 1

Leftmost Reduction #1:
baabba
Baabba
BAabba
BAAbba
BCbba
Abba
ABba
ABBa
ADa
Ba
BA
S

Leftmost Reduction #2:
baabba
Baabba
BAabba
BAAbba
BAABba
BASba
BAba
BABa
BSa
Ba
BA
S

Problem 2

a) Proof (by construction):

- Let M_P be a Turing Machine that recognizes L_P.
- Let M_A be a Turing Machine that decides L_A.
- Construct M for $L_P \cup L_A$.
- Use UTM to simulate M_A on a given input w.
  - Since M_A decides a language, it's guaranteed to halt.
- If M_A halts and accepts, M halts and accepts.
- Else (M_A has halted and rejected):
  - Use UTM to simulate M_P on w (this may enter an infinite loop).
  - If M_P halts and accepts, M halts and accepts.
  - If M_P halts and rejects, M halts and rejects.

b) Justification:
By definition, a machine that recognizes the language $L_P \cup L_A$, must recognize every string in L_P. Since L_P is an RE language, we cannot guarantee that all strings recognized by M_P cause M_P to halt. As a result, we must account for the possibility that some strings in L_P cannot be decided, only recognized. Therefore, the language $L_P \cup L_A$ cannot be assumed to be recursive, it must be RE.