1. Two stacks (20 points). Show that the language $L$ below over the alphabet $\Sigma = \{0,1\}$ can be recognized by an NPDA that has two independent stacks rather than one stack. As part of your answer, be sure to specify formally what it means for an NPDA to have two stacks.

$L = \{ww \mid w \in \{0,1\}^*\}$.

2. Two stacks (40 points). Using your formal specification of two-stack NPDA, show that NPDA with two stacks are equivalent to Turing machines. That is, show that every language that is recognized by some Turing machine is also recognized by some two-stack NPDA and that every language that is recognized by some two-stack NPDA is also recognized by some Turing machine.

3. Enumerators (40 points). Let $L_1 \oplus L_2 = \{w \mid (w \in L_1 \text{ and } w \notin L_2) \text{ or } (w \in L_2 \text{ and } w \notin L_1)\}$ for languages $L_1, L_2 \in \text{CFL}$.
   a) Specify an enumerator that will print the language $L_1 \oplus L_2$.
   b) Is $(L_1 \oplus L_2) \in \text{CFL}$? Prove or disprove your answer.
   c) Is $(L_1 \oplus L_2) \in \text{RE}$? Prove or disprove your answer.
   d) Is $(L_1 \oplus L_2) \in \text{R}$? Prove or disprove your answer.