“B problems” must be turned in.

**Problem B1 (40 pts).** (a) Give an NFA with five states and two $\epsilon$-transitions accepting the language $L = \{ab, aab, aba\}^*$.

(b) Convert the NFA of question (a) to a DFA using the algorithm described in the class notes. Give both the transition table of the DFA, with a column listing the states of the DFA as subsets of the set of states of the NFA, and a drawing of the DFA as a directed graph.

**Problem B2 (45 pts).** Let $L$ be a regular language. Are the following languages regular, and if so, give a construction and a proof of its correctness.

(a) $\text{Pre}(L) = \{u \mid u$ is a prefix of some $w \in L\}$

(b) $\text{Suf}(L) = \{u \mid u$ is a suffix of some $w \in L\}$

(c) $\text{Sub}(L) = \{u \mid u$ is a substring of some $w \in L\}$

**Problem B3 (40 pts).** Let $R$ be any regular language over some alphabet $\Sigma$. Prove that the language

$$L = \{u \in \Sigma^* \mid \exists v \in \Sigma^*, uvw \in R, |u| = |v|\}$$

is regular.

**TOTAL: 125 points**