Answer all questions on your own. Turn in your answers at the beginning of class. Write your preferred e-mail address (e.g. zz6000@csc). If you are using more than one sheet of paper, make sure that you staple all the sheets together.

Remember that collaboration of any kind is not allowed.

1. Construct a deterministic finite automaton (DFA) that recognizes the following language:
\[ \{ w \in \{a, b\}^* \mid w \text{ starts with } b \text{ and contains } bb \text{ as a substring.} \} \]

The alphabet is \{a, b\}.

Note: bb is in the language and so should be accepted by the DFA.

2. Consider the language
\[ a^*b \cup b^* \]
(i.e., \{a\}^*\{b\} \cup \{b\}^*).

The alphabet is \{a, b\}.

(a) Construct a deterministic finite automaton (DFA) recognizing this language.

(b) Show that any DFA that accepts this language has to contain a dead state.

Hint: Find a string w such that any string that has w as a prefix will not be in the language. It is not enough to exhibit one DFA for this language that has a dead state.