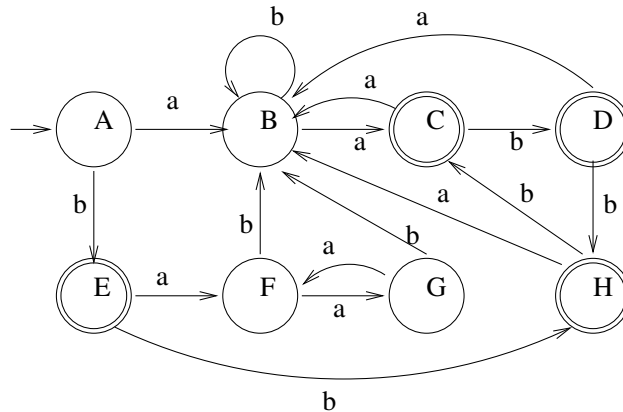The answers must be the original work of the author. While discussion with others is permitted and en-couraged, the final work should be done individually. You are not allowed to work in groups. You are allowed to build on the material supplied in the class. Any other source must be specified clearly.

1. *(60 points)* Consider the DFA below.

(a) Construct a two dimensional table where the row and column headers are the states of the above DFA. Mark each cell with a '1' (or a higher number representing the iteration number) if the states are "different." Unmarked cells will represent indistinguishable states.

(b) Construct a minimized DFA by collapsing (groups of) indistinguishable states into single states.

2. *(40 points)* Consider the following grammars G_1 and G_2:

G_1 :
$S \rightarrow xAx$
$A \rightarrow Aa \,|\, Ab \,|\, c \,|\, d$

G_2 :
$S \rightarrow xAx$
$A \rightarrow c \,|\, d \,|\, cB \,|\, dB$
$B \rightarrow aB \,|\, bB \,|\, a \,|\, b$

(a) Give a derivation sequence for string $xcabx$ in G_1. Give the derivation tree of the sequence.

(b) Give a derivation sequence for string $xcabx$ in G_2. Give the derivation tree of the sequence.