Problem 1 (8 points)

Below is a grammar for the city-state-zip line of a postal address, in which terminal symbols are indicated by this typewriter typeface. The starting symbol is CityStateZip; space indicates a space character.

- CityStateZip → City, space State space space Zip
- City → Word | Word space City
- Word → UpperCase | UpperCase LowerCaseString
- UpperCase → A | B | ... | Z
- LowerCaseString → LowerCase | LowerCase LowerCaseString
- LowerCase → a | b | ... | z
- State → UpperCase UpperCase
- Zip → Digit Digit Digit Digit Digit
- Digit → 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

(a) (5 points) Mark each of the following eight addresses “legal” or “illegal” according to this grammar.

- Irvine, CA 92697-3440
- Sherman Oaks, Ca 91403
- Marengo, Illinois
- Half Moon Bay, CA 94019
- Freeport, Maine 04032
- McCool, MS 39108
- Planet X, OS 00000
- Hilo, HI 96721

(b) (3 points) Choose one of the legal addresses above and draw a derivation tree (parse tree) showing how to derive it from the grammar. You may abbreviate the nonterminal symbols in the rules. [Hint: Choose the shortest legal address.]
Problem 2 (12 points)

(a) (8 points) Draw a state transition diagram for an FSA that accepts the same valid city-state-zip address lines that the grammar from Problem 1 generates, except that you don't have to distinguish upper-case from lower-case letters. You may omit drawing the error state. Be sure to indicate the initial state and the accept state(s).

[Hint: Be careful to count the digits correctly.]

(b) (4 points) Draw the state transition table for the first four states of your FSA above. You may leave blank any unspecified transitions; you should omit the error state. We have supplied horizontal lines; you will supply the vertical lines and everything else.

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