Question 1)

States alphabet trans func initial state Final state

From the textbook, a DFA $M = (Q, \Sigma, \delta, q_0, F_0)$

exists if a language L is regular where $L = L(M)$

then has a complimant $M = (Q, \Sigma, \delta, q_0, Q/F)$ where

the accepting & non-accepting states are switched.

Per Demorgan's laws, $(A \cap B)' = A' \cup B'$ &

according to the textbook, if A & B are regular

languages, $A \cup B$ is regular from the closure to

union proof. Using the closure under complement

proof, A' & B' are also regular when A & B is & $A' \cup B'$ is regular

regular. If $A' \cup B'$ is regular, so it $(A \cap B)'$. Under

closure to complement, $A \cap B$ is also regular.

Question 2)

Variabe S, Start states for variables A & B are S_A, S_B, Z = all rules from A, B.

x) $S_A \to wy$
$y \to a$

y) $S_B \to bC$
$C \to \varepsilon$

z) $S \to S_A S_B$

Z is CFL that accepts A & B in this model, So Z will accept A·B.

Question 3)

Professor Brainy is claiming $S \to SS$. If you add S to any context free grammar you are still not including $S \to \varepsilon$, L^* must include the empty string. G does not generate L^* b/c it is not gauranteed that there is a terminal pointing to ε.

Question 4)

<u>Context free grammar</u>

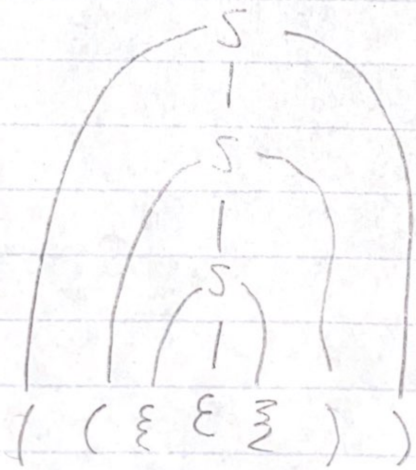
$S \to SS$

$S \to (S)$

$S \to \{S\}$

$S \to \varepsilon$

<u>Parse tree</u>



Question 5)

a) 0^*1^*

Alone 1 & 0 are CFL.

From proof in question 2, if A & B are CFL, then A∘B are CFL. Same concept here. Since 1 & 0 are Context Free, 0^*1^* are Context Free.

b) $1^n0^n / 0^n1^n$

$S \to x$ $\quad x \to 1x0 \mid \varepsilon$

$S \to y$ $\quad y \to 0y1 \mid \varepsilon$

where S, x, y are variables, language is {0, 1}

No matter whether the language choses x or y, it will still create a set of terminals / resulting String representing 0^n1^n or 1^n0^n, each having equal 0's & 1's. B/c x & y can infinitely reference itself, there can be 0^n1^n or 1^n0^n # of 1's and 0's. When the # reaches n, the String can Simply Complete by taking ε.

5c)

$S \to 0S0 \mid 1S1 \mid \varepsilon$

This is essentially a palindrome except S cannot include $S \to 0 \mid 1$ b/c the string can't have length 1. It needs to be of even length or empty. S is self referential & can loop as many times as needed & needs to start & end in the same string for each loop of S.