CSE3064 Final Exam Study Questions

1. Consider the context-free grammar S → ySx | yySx | ε
   a. Show that the grammar is ambiguous.
   b. Derive an equivalent unambiguous grammar.

2. Design a PDA for the following languages:

   a. $L_1 = \{0^{2k}\ 1^{3k} \mid k \geq 0\}$
   b. $L_2 = \{\ 0^a 1^b 2^c \mid a, b, c \geq 0 \text{ and } a + b = c\ \}$

3. Prove or disprove the following statement:

   The class of context-free languages are closed under the intersection operation.
   Hint: Consider the following two languages:

$$L_1 = \{a^m b^n c^n \mid m, n \geq 0\}$$
$$L_2 = \{a^n b^n c^m \mid m, n \geq 0\}$$

4. Given the following context-free grammar:

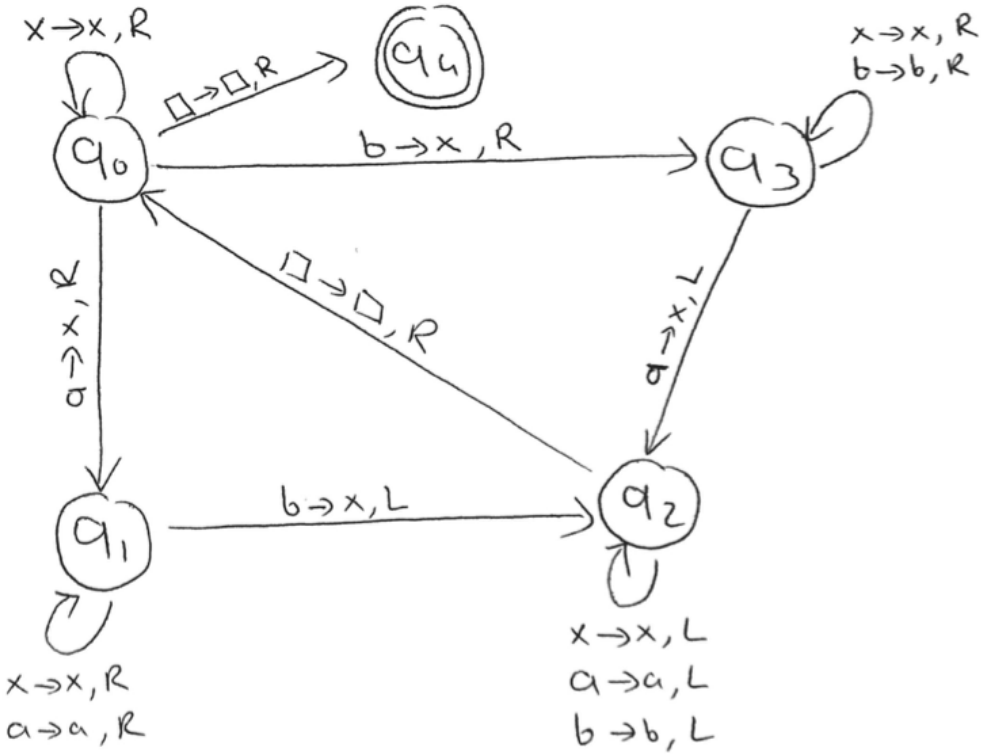
   S → XY | ε
   X → xY
   Y → Sy

   a. What is the language generated by this grammar?
   b. Draw the parse tree for the string xxyyyy.

5. Convert the following context-free grammar to an equivalent grammar in Chomsky Normal Form.

   S → ASA | A | ε
   A → 11 | ε

6. What is the language on {a,b} recognized by the following Turing Machine (a,b,x, and box are the tape symbols where box denotes the empty cell) ?



7. Prove or disprove the following statement:
   Turing-recognizable languages are closed under the intersection operation.

8. Prove that the following languages are decidable (give the deciders for each of the language):

   a. $L_1 = \{ < D, R > \mid D \text{ is a DFA}, R \text{ is a regular expression and } L(D) = L(R) \}$
   b. $L_2 = \{ < N > \mid N \text{ is an NFA and } L(N) = \Sigma^* \}$