Name: _

1 True/False

Answer whether the following statements are true or false and briefly explain your answer.

a) [TRUE/FALSE] For any NFA N, an equivalent NFA N' can be created that has only one accept state. [5 pts]

b) [TRUE/FALSE] Converting any context-free grammar to Chomsky normal form will ensure that it is unambiguous. [5 pts]

2 Finite Automata

Draw a DFA, NFA, or GNFA for each of the following languages.

a) $\{w \in \{0,1\}^* \mid w \text{ begins with a 1 and ends with a 0}\}$

[5 pts]

3 Language Identification

Identify each language below as regular, context-free, or non-context-free. If the language is regular, provide a finite automaton or regular expression for it. If the language is context-free, use the pumping lemma to show that it is *not* regular and provide a context-free grammar or pushdown automaton for it. If the language is not context-free, use the context-free pumping lemma to prove this.

a) \overline{A} , where $A = \{0^n 1^n \mid n \ge 0\}$.

[10 pts]

4 Proofs

a) Show that $\{w \in \{0,1\}^* \mid w \text{ is a binary multiple of } n\}$ is regular for any $n \in \mathbb{N}$. [10 pts]

b) Use the context-free pumping lemma to show that $\{a^i b^j c^k \mid 0 \le i < j < k\}$ is not context-free. [10 pts]