## Quiz 2

**Instructions:** Succinctly answer each question. No justification is needed for  $\mathbf{True}/\mathbf{False}$  questions.

1. Complete the following definition: a CFG  $G = (V, \Sigma, R, S)$  is **regular** if:

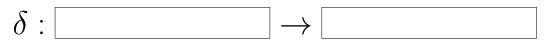
2. Complete the following start of a proof for showing  $L_5 = \{x \in \{a, b\}^* : 0 \le |x| \le 4\}$ cannot be accepted by any 5-state DFA: Assume for contradiction that there is a 5-state DFA  $M = (Q, \Sigma, \delta, q_0, F)$  that accepts  $L_5$ . Consider then the strings

and the corresponding states of M

By the pigeonhole principle, we know that

for some  $0 \le i < j \le$  [The proof continues, you are not asked how.]

3. According to the conventions of your text, a **Turing machine** is a 7-tuple  $M = (Q, \Sigma, \Gamma, \delta, q_0, q_{\text{accept}}, q_{\text{reject}})$  where



(Fill in the domain and range of the function  $\delta$ .)

4. Explain what is the difference in meanings between "Turing machine M accepts the language L" and "Turing machine M decides the language L."

5. In a sentence or two, state the **Church-Turing thesis**.

- 6. **True** or **False**: The language  $L_n = \{0^n 1^n\}$  is always regular.
- 7. True or False: Language  $L = \{w \in \{0,1\}^* : w \text{ has an equal number of 01's and 10's}\}$  is regular.
- 8. True or False: Let  $noPrefix(L) = \{w \in L | no proper prefix of w is in L\}$ . Then noPrefix(L) is finite.
- 9. **True** or **False**: Deterministic and nondeterministic TMs accept exactly the same languages.
- 10. **True** or **False**: It is possible to convert a TM M into an unrestricted grammar G the language of which is L(M).
- 11. True or False: If L is r.e. then  $L^*$  is r.e.
- 12. True or False: If  $L^*$  is decidable then L is decidable.
- 13. **True** or **False**: The language  $A = \{\langle M, w \rangle : \text{TM } M \text{ rejects } w\}$  is r.e.
- 14. **True** or **False**: The language  $B = \{\langle M \rangle : \text{TM } M \text{ rejects some string } w\}$  is r.e.
- 15. **True** or **False**: The language  $C = \{\langle M \rangle : L(M) \text{ is finite }\}$  is r.e.