Quiz 2

Instructions: Succinctly answer each question. No justification is needed for **True/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 $L_5 = \{x \in \{a, b\}^* : 0 \leq |x| \leq 4\}$ 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*

   $\boxed{}$

   and the corresponding states of M

   $\boxed{}$.

   By the pigeonhole principle, we know that

   $\boxed{}$

   for some $0 \leq i < j \leq \boxed{}$. [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

   $$\delta : \boxed{} \to \boxed{}$$

   (*Fill in the domain and range of the function δ.*)

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 $\mathsf{noPrefix}(L) = \{w \in L |$ no proper prefix of w is in $L\}$. Then $\mathsf{noPrefix}(L)$ 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.