

NAME _____

CSci 311: Models of Computation
CSci 500: Fundamental Concepts of Computing
Fall 2024 Exam 3 100 points

Directions: You must submit this exam by 2:30 pm on Thursday, December 5, 2025. My preference is that you turn the handwritten portions in to me on this Thursday at 2:30 pm in the classroom; however, you can submit digital versions. For each JFLAP question, upload a jff file with the correct label corresponding to the question number.

1. (12 points. 2 points each) Match terms in the list with the statements given below. For each statement write the letter of the **best** matching term in the blank. **A term may be used more than once.**

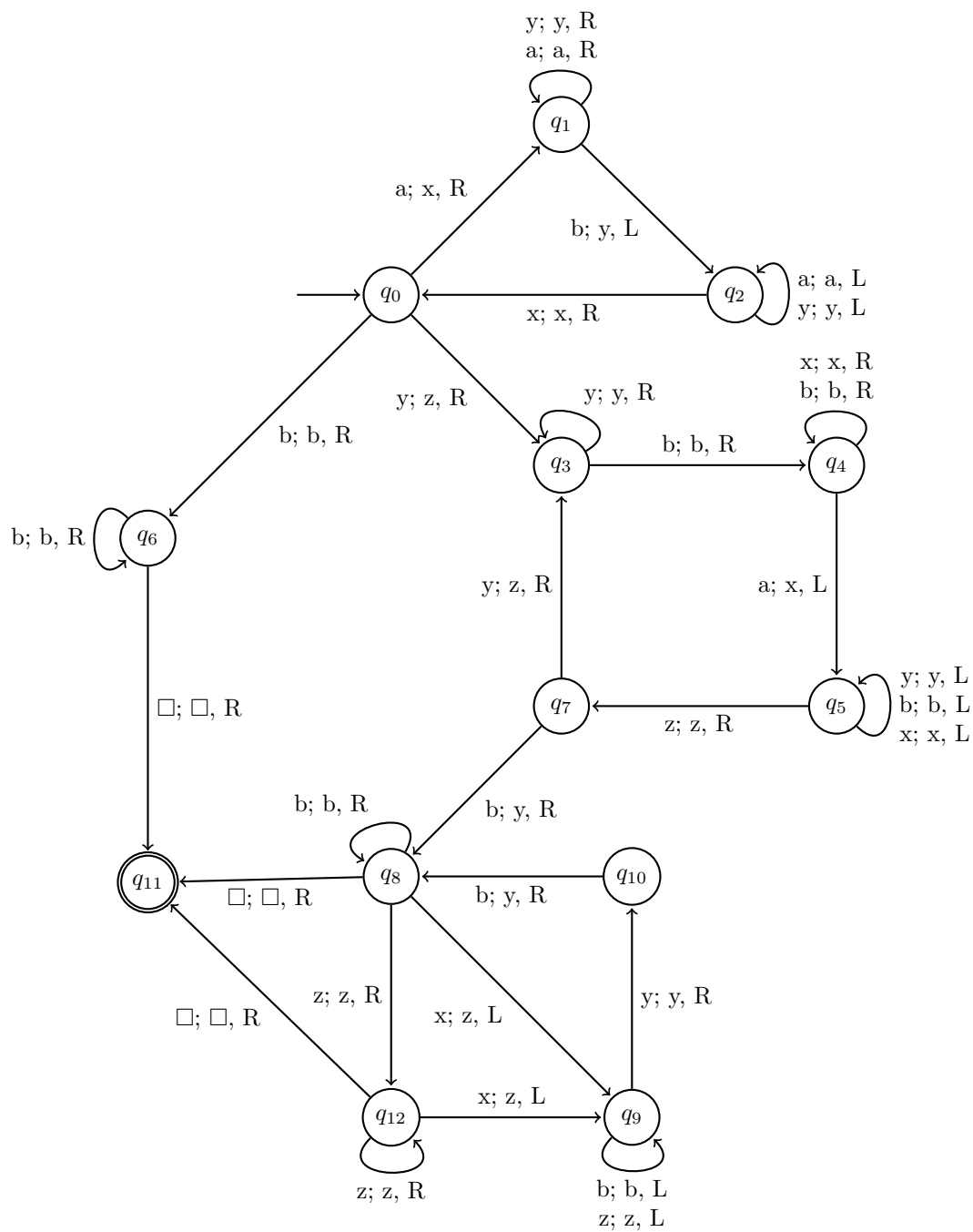
A. regular	B. context-free	C. finite
D. tape alphabet	E. Chomsky normal form	F. NFA
G. DPDA	H. \square	I. acceptor
J. transducer	K. DFA	L. left linear
M. recursive enumerable	N. read-write head	O. Type-0 languages
P. NPDA	Q. The Halting Problem	R. equivalent

- _____ This symbol is used to separate different strings on a tape.
- _____ The fact that there doesn't exist an algorithm that will determine the outcome of any given program with any given input is the basis of the _____.
- _____ General term for an automaton that produces a string for its output
- _____ Is used to read or modify the tape.
- _____ General term for an automaton that halts in a final state when the string read is in the associated language
- _____ Any symbol that can be read or written during while a Turing Machine is processing the input.
2. (8 points. 2 points each) Place **T** on the line for each statement that is true and place **F** on the line for each statement that is false.

- _____ A Turing Machine can be built to accept context-free languages.
- _____ The tape alphabet and the input alphabet are always the same for a Turing Machine.
- _____ All Type 2 grammars have a FA to accept strings in the language.
- _____ All recursively enumerable languages can be represented by a PDA.

3. (10 points) Draw a diagram representing the Chomsky Hierarchy and label it with information corresponding to the type of languages, grammars and machines and/or automata that can be used for each.

4. (10 points. 2 points each) Using the Turing Machine below for a - e, place an **A** by each string that is accepted and **R** by each string that is rejected.



- ____(a) abba
 ____ (b) abbba
 ____ (c) abbbabab
 ____ (d) bbbb
 ____ (e) aaaaaa

5. (15 points each. 10 points for each transition graph and 5 points for septuple and transition functions/table) For each of the questions below, you are to use JFLAP to build a Turing Machine that will accept the language and provide the septuple describing the machine including transition functions/table.

(a) $L_1 = \{w : n_a(w) = n_b(w) = n_c(w)\}$

(b) $L_2 = \{a^n b^m c^p : n \geq m > p\}$

(c) $L_3 = \{a^n b^m : n, m \geq 0\}$

(d) $L_4 = \{a^n b^m : n \geq m\}$