

17 Lecture - CS402

Important Subjective

1. What is an NFA, and how does it differ from a DFA?

Answer: An NFA (nondeterministic finite automaton) is a theoretical model of computation that extends the concept of a deterministic finite automaton (DFA) by allowing multiple possible transitions from a given state on a given input symbol. The main difference between NFA and DFA is that the DFA has a unique transition from each state on each input symbol, while the NFA can have multiple possible transitions from a given state on a given input symbol.

What are the advantages of using an NFA over a DFA?

Answer: One advantage of an NFA over a DFA is that an NFA can be more compact than a DFA. Another advantage is that some languages can be recognized by an NFA but not by a DFA, so an NFA can recognize a larger class of languages than a DFA.

What is the Kleene star, and how is it used to define regular expressions?

Answer: The Kleene star is a unary operator that is used to construct regular expressions. The Kleene star of a language L is denoted by L^* , and it represents the set of all possible concatenations of zero or more strings from L . The Kleene star is used in the definition of regular expressions to allow repetition of the same pattern zero or more times.

What is the relationship between regular expressions and NFAs?

Answer: A regular expression can be converted to an NFA, and an NFA can be converted to a regular expression. This is known as Kleene's Theorem, which states that any language recognized by an NFA can also be recognized by a regular expression.

What is the pumping lemma, and how is it used to prove that a language is not regular?

Answer: The pumping lemma is a tool used to prove that a language is not regular. It states that for any regular language L , there exists a pumping length p such that any string s in L of length greater than or equal to p can be split into three parts, $s = xyz$, such that y is not empty, $|xy| \leq p$, and for all $i \geq 0$, xy^iz is also in L . By choosing a suitable string s and showing that it cannot be split into three parts satisfying these conditions, one can prove that L is not regular.

What is the difference between an ϵ -transition and a regular transition in an NFA?

Answer: An ϵ -transition is a special type of transition in an NFA that allows the machine to move from one state to another without consuming any input. A regular transition, on the other hand, consumes one input symbol and moves the machine to a new state.

What is the difference between a deterministic and a nondeterministic automaton?

Answer: A deterministic automaton (DFA) is an automaton where each input symbol uniquely determines the next state. A nondeterministic automaton (NFA) is an automaton where multiple next states may be possible for a given input symbol.

What is the power set construction, and how is it used to convert an NFA to a DFA?

Answer: The power set construction is a method used to convert an NFA to a DFA. It works by constructing a new DFA whose states correspond to subsets of the states of the NFA. The

transition function of the DFA is defined such that for each input symbol and each state in the DFA, the resulting state is the set of states in the NFA that can be reached from any state in the current state set on the input symbol.

What is the language recognized by an NFA with a single state that is also a final state?

Answer: The language recognized by such an NFA is the