

# COL352: Assignment 1

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## 1 Question 1

## 2 Question 2

**An all-NFA  $M$  is a 5-tuple  $(Q, \Sigma, \delta, q_0, F)$  that accepts  $x \in \Sigma^*$  if every possible state that  $M$  could be in after reading input  $x$  is a state from  $F$ . Note, in contrast, that an ordinary NFA accepts a string if some state among these possible states is an accept state. Prove that all-NFAs recognize the class of regular languages.**

To prove that all-NFA's recognise the class of regular languages we need to show two things, firstly that the language accepted by all-NFA's is regular, and secondly given any regular language there exists an all-NFA which accepts it. Following are the proofs of these parts,

**To Prove:** Language accepted by all-NFA is regular.

**Proof:** Now by the definition, all-NFA  $M$  is a 5-tuple  $(Q, \Sigma, \delta, q_0, F)$  that accepts  $x \in \Sigma^*$  if every possible state that  $M$  could be in after reading input  $x$  is a state from  $F$ . This would mean the all-NFA's are NFA because NFA accepts the string even if some of the states reached after reading an input  $x$  is in accept state  $F$ . Now we know that the language accepted by NFA is regular. Therefore the language accepted by all-NFA is also regular. Hence proved.

**To Prove:** For every regular language there exists an all-NFA that accepts it.

**Proof:** We know that for every regular language there exists a DFA which accepts it. Now the definition of a DFA  $M$  is that it is a 5-tuple  $(Q, \Sigma, \delta, q_0, F)$  that accepts  $x \in \Sigma^*$  if the state that  $M$  could be in after reading input  $x$  is a state from  $F$ . Now we also know that the set of states DFA  $M$  would be in after reading the input  $x$  is a singleton set (Deterministic nature) and the state belongs to  $F$  if  $x$  is accepted by DFA. So every DFA is an all-NFA. Therefore for every regular language, there exists an all-NFA that accepts it. Hence proved.

Now above two facts would imply that the all-NFA's recognize the class of regular languages.

**3 Question 3**

**4 Question 4**

**5 Question 5**

**6 Question 6**