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Single Substring Based Classification for Nondeterministic Finite Automata

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***Abstract*—**Nondeterministic Finite Automata (NFA) designed to accept the string. The chain starts from the starting state then moves from one state to another state. In case of the loop, it stays in the same state. But finally it reaches the accepting states if NFA has the proper design. Based on the single substring NFA can be classified into three categories. Those are 1. NFA that starts with a substring 2. NFA that contains a substring 3. NFA that ends with a substring.

***Keywords*—** Containing condition, Ending condition, NFA, Substring, Starting condition.

I. INTRODUCTION

The designing of NFA based on the string. NFA has five tuples as a component. Those are starting state, ending state, the collection of states, transition functions and input characters.

NFA has following properties.

- ❖ No of starting state is exactly one.
- ❖ No of ending state is normally one. In sometimes it may be more than one state.
- ❖ During the transition, if it is loop then it stays in the same loop. Otherwise, it will move to another state.
- ❖ More transition at the same time is possible.
- ❖ Maximum number of transition for an NFA is represented by equation 1

$$M=ez^{h}!$$

Where

M stands for Maximum number of transitions,

e stands for no of input,

z stands for number of states,

h has the fixed value 2.

Ex. 1. If the input are {e,z,h,i,l} i.e totally 5 input symbols and no of states are {q0,q1,q2,q3} i.e totally 4 states then the maximum number of possible transition will be 5 * 4 power 2 =5 * 16 = 80 transitions.

Ex. 2. If the input are {a,r,s,u} i.e totally 4 input symbols and no of states are {q0,q1,q2,q3,q4,q5} i.e totally 6 states then the maximum number of possible transition will be 4 * 6 power 2 =4 * 36 = 144 transitions.

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II. RELATED WORK

Ezhilarasu et. al. [2014] classified NFA based on single loop and its position into three types. Those are 1) NFA accepting the string, which starts with particular substring. (String = Substring followed by self-loop at the ending state). 2) NFA is receiving the string; that ends with particular string (String = Self-loop at the starting state followed by the given substring). 3) NFA accepting the string that starts with the particular string and ends with the particular string (String = given substring1 followed by self-loop in the intermediate state and substring2), as in [1].

Ezhilarasu et. al. [2014] classified NFA that contains dual loops and its position into three categories. Those are 1) Loop at the starting and ending state (String = Self-loop at the starting state followed by given substring and self-loop at the ending state). 2) Loop at the beginning and intermediate state (String = Self-loop at the starting state followed by given substring1 and self-loop at the intermediate state followed by substring2). 3) Loop at ending and intermediate state (String = Substring1 followed by Self loop at the intermediate state followed by given substring2 and self-loop at the ending state), as in [2].

Ezhilarasu et. al. [2014] classified NFA that contains more than two loops and its position into three types. Namely 1) Containing two or more substrings (String = Self-loop at starting, intermediate(>=1) and ending state). 2) Starting with a particular substring and containing two or more substrings (String = Self-loop at intermediate(>=1) and ending state). 3) Ending with a particular substring and containing two or more substrings (String = Self-loop at starting and intermediate state(>=1)), as in [3].

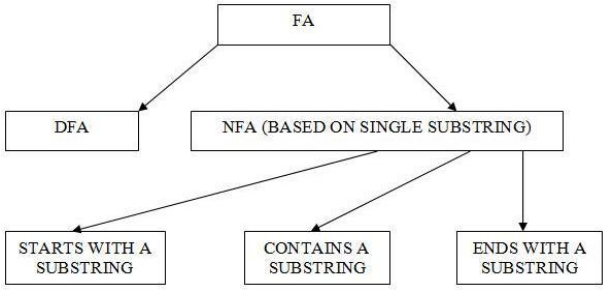

Fig. 1. Classification of NFA based on single substring

III. ABOUT NFA CLASSIFICATION

Based on, as in [1], [2], [3], [4], [5], [6] the non-deterministic finite automata classified. It categories single substring into three categories, as shown in Fig. 1.

IV. NFA TYPES

The NFA that contains single substring classified as 1) starts with a substring, 2) contains a substring 3) ends with a substring.

A. Nfa That Starts With A Substring

This first type NFA has the loop, which is present at the ending state. That means it can have a finite amount of input characters (Substring) before the accepting state. In the final state, it will stay in the same state, and it will process the balance data in the accepting state itself, as shown in Fig. 2.

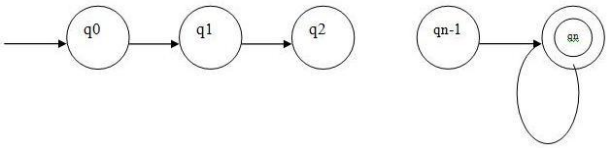

Fig. 2. General form of NFA with a starting substring

GENERAL FORMAT: Substring + Self-loop at the ending state

Ex. An NFA that accepts a string that starts with a Substring "ezh" over {e,z,h, i,l}, as shown in Fig. 3.

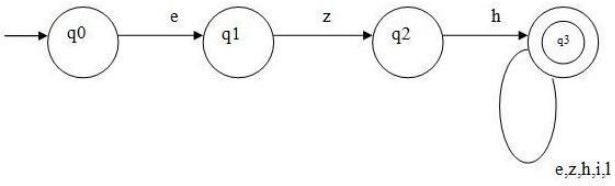

Fig. 3. Starting condition NFA

B. Nfa That Contains A Substring

This second type NFA has the loop, which is present in the starting and ending state. That means it can have the finite amount of input characters (Substring) between starting and the accepting state. In the last state, it will remain in the same state, and it will process the remaining inputs in the accepting state itself, as shown in Fig. 4.

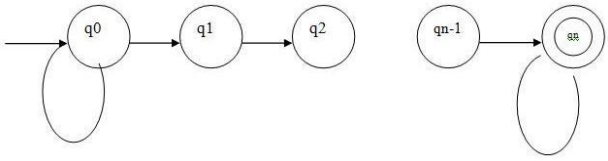

Fig. 4. General form of NFA with a starting substring

GENERAL FORMAT: Self loop at the starting state + Substring + Self-loop at ending state

Ex. An NFA that accepts a string that contains a Substring "ezh" over {e,z,h, i,l}, as shown in Fig. 5.

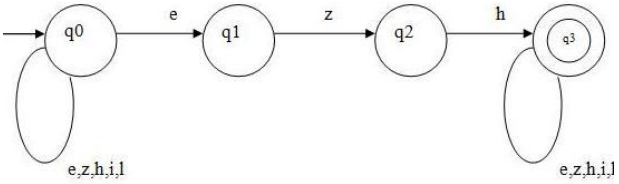

Fig. 5. Containing condition NFA

C. Nfa That Ends With A Substring

This third type NFA has the loop, which is present in the starting state. That means it can have the finite amount of input characters (Substring) after starting state. Once it reaches the accepting state, it will remain in the same state, as shown in Fig. 6.

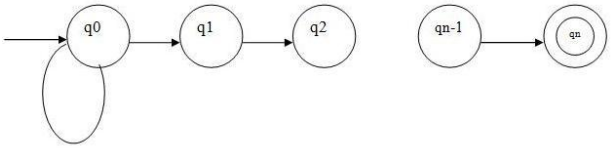

Fig. 6. General form of NFA with a starting substring

GENERAL FORMAT: Self loop at the starting state + Substring

Ex. An NFA that accepts a string that ends with a Substring "ezh" over {e,z,h, i,l}, as shown in Fig. 7.

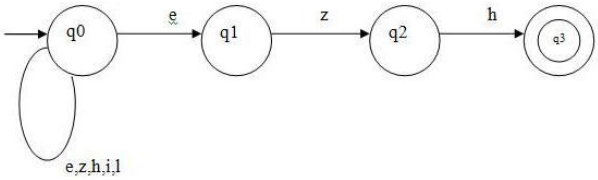

Fig. 7. Ending condition NFA

V. CONCLUSION

Based on single substring NFA can be classified into three categories. 1. NFA that starts with a substring (substring+self loop at the end state) 2.NFA that contains a substring (self-loop at the start state+ substring+self loop at the final state) 3. NFA that ends with a substring (self-loop at the start state+ substring).

REFERENCES

[1] Ezhilarasu P, Prakash J, Krishnaraj N, Satheesh Kumar D, Sudhakar K and Dhiyanesh B, "A Novel Approach to Classify Nondeterministic Finite Automata Based on Single Loop and its Position" International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), Volume 1, Issue 4, 2014, pp. 7-10.

[2] Ezhilarasu P, Prakash J, Krishnaraj N, Satheesh Kumar D, Sudhakar K, Parthasarathy C, "A Novel Approach to Classify Nondeterministic Finite Automata Based on Dual Loop and its Position ",International Journal of Engineering Trends and Technology (IJETT), Volume-18 Number-3,2014, pp. 147-150.

[3] Ezhilarasu P, Prakash J, Krishnaraj N, Satheesh Kumar D, Sudhakar K, Parthasarathy C, "A Novel Approach to Classify Nondeterministic Finite Automata Based on More than Two Loops and its Position" SSRG International Journal of Computer Science and Engineering (SSRG-IJCSE), Volume1 Issue10 - December 2014, pp. 46-49.

[4] Theory of Computation subject handled by Prof.Dr.P.Ezhilarasu for CSE students Batch 2007-2011, Hindusthan College of Engineering and Technology, Coimbatore.
[5] Formal Languages and Automata Theory subject handled by Prof.Dr.P.Ezhilarasu for CSE students Batch 2008-2012, Hindusthan College of Engineering and Technology, Coimbatore.
[6] Formal Languages and Automata Theory subject handled by Prof.Dr.P.Ezhilarasu for CSE students Batch 2010-2014, Hindusthan College of Engineering and Technology, Coimbatore.