



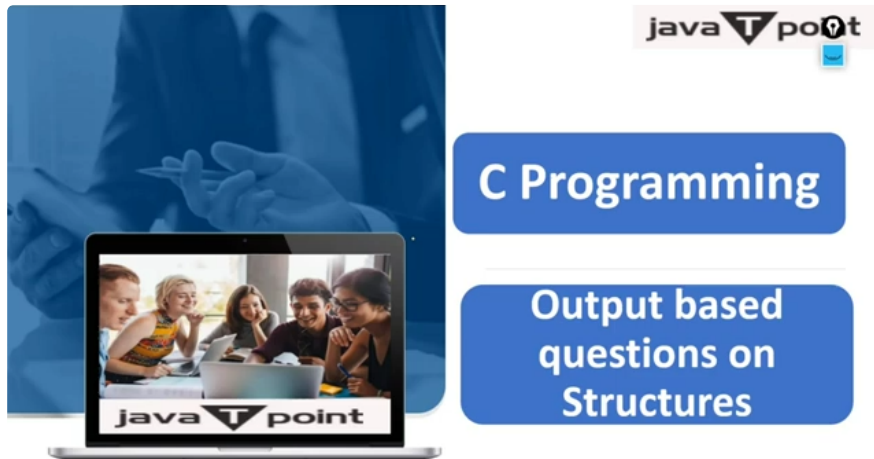
# Arden's Theorem

The Arden's Theorem is useful for checking the equivalence of two regular expressions as well as in the conversion of DFA to a regular expression.

Let us see its use in the conversion of DFA to a regular expression.

Following algorithm is used to build the regular expression from given DFA.

1. Let  $q_1$  be the initial state.



2. There are  $q_2, q_3, q_4, \dots, q_n$  number of states. The final state may be some  $q_j$  where  $j \leq n$ .

3. Let  $\alpha_{ji}$  represents the transition from  $q_j$  to  $q_i$ .

4. Calculate  $q_i$  such that

$$q_i = \alpha_{ji} * q_j$$

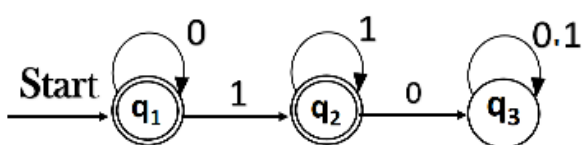
If  $q_j$  is a start state then we have:

$$q_i = \alpha_{ji} * q_j + \epsilon$$

5. Similarly, compute the final state which ultimately gives the regular expression 'r'.

## Example:

Construct the regular expression for the given DFA



## Solution:

Let us write down the equations

$$q_1 = q_1 \emptyset + \epsilon$$

Since  $q_1$  is the start state, so  $\epsilon$  will be added, and the input 0 is coming to  $q_1$  from  $q_1$  hence we write  
 State = source state of input  $\times$  input coming to it

Similarly,

$$\begin{aligned} q_2 &= q_1 1 + q_2 1 \\ q_3 &= q_2 \emptyset + q_3 (\emptyset+1) \end{aligned}$$

Since the final states are  $q_1$  and  $q_2$ , we are interested in solving  $q_1$  and  $q_2$  only. Let us see  $q_1$  first

$$q_1 = q_1 \emptyset + \epsilon$$

We can re-write it as

$$q_1 = \epsilon + q_1 \emptyset$$

Which is similar to  $R = Q + RP$ , and gets reduced to  $R = QP^*$ .

Assuming  $R = q_1$ ,  $Q = \epsilon$ ,  $P = \emptyset$

We get

$$\begin{aligned} q_1 &= \epsilon.(\emptyset)^* \\ q_1 &= \emptyset^* \quad (\epsilon.R^* = R^*) \end{aligned}$$

Substituting the value into  $q_2$ , we will get

$$q_2 = \emptyset^* 1 + q_2 1$$

$$q_2 = \emptyset^* 1 (1)^* \quad (R = Q + RP \rightarrow Q P^*)$$

The regular expression is given by

$$r = q_1 + q_2$$

$$= \emptyset^* + \emptyset^* 1.1^*$$

$$r = \emptyset^* + \emptyset^* 1^+ \quad (1.1^* = 1^+)$$

← Prev

Next →

 [For Videos Join Our Youtube Channel: Join Now](#)

## Feedback

- Send your Feedback to [feedback@javatpoint.com](mailto:feedback@javatpoint.com)






## Help Others, Please Share








## Learn Latest Tutorials








 Splunk tutorial Splunk	 SPSS tutorial SPSS	 Swagger tutorial Swagger	 T-SQL tutorial Transact-SQL	 Tumblr tutorial Tumblr
 React tutorial ReactJS	 Regex tutorial Regex	 Reinforcement learning tutorial Reinforcement Learning	 R Programming tutorial R Programming	 RxJS tutorial RxJS
 React Native tutorial React Native	 Python Design Patterns Python Design Patterns	 Python Pillow tutorial Python Pillow	 Python Turtle tutorial Python Turtle	 Keras tutorial Keras

## Preparation
























 Aptitude Aptitude	 Logical Reasoning Reasoning	 Verbal Ability Verbal Ability	 Interview Questions Interview Questions	 Company Interview Questions Company Questions
---	---	---	---	---

## Trending Technologies

 Artificial Intelligence Tutorial Artificial Intelligence	 AWS Tutorial AWS	 Selenium tutorial Selenium	 Cloud Computing tutorial Cloud Computing	 Hadoop tutorial Hadoop
--	--	--	--	--

 <b>ReactJS Tutorial</b> ReactJS	 <b>Data Science Tutorial</b> Data Science	 <b>Angular 7 Tutorial</b> Angular 7	 <b>Blockchain Tutorial</b> Blockchain	 <b>Git Tutorial</b> Git
 <b>Machine Learning Tutorial</b> Machine Learning	 <b>DevOps Tutorial</b> DevOps			

## B.Tech / MCA

 <b>DBMS tutorial</b> DBMS	 <b>Data Structures tutorial</b> Data Structures	 <b>DAA tutorial</b> DAA	 <b>Operating System tutorial</b> Operating System	 <b>Computer Network tutorial</b> Computer Network
 <b>Compiler Design tutorial</b> Compiler Design	 <b>Computer Organization and Architecture</b> Computer Organization	 <b>Discrete Mathematics Tutorial</b> Discrete Mathematics	 <b>Ethical Hacking Tutorial</b> Ethical Hacking	 <b>Computer Graphics Tutorial</b> Computer Graphics
 <b>Software Engineering Tutorial</b> Software Engineering	 <b>html tutorial</b> Web Technology	 <b>Cyber Security tutorial</b> Cyber Security	 <b>Automata Tutorial</b> Automata	 <b>C Language tutorial</b> C Programming
 <b>C++ tutorial</b> C++	 <b>Java tutorial</b> Java	 <b>.Net Framework tutorial</b> .Net	 <b>Python tutorial</b> Python	 <b>List of Programs</b> Programs
 <b>Control Systems tutorial</b> Control System	 <b>Data Mining Tutorial</b> Data Mining	 <b>Data Warehouse Tutorial</b>		

