Swinburne University Of Technology

Faculty of Information and Communication Technologies

ASSIGNMENT COVER SHEET

Subject Code:	COS30023
Subject Title:	Languages in Software Development
Assignment number and title:	4, Automata
Due date:	**September 8, 2014, 10:30, on paper**
Lecturer:	Dr. Markus Lumpe

Your name:_____

Marker's comments:

Problem	Marks	Obtained
3	100	
Total	100	

Extension certification:

This assignment has been given an extension and is now due on _____

Signature of Convener:_____

Assignment 4

COS30023 - Languages in Software Development

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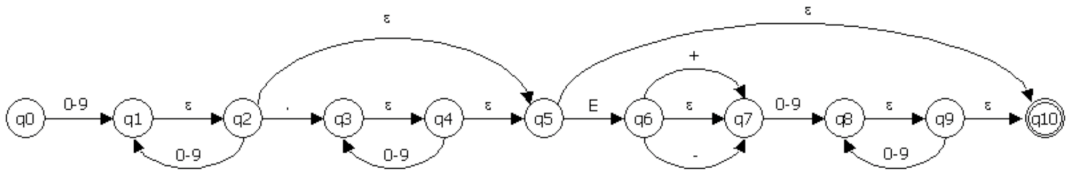
September 7, 2014

1. Problem 1

1.1. Finite Automaton



1.2. Equations and Rules

$(S_1 \cdot S_2) \cdot S_3 = S_1 \cdot (S_2 \cdot S_3)$
$(S_1|S_2) \cdot T = S_1 \cdot T|S_2 \cdot T$
$T \cdot (S_1|S_2) = T \cdot S_1|T \cdot S_2$
$S \cdot \epsilon = S$
$S \cdot \emptyset = \emptyset$
$S \cdot (T \cdot S)^* = (S \cdot T)^* \cdot S$

1.2.1. Arden's Rule

$X = S \cdot X|T$ has solution $S^* \cdot T$

1.3. Equation Set

$q_0 = 0 - 9 \oplus q_1$
$q_1 = \epsilon \oplus q_2$
$q_2 = 0 - 9 \oplus q_1 \mid . \oplus q_3 \mid \epsilon \oplus q_5$
$q_3 = \epsilon \oplus q_4$
$q_4 = 0 - 9 \oplus q_3 \mid \epsilon \oplus q_5$
$q_5 = E \oplus q_6 \mid \epsilon \oplus q_{10}$
$q_6 = + \oplus q_7 \mid \ - \oplus q_7 \mid \epsilon \oplus q_7$
$q_7 = 0 - 9 \oplus q_8$
$q_8 = \epsilon \oplus q_9$
$q_9 = 0 - 9 \oplus q_8 \mid \epsilon \oplus q_{10}$
$q_{10} = \epsilon$

1.3.1. Simplified Sets

$q_0 = 0 - 9 \oplus q_1$
$q_1 = q_2$
$q_2 = 0 - 9 \oplus q_1 \mid . \oplus q_3 \mid q_5$
$q_3 = q_4$
$q_4 = 0 - 9 \oplus q_3 \mid q_5$
$q_5 = E \oplus q_6 \mid q_{10}$
$q_6 = (+ \mid - \mid \epsilon) \oplus q_7$
$q_7 = 0 - 9 \oplus q_8$
$q_8 = q_9$
$q_9 = 0 - 9 \oplus q_8 \mid q_{10}$
$q_{10} = \epsilon$

1.3.2. Substitute q_{10}

$$\begin{aligned} q_5 &= E \oplus q_6 \mid q_{10} \\ &= E \oplus q_6 \mid \epsilon \end{aligned}$$

$$\begin{aligned} q_9 &= 0 - 9 \oplus q_8 \mid q_{10} \\ &= 0 - 9 \oplus q_8 \mid \epsilon \end{aligned}$$

1.3.3. Substitute q_9

$$\begin{aligned} q_8 &= 0-9 \oplus q_8 \mid \epsilon \\ &= (0-9)^* \oplus \epsilon \quad Arden's Rule \\ &= (0-9)^* \end{aligned}$$

1.3.4. Substitute q_8

$$q_7 = 0-9 \oplus (0-9)^*$$

1.3.5. Substitute q_7

$$q_6 = (+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)$$

1.3.6. Substitute q_6

$$q_5 = E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon$$

1.3.7. Substitute q_5

$$q_4 = 0-9 \oplus q_3 \mid (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)$$

$$q_2 = 0-9 \oplus q_1 \mid . \oplus q_3 \mid (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)$$

1.3.8. Substitute q_4

$$\begin{aligned} q_3 &= 0-9 \oplus q_3 \mid (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon) \\ &= (0-9)^* \oplus (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon) \quad Arden's Rule \end{aligned}$$

1.3.9. Substitute q_3

$$\begin{aligned} q_2 = 0-9 &\oplus q_1 \\ &\mid . \oplus ((0-9)^* \oplus (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)) \\ &\mid (E \oplus ((+|-|\epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon) \end{aligned}$$

1.3.10. Substitute q_2

$$
\begin{aligned}
q_1 &= 0-9 \oplus q_1 \\
&\quad \mid . \oplus ((0-9)^* \oplus (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)) \\
&\quad \mid (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon) \\
&\quad = (0-9)^* \oplus (. \oplus ((0-9)^* \oplus (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)) \\
&\quad \mid (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon))
\end{aligned}
$$

1.3.11. Substituteq_1

$$
\begin{aligned}
q_0 = 0-9 \oplus ((0-9)^* \oplus (. \oplus ((0-9)^* \oplus (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)) \\
\mid (E \oplus ((+\mid -\mid \epsilon) \oplus (0-9 \oplus (0-9)^*)) \mid \epsilon)))
\end{aligned}
$$

1.4. Regular Expression

$$^{\wedge}[0-9]^{+}\backslash.?[0-9]^{*}(E[+-]?[0-9]^{+})?\$$$

1.5. Token Type

The token defined above is an unsigned IEEE floating point number. Here are some strings that are valid in the above definition.

- 123
- 123.123
- $123.123E+123$
- $123.123E-123$
- $123.123E123$
- $123E+123$
- etc.