CSC236 Worksheet 9 Solution

Hyungmo Gu

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Question 1

a. **Rough Works:**

1. Find regular expression for even number of 1's
   - Find reg. expressions for $L = \{x \in \Sigma \mid x \text{ has 0 number of 1s}\}$

     $$0^* \tag{1}$$

   - Find reg. expressions for $L = \{x \in \Sigma \mid x \text{ has 2 number of 1s}\}$

     $$0^*10^*10^* \tag{2}$$

   - Find reg. expressions for $L = \{x \in \Sigma \mid x \text{ has 4 number of 1s}\}$

     $$0^*10^*10^*10^*10^* \tag{3}$$

   - Hey I see a pattern!!

     From above, I see a pattern that

     $$(0^*10^*1)(0^*10^*1)0^* \tag{4}$$

   - Conclude :)

Using the pattern, I can conclude that the regular expression for even number of 1s is

$$(0^*10^*1)^*0^* \tag{5}$$

2. Find regular expression for odd number of 0's
3. Combine 1 and 2 using +

Notes:

- Regular Expression
  - Quick Guide

$$(0+1)((01)^*0) \tag{6}$$

The expression implies that

1. Starts with 0 **or** 1
   - indicated by $(0 + 1)$
2. Are then followed by **one or more repeatitions** of 01
   - indicated by $(01)^*$
3. Ends with 0
   - indicated by the final 0

- Examples
  1. $L = \{w \in \{a, b\}^* \mid w \text{ has an } a\}$

Answer:

$$(a+b)^*a(a+b)^* \tag{7}$$

- Means there is one or more repeatitions of a or b at front
- Means there is a in the middle
- Means there is zero or more repeatitions of a or b at end

  2. $L = \{w \in \{a, b\}^* \mid w \text{ has at lest two } a\text{s}\}$

Answer:

$$(a+b)^*a(a+b)^*a(a+b)^* \tag{8}$$

3. $L = \{w \in \{a,b\}^* \mid |w| \geq 2\}$

Answer:

$$(0+1)(0+1)(0+1)^* \tag{9}$$

In this example,

- Two characters are created (indicated by $(0+1)(0+1)$)
- And more :D!! (indicated by$(0+1)^*$)