Worksheet #20 Solution

(From Lecture #20 given on 4/1/2019)

Write regular expressions for each of the following languages

Language L1,
consisting of strings of 0's and 1's that may have a 0, but **whenever a 0 occurs it must be followed by a 1.**

$\Sigma = \{0, 1\}$

To include **ε** in L1 : **(1 | 01)***

To not include **ε** in L1 : **(1 | 01)+**

Language L1

To include **ε** in L1 : **(1 | 01)***

To not include **ε** in L1 : **(1 | 01)+**

Incorrect RegEx from students (L1)

L(**(01)***) = {**ε** , 01, 0101, 010101, …} : Doesn't contain **11**

L(**(01+)***) : Doesn't contain **101**

L(**1*(01)*1***) : Doesn't contain **01101**

L(**(01*)***) : Contains **00**

L(**(0?1*)***) : Contains **00** -> **Possible Fix : (0?1+)***

L(**(1* | 01*)***) : Contains **00** -> **Possible Fix : (1* | 01+)***

Language L1

To include **ε** in L1 : **(1 | 01)***

To not include **ε** in L1 : **(1 | 01)+**

Other Correct RegEx from students (L1)

1*(01+)*

(1*(01)*)*

(1 | 01 | ε)* → **ε is redundant, since the outermost * indicates that the language for the RegEx already includes ε**

Language L2,
consisting of strings from the alphabet
{ a-z, 0-9, _ }. A string in L2 **must start with a lowercase letter or an underscore**, and **followed by one or more** of lowercase letters and digits and underscores. Further, **each underscore must be followed by a letter or a digit**.

Strings in L2 must satisfy the following

1. constructed from the alphabet Σ = {a-z, 0-9, _}
2. must start with a lowercase letter or an underscore.
3. length is at least 2.
4. each underscore must be followed by a letter or a digit.

Strings in Language L2…

1. constructed from the alphabet Σ = {a-z, 0-9, _}
2. must start with a lowercase letter or an underscore.
3. length is at least 2.
4. each underscore must be followed by a letter or a digit.

RegEx for strings in L2 which begin with _ :

_[a-z0-9]([a-z0-9] | _[a-z0-9])*

RegEx for strings in L2 which begin with **[a-z]** :

[a-z]([a-z0-9] | _[a-z0-9])+

Correct :

_[a-z0-9]([a-z0-9] | _[a-z0-9])* | [a-z]([a-z0-9] | _[a-z0-9])+

Strings in Language L2…

1. constructed from the alphabet Σ = {a-z, 0-9, _}
2. must start with a lowercase letter or an underscore.
3. length is at least 2.
4. each underscore must be followed by a letter or a digit.

Incorrect RegEx from students (L2) :
Most of the students' answers were slightly incorrect

([a-z] | _[a-z0-9])([a-z0-9] | _[a-z0-9])* : matches **a**

([a-z] | _[a-z0-9])([a-z0-9] | _[a-z0-9])+ : can't match **_a**

([a-z] | _)[a-z0-9]([a-z0-9] | _[a-z0-9])* : can't match **a_a**

Language L3,
consisting of strings of 0's and 1's such that each string **contains at least 3 consecutive 0's**.

$\Sigma = \{0, 1\}$

(0 | 1)* 000 (0 | 1)*

Some students used
( ) and [] as if the two were equivalent,
but they are different in meaning.

( ) : Used to change precedence, or grouping

[ ] : character classes