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CptS 317 Homework #1

① * Regular Expression:

$$R_1 = 0(10+0)^*11$$

The word which is present in R_1 is
It contains starting with '0', in between any number of '10', '0', or 'ε' and ends with '11'.

Example: 010101011, 000011, 011, etc.

* The words not in R_1 are:

Example: 010011, 10011, 11001l, etc.

* $R_2 = (0+110)^*1(01+1)^*$

The words which is present in R_2. Contains starting with either '0', '110', 'ε', in between '1' and ending with any number of '01's, '1's, or 'ε'.

Example: 11010101, 010101, 0111111 is accepted.

* The words not in R_2 are:

Example: 10110101 (starting '10' is not accepted)
0011010l (starting '00' is not accepted)

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2 1. All strings containing more than two 0's:

Regular expression: (0+1)* 0 (0+1)* 0 (0+1)*

2. All strings do not contain 01:

Regular expression: 1* 00* (0+1)*

3. All strings contain both 1011 and 0111 as substrings:

Regular expression: [(0+0* 1 1* 00) 1 (1+1* 0111) 011 (0+1)*] and

[(1+1* 00* 11) 0 (0+0* 111) 111 (0+1)*]

4. All strings do not ended with 01:

Regular expression: (0+1)* (00 + 10 + 11)

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③ 1. $L_1 L_1^* = L_1^* L_1 L_1^*$

Suppose $L_1 = \{0, 1\}$

$L_2 = \{01, 10, 11, 00\}$

1. $L_1 L_1^* = L_1^* L_1 L_1^*$

$L_1^* = \{\epsilon, 0, 1, 01, 10, 100, \dots\}$

$L \cdot H \cdot S = L_1 L_1^* = \{0, 1, 00, 01, 001, 101, \dots\}$

$R \cdot H \cdot S = L_1^* L_1 L_1^* = \{0, 1, 00, 01, 001, 101, \dots\}$

$L \cdot H \cdot S = R \cdot H \cdot S$

This is true ✓

2. $(L_1^* L_2)^* L_1^* = (L_1 + L_2)^*$

$L_1^* L_2 = \{\epsilon, 0, 1, 01, 10, 100 \dots\}\{01, 10, 11, 00\}$

$= \{01, 10, 11, 00, 001, 010, 011, 000, \dots\}$

$(L_1^* L_2)^* = \{\epsilon, 01, 10, 11, 00, 0110, 0111, \dots\}$

$L \cdot H \cdot S = (L_1^* L_2)^* L_1^*$

$= \{\epsilon, 01, 10, 11, 00, 0110, 011, \dots\}\{\epsilon, 0, 1, 01, 10\}$

$= \{\epsilon, 0, 1, 01, 10, 11, 00, \dots\}$

$L_1 + L_2 = \{0, 1\} + \{01, 10, 11, 00\}$

$= \{0, 1, 01, 10, 11, 00\}$

$(L_1 + L_2)^* = \{\epsilon, 0, 1, 01, 10, 11, 00, \dots\}$

$\therefore$ $L \cdot H \cdot S = R \cdot H \cdot S$ $\rightarrow$ This is true ✓

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4) Let $L_1 = \{a\}$

$L_2 = \{b\}$

So, $L_1^* = \{\epsilon, a, aa, \dots\}$

$L_1^* L_2 = \{\epsilon, a, aa, \dots\} \cdot \{b\}$

$= \{b, ab, aab, \dots\}$

So, $L_1^* + (L_1^* L_2)^* = \{\epsilon, a, aa, \dots\} + \{\epsilon ab, bb, ab, abab, aab, aabaab, \dots\}$

And, $(L_1^* + (L_1^* L_2)^*) = \{\epsilon, a, b, aa, bb, ab, abab, aabaab, \dots\}$

$(L_1 + L_2)^* = (a+b)^* = \{\epsilon, a, b, aa, bb, aaa, bbb, \dots\}$

So, you can see:

$L_1^* + (L_1^* L_2)^* \neq (L_1 + L_2)^*$

Hence, it is proved.

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5 There are three ~~possibilities~~ possibilities for end of every day. They are:

- 3 damsels
- 3 clowns
- 2 clowns and 1 damsel

Now, let damsels are represented as D and clowns as C, then $(D)^m$ represents the sequence in regular expression here $m = 3$.

Clowns are represented as $(C)^m$ where $m=3$.

Then the last possibility is 2 clowns and 1 Damsel.
$(C)^n D$

Hence, the required regular expression is:

$(D)^m + (C)^m + (C)^n D$ where $m = 3$
$n = 2$