UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF ENGINEERING

SCHOOL OF COMPUTING

SESSION 2020/2021 SEMESTER 2

SCSJ3203 THEORY OF COMPUTER SCIENCE
SECTION 04

TUTORIAL 3
LANGUAGES

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TCS Tutorial 3 : Languages.

1. $A = \{w \in \{0,1\} \mid w \text{ begins with } 11\}$
   $B = \{w \in \{0,1\} \mid w \text{ ends with } 00\}$

a) $A \cap B$

$= 11(1 \cup 0)^* 00$

b) $A \cup B$

$= (11(1 \cup 0)^*) \cup ((1 \cup 0)^* 00)$

2. $\Sigma = \{a, b\}$

a) L_1 = All strings
$= (a+b)^*$

b) L_2 = All strings except empty string.
$= (a+b)^+$

c) L_3 = All strings starting with ab.
$= ab(a+b)^*$

d) L_4 = All strings ending with ab.
$= (a+b)^* ab$

e) L_5 = All strings that begin AND end with ab.
$= ab(a+b)^* ab + ab$

f) L_6 = All strings that begin OR and with ab.
$= ab(a+b)^*(a+b)^* ab$

g) L_7 = All strings that contain the substring ab.
$= (a+b)^* ab (a+b)^*$

h) L_8 = All strings that contain the substring ba.
$= (a+b)^* ba (a+b)^*$

i) L_9 = All strings that contain the substring ab or ba
$= (a+b)^*(ab+ba)(a+b)^*$

j) L_{10} = All strings containing exactly two a's.
$= b^*ab^*ab^*$

k) L_{11} = All strings containing at least two a's.
$= (a+b)^*a(a+b)^*a(a+b)^*$

3. Let L be the language over {0, 1, 2} consisting of all strings of zero or more 0's followed by one or more 1's, followed by one or more 2's. For example, 001122, 122 and 0111122 are in L; 012 (too few 2's), and 01121 22 (a 2 precedes a 1) are not. Write a regular expression whose language is L.

$L = 0^*11^*22^*$

4. Give a regular expression that represents the described set.

a) The strings over {a, b, c} with length three.

$= (a+b+c)(a+b+c)(a+b+c)$

b) The strings over {a, b, c} with length less than three.

$= (\epsilon+a+b+c)(\epsilon+a+b+c)$

c) The set of strings over {a, b, c} with length greater than three.

$= (a+b+c)(a+b+c)(a+b+c)(a+b+c)^+$

5.

Languages	(IN)	(OUT)	Description
$ab(a+b)^*$	ab, aba, abb, abba, abbb	a, b, aa, ba	All strings starting with a b.
$(a+b)b(a+b)^*$	ab, bb, aba, bba, bbb	a, b, aa, ba, aab, bab	All strings with b as the second letter
$(a(a+b)^*b) + (b(a+b)^*a)$	ab, ba, aab, baa, abb, bba	a, b, aa, bb, aba, bab.	All strings that starts and ends with different letters

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

Matching Language	Regular Expressions
6	1^*01
11	1^*01^*01
7	$01(0+1)^*01$
13	$1(0+1)^*0(0+1)^*1$
3	$(0+1)^+$
14	$01(0+1)^*$
12	$(0+1)^*10(0+1)^*$
10	$(0+1)^*1(0+1)$
5	$(0+1)^*$
15	$(0+1)^*0(0+1)^*0(0+1)^*$
2	$(0+1)1(0+1)^*$
8	$(0+1)^*(01+10)(0+1)^*$
1	$(0+1)^*01$
9	$01(0+1)^* + (0+1)^*01$
4	$(0+1)^*01(0+1)^*$

TABLE 2.