

Regular Expressions and Finite State Automata

CSC 28 Fall 2020

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1. a. The regular expression with the alphabet $\{c,d\}$ for all strings:
“that begin with c and end with c and there is no more than one d ” is:
(2 points)
- (i) cdc
 - (ii) $c(c+d)^*c$
 - (iii) c^*dc^*
 - (iv) c^+dc^+
- b. Provide two different possible example strings that the regular expression $r = a(a + b)^*$ generates in $L(r)$. In this case, the $+$ symbol has the meaning of Union symbol \cup . Notice that $+$ is not a superscript. **(2 points)**
- c. For the Regular Expression (RE) $r = a^*(\lambda + b)^*a^*$ Here the $+$ has the meaning of Union symbol \cup . Notice that $+$ is not a superscript.

Mark True or False next to each string if the string is generated (TRUE) and not generated (FALSE) by the RE r . **(8 points)**

- (i) abb
 - (ii) bba
 - (iii) aa
 - (iv) b
 - (v) λ
 - (vi) ba
 - (vii) $bbbb$
 - (viii) a
- d. Express in English the meaning of the following Regular Expressions: Here the meaning of $a + b$ is same as a OR b or in other words, a Union \cup . **(10 points)**

- (i) a^*
- (ii) $a(bb)^*$
- (iii) $(aa)^*(bb)^*$
- (iv) $(a + b)^*$
- (v) $(b)^*b$

2. (a) Define and draw a finite State Machine (FSA) M1 for the following patterns. Mark your Final States clearly.

all strings that begin OR end with an **a**.

Note that the alphabet $A = \{a, b\}$ (in other words contains letters a and b only [Hint: first write the regular expression to make it easy for you]. **(6 points)**

Show that the following strings will be accepted by the FSA M1 (by providing the sequence of states and the type of the end state): **(5 points)**

- abb
- bba
- abba
- a
- aa

Show that the following strings will not be accepted by the FSA M1 (by providing the sequence of states and the type of the end state): **(5 points)**

- baab
- bb
- bbaab
- b
- λ

- (b) Define and draw a finite State Machine (FSA) M2 for the following patterns. Mark your Start State and Final States clearly.

all strings that have even number of 0's followed immediately by even number of 1s. The string may start with anything other than 0 or 1 from the alphabet $\{0, 1, 2, 3\}$

(6 points)

Show that the following strings will be accepted by M2: (by providing the sequence of states and the type of the end state): **(3 points)**

- 2001111
- 333322211
- 323200

Show that the following strings will not be accepted by M2: (by providing the sequence of states and the type of the end state): **(3 points)**

- 0011
- 20111
- 33320101