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COSC 3340 Exercise Set 2

1. My alphabet for this problem would be LN = {a,l,$}.  
   Using this alphabet I designed the following DFAs to accept the following languages.  
   a) All strings over LN  
   A picture containing text, clock

   Description automatically generated  
   b) No strings over LN  
   Diagram

   Description automatically generated  
   c) Only the empty string over LN  
   Diagram

   Description automatically generated  
   d) All strings that contain the suffix ab (“al” is the suffix in my case)  
   A picture containing text, clock

   Description automatically generated  
   (b) I ran this DFA (part d) on JFLAP with the following 3 strings in the language: $$$$aaa$al$al, al, aaaa$lal. I also ran this DFA with the following 3 strings not in the language $$$$$la, aaaaaa$, la$. The verdicts of each test are listed below.

$$$$aaa$al$al : Accepted.  
Diagram

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al : Accepted.   
Diagram

Description automatically generated  
  
aaaa$lal : Accepted.  
Diagram

Description automatically generated  
  
  
$$$$$la : Not accepted.  
Diagram

Description automatically generated  
  
  
  
aaaaaa$ : Not accepted.  
Diagram

Description automatically generated  
  
la$ : Not accepted.  
Diagram

Description automatically generated

1. The smallest equivalence relation on the set LN = {a,l,$} is R = {(a,a), (l,l), ($,$)}. This equivalence relation R is the smallest one because for any set S the smallest equivalence relation is the one that contains all the pairs (s,s) for s E S. For a set to have equivalence relation it must satisfy the three requirements: reflexive, symmetric, and transitive.   
     
   I prove the three below:  
   Reflexive: x E A, (x,x) E R , therefore the set R is reflexive.  
   Symmetric: (x,y) E R => (y,x) E R for all x,y E A , therefore set R is symmetric.  
   Transitive: (x,y) E R, (y,z) E R => (x,z) E R for all x,y,z E A , therefore the set R is also transitive.  
     
   The next smallest equivalence relation on the set LN = {a,l,$} is R = {(a,a), (l,l), ($,$), (a,l), (l,a)}. This equivalence relation is the next smallest from the previous one listed above and is NOT unique because the ordered pairs (a,l) and (l,a) in the set R can be switched out by other ordered pairs such as ($,a) and (a,$) and the set would still be the same length and still be the next smallest equivalence relation to the set LN. Using the above definitions of reflexivity, symmetry, and transitivity I prove this set R is also an equivalence relation as it satisfies all three requirements.
2. The regular expressions for the languages in question 1 are shown below using the algorithm discussed in book/class.   
   (c) Only the empty strings over LN: The regular expression for this one would be L = E  
     
   (d) All strings that contain the suffix ab: The regular expression for this part is   
   L = (aa\*$(l+$))\*aa\*l(a+l+$)\*
3. Constructing NFAs from the regular expressions above in Question 3 we get:  
   (c)   
     
   (d)