University of Liverpool
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Centre for Doctorial Training
In Distributed Algorithm

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Week 3 tutorials

Introduction to the theory of computation (COMP218)

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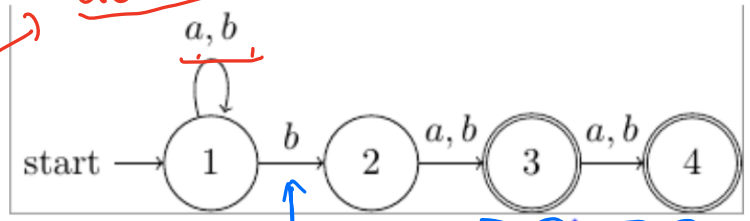
P1

1. **Give regular expressions according to the description a) and the automaton b).**
   a) **The set of strings over alphabet A = {0, 1} that contains no two adjacent 1s.**
   b)



$(a+b)^*$ ab aa, bb

$(a+b)^* b (a+b)$ RE

$(a+b)^* b (a+b)(a+b)$ 2nd RE

$(a+b)^* b (a+b) + (a+b)^* b (a+b)(a+b)$

$\varepsilon + (00^*1)^* 0^*$

② for backward of

① You start with ε → ✓

② You start with a single 1 ✓

③ You have more 1s ✗

$(1+\varepsilon)(00^*1)^* 0^*$

1111

P2

2. **Consider the following regular expressions which are given along with three words: for each word say whether it belongs to the language of the regular expression.**

a) **regular expression a*b*c*d*and words abcd, abbc, aba.**

b) **regular expression (ab)*(abb)*and words ababab, ababba, ababbab.**

For each pair of regular expressions below, say whether they represent the same language. If they correspond to different languages, give an example of a word that belongs to one language but not the other.

c) **(a*) U (b*) and {a,b}***

d) **{a, ab, abc} {d, cd} and {a, ab} {c, cd, d}**

e) **(ab)* U (aba)*a and a((ba)* U (baa)*)**

P3

3. **Which of the following regular expressions are equivalent to each other?**

1. ca(a*)b	**2. c(a*)ab**	**3. c(a)*ab U caaab**
4. cab(ab)*	**5. c(aba)*b**	**6. ca(ba)*b**

Identify a pair of the above expressions that are not equivalent, and give an example of a word that belongs to one of their languages but not the other.

RE 1. 2 3.

RE 4, 6

the word "cb" is in 5 but not in the 6

4. Convert the regular expression (0+1)*(0+ε) to an epsilon-NFA.