course: CSC 135-01 - Computing Theory and Programming Languages

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related_notes: 2022-03-10

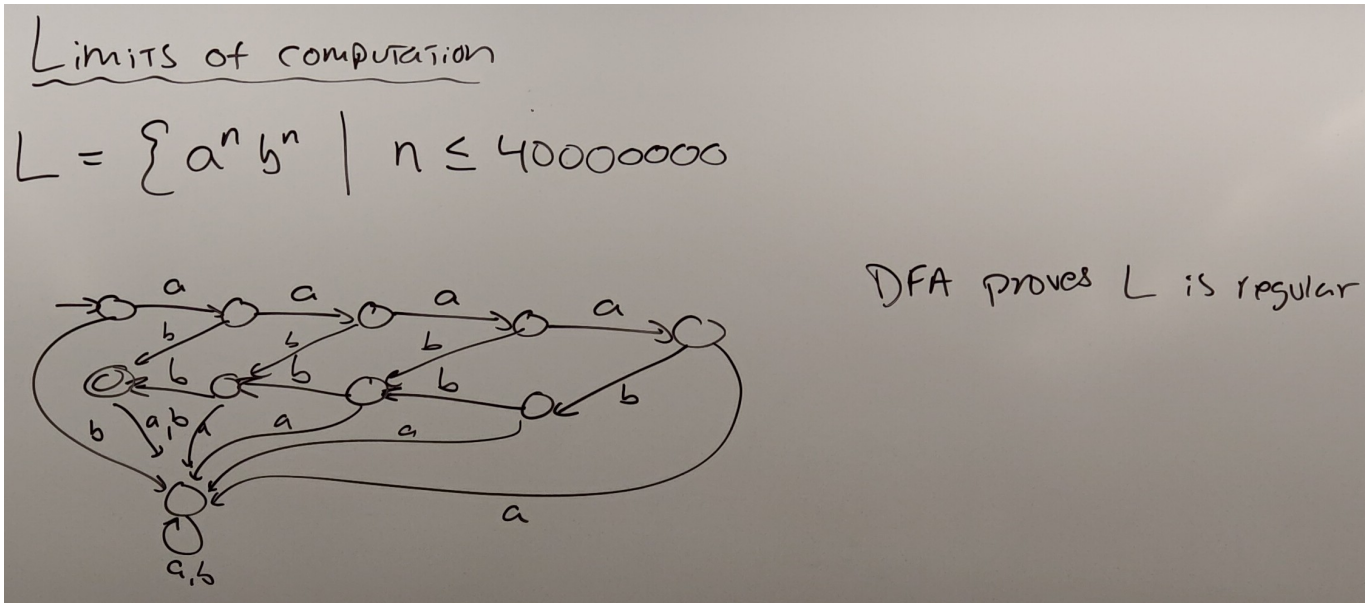
Limits of Computation

W10.4 | Thursday, March 10, 2022 | 08:59 AM

Notes - Limits of Computation

$$L = \{a^n b^n | n \leq 4\}$$
$$L = \{a^n b^n | n \leq 40\}$$
$$L = \{a^n b^n | n \leq 9000\}$$

DFA proves L is regular



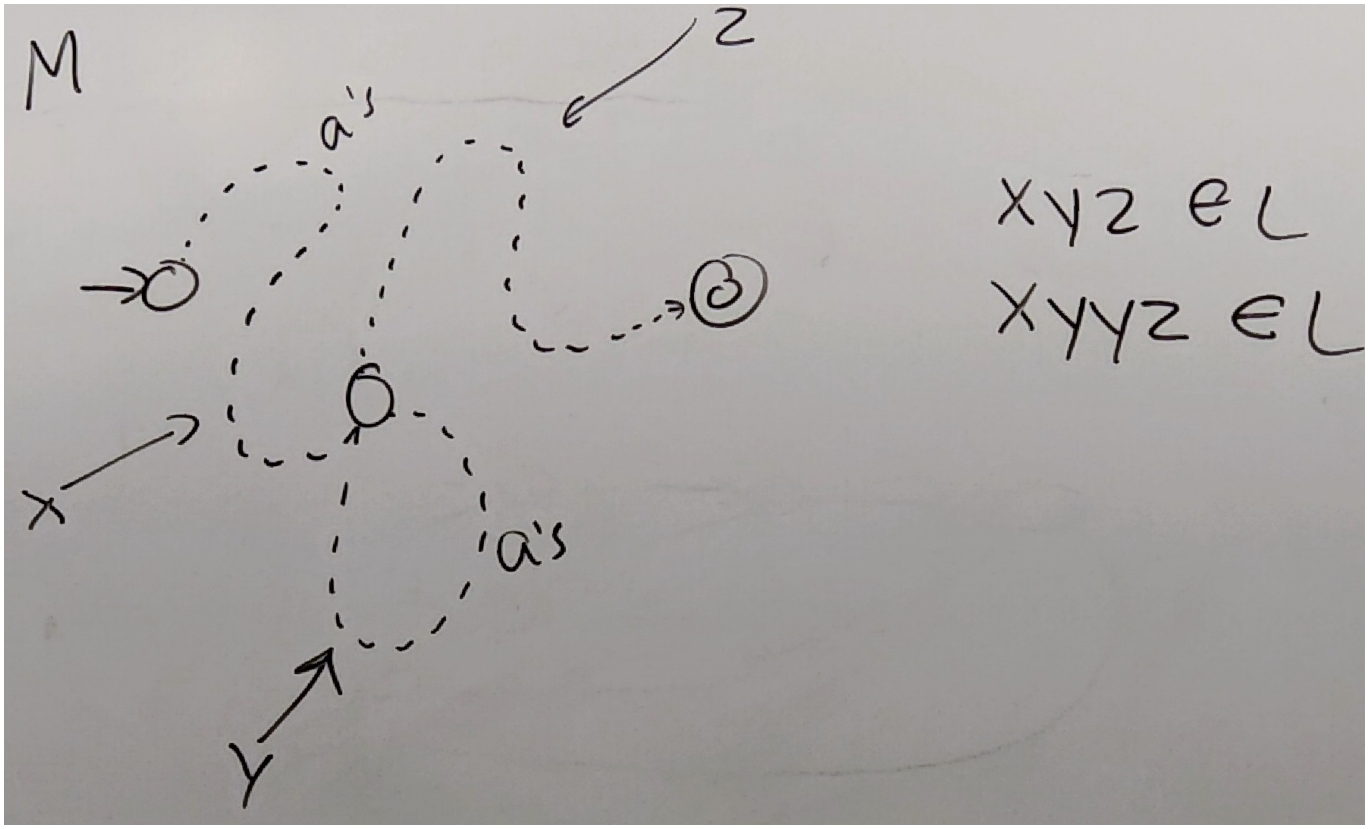
L is Not Regular - Proof By Contradiction

Theorem: L is not regular

> Proof Sketch
>
> > For contradiction assume L is regular
> > Let M be a DFA with P states that recognizes L

> Consider the string $a^P b^P$
> While consuming a^P M will repeat some state (pigeon hole/musical chair principle)
> Let x represent the string leading to the first repeated state
> Let y represent the string leading back to the repeated state
> Let z represent the rest of the string
> $xyyz$ will lead to an accept state and so is in L
> But $xyyz$ has more a's than b's and so is not in L
> This contradiction prove L is not regular

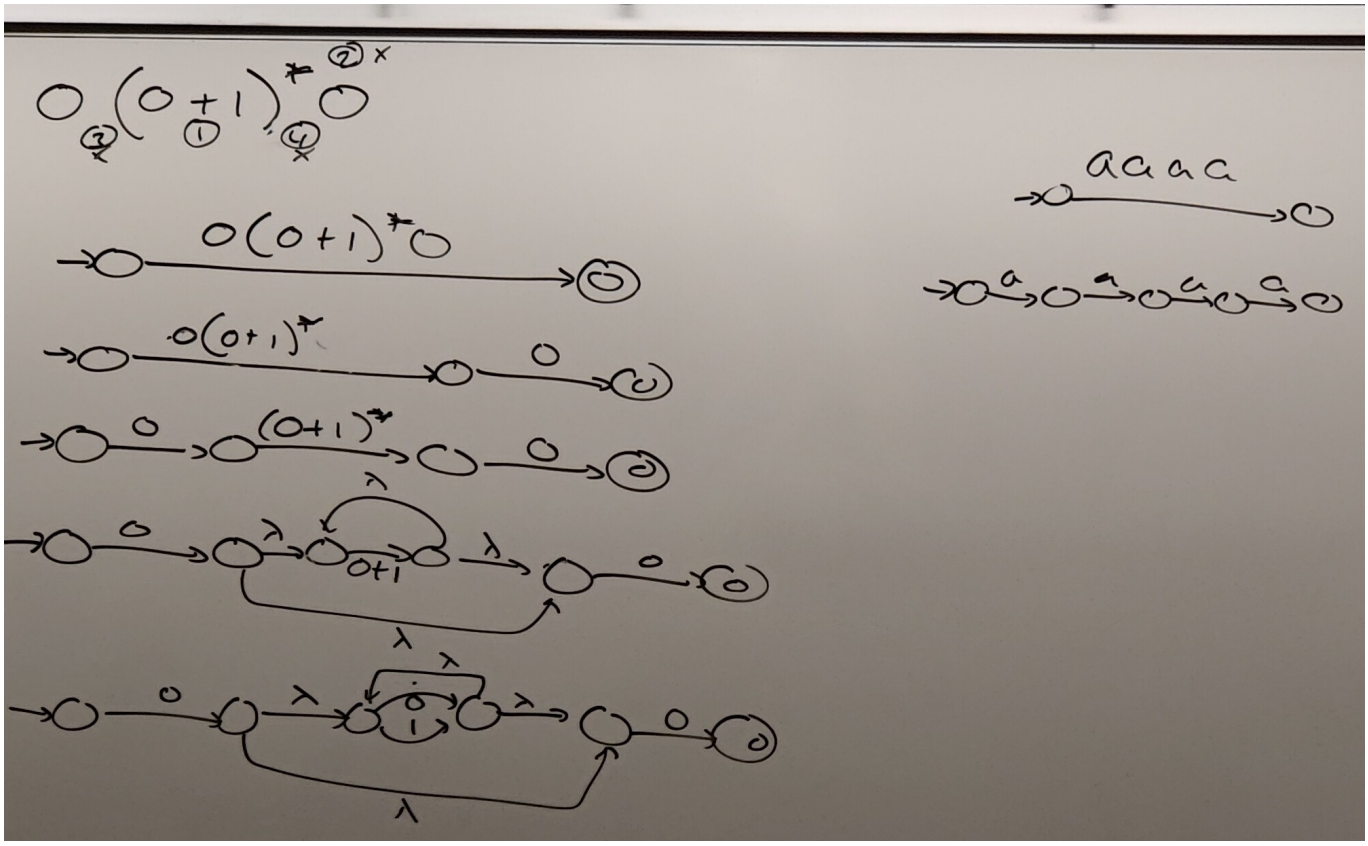
$xyz \in L$
$xyyz \in L$



Examples RE → NFA → DFA: $0(0+1)^*0$

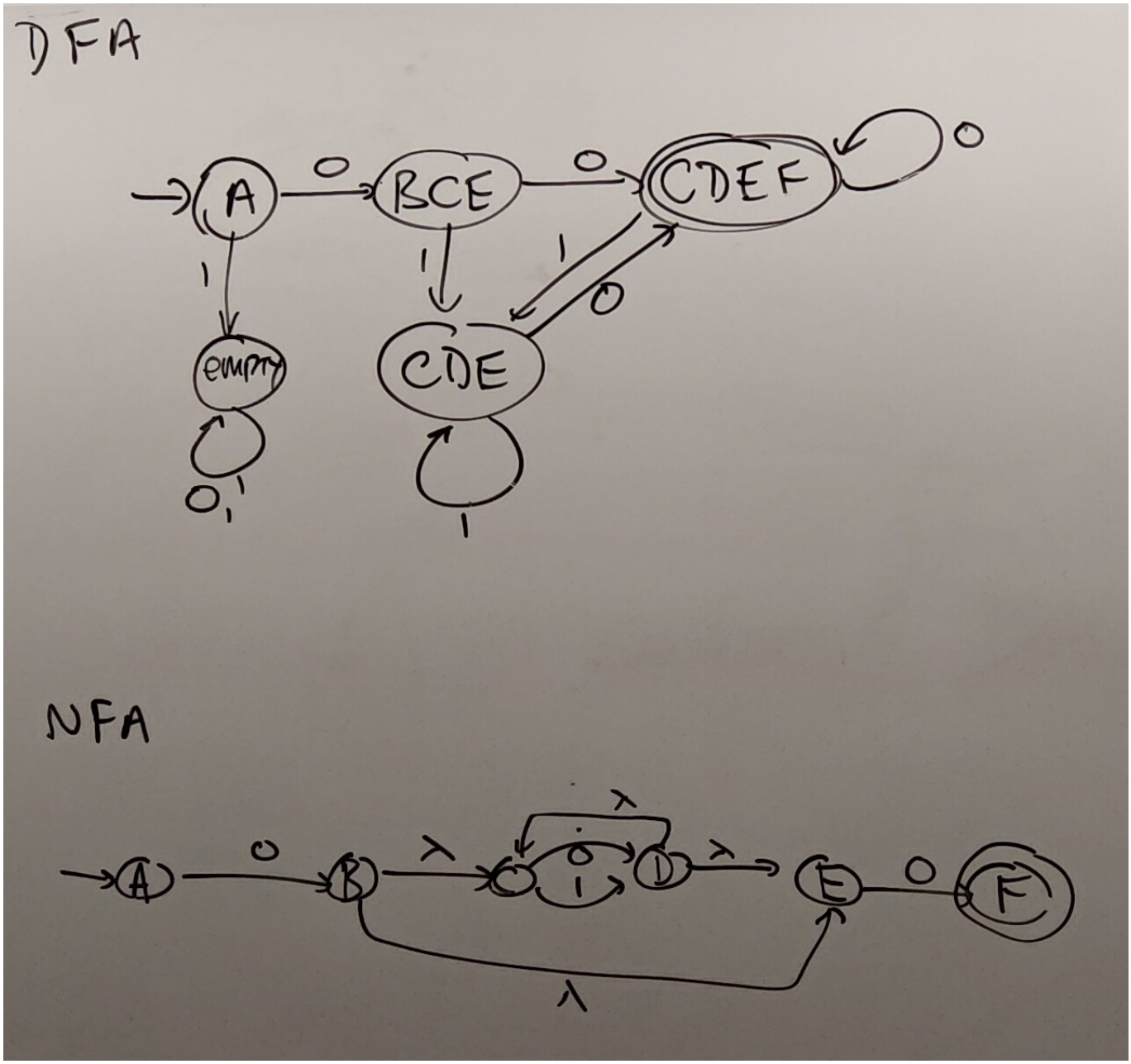
RE → NFA

$0(0+1)^*0$



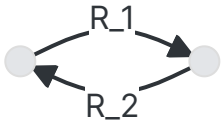
NFA → DFA

Zero (0)
C: CDE
D: CDEF
E: F
F: empty

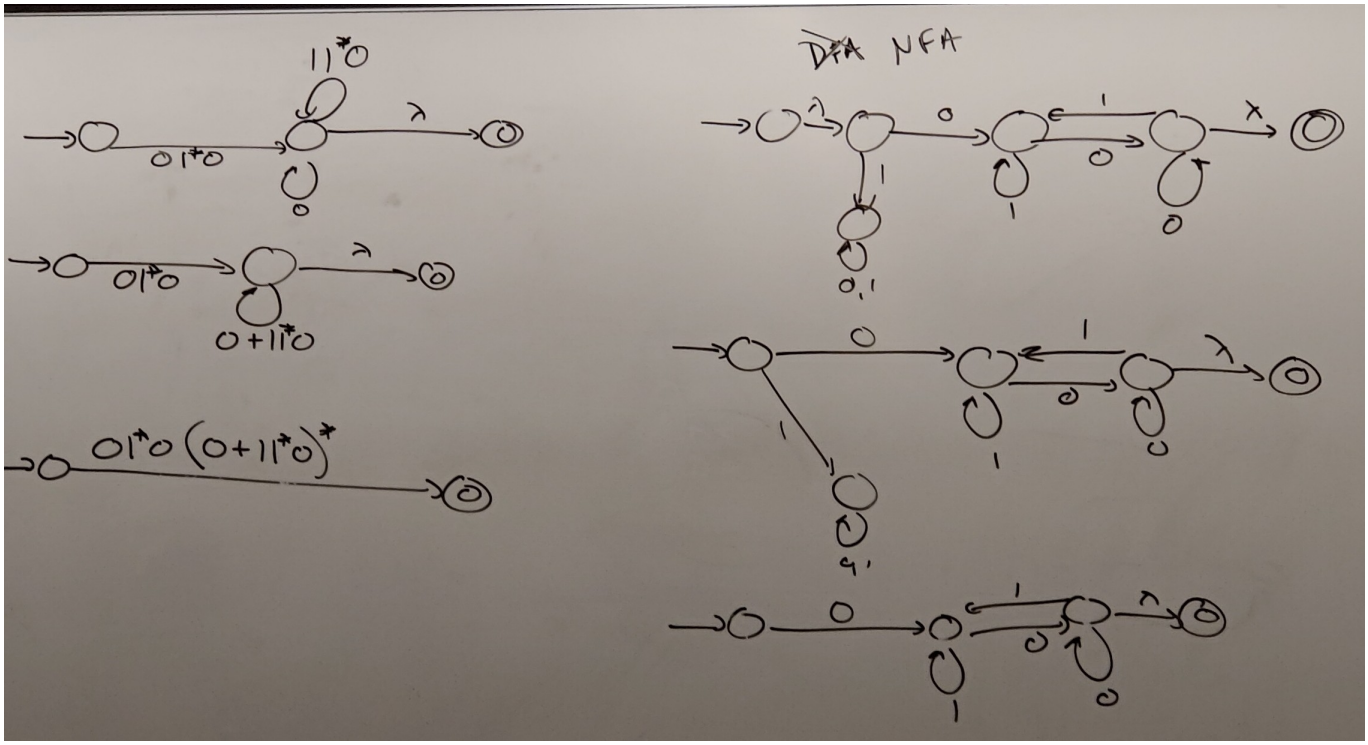


NFA → RE

- Loops do not count for they become stars $*$
- Number of in arrows times the number of out arrows
- Parallel edges you'd combine them with a plus $+$



BECOMES


11*0
01*0
λ
0
01*0
λ
0+11*0
01*0 (0+11*0)*
DFA NFA
λ
0
1
λ
0,1
0
1
λ
0,1
0
1
λ