Undecidability - I

Complete Course on Theory of Computation

Subbarao Lingamgunta • Lesson 41 • Mar 30, 2022

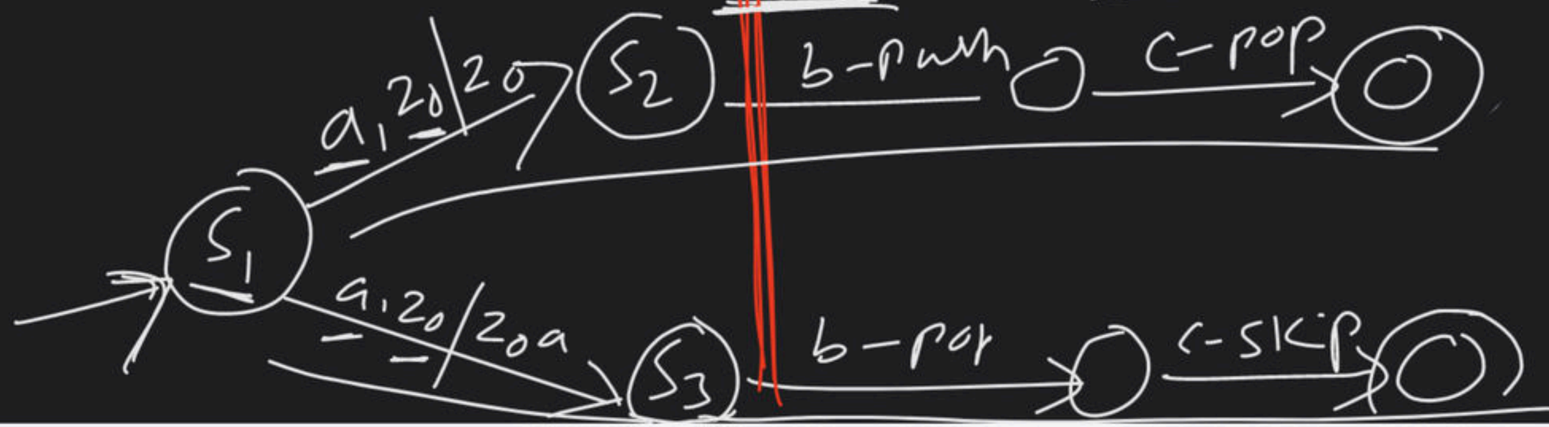
$L_1 = a^m (b^n c^n) \mid m, n \geq 1$ ⟹ DCFL ⟹ a-S, b-PU, c-PO

$L_2 = (a^m b^m) c^n \mid m, n \geq 1$ ⟹ DCFL ⟹ a-PU, b-PO, c-S

$L_1 \cap L_2 = a^n b^n c^n \mid n \geq 1$ ⟹ Not DCFL
Not CFL

$L_1 \cup L_2 = \{ a^i b^j c^k \mid i, j, k \geq 1 \}$ ~~DCFL~~ CFL ✓

$i = j$ (or) $j = k$



DCFL ⊂ CFL

DCFL = Complement

CFL = Complement

construct PDA $L = \{ a^m b^n c^n d^m \mid m, n \geq 1 \}$ ✓

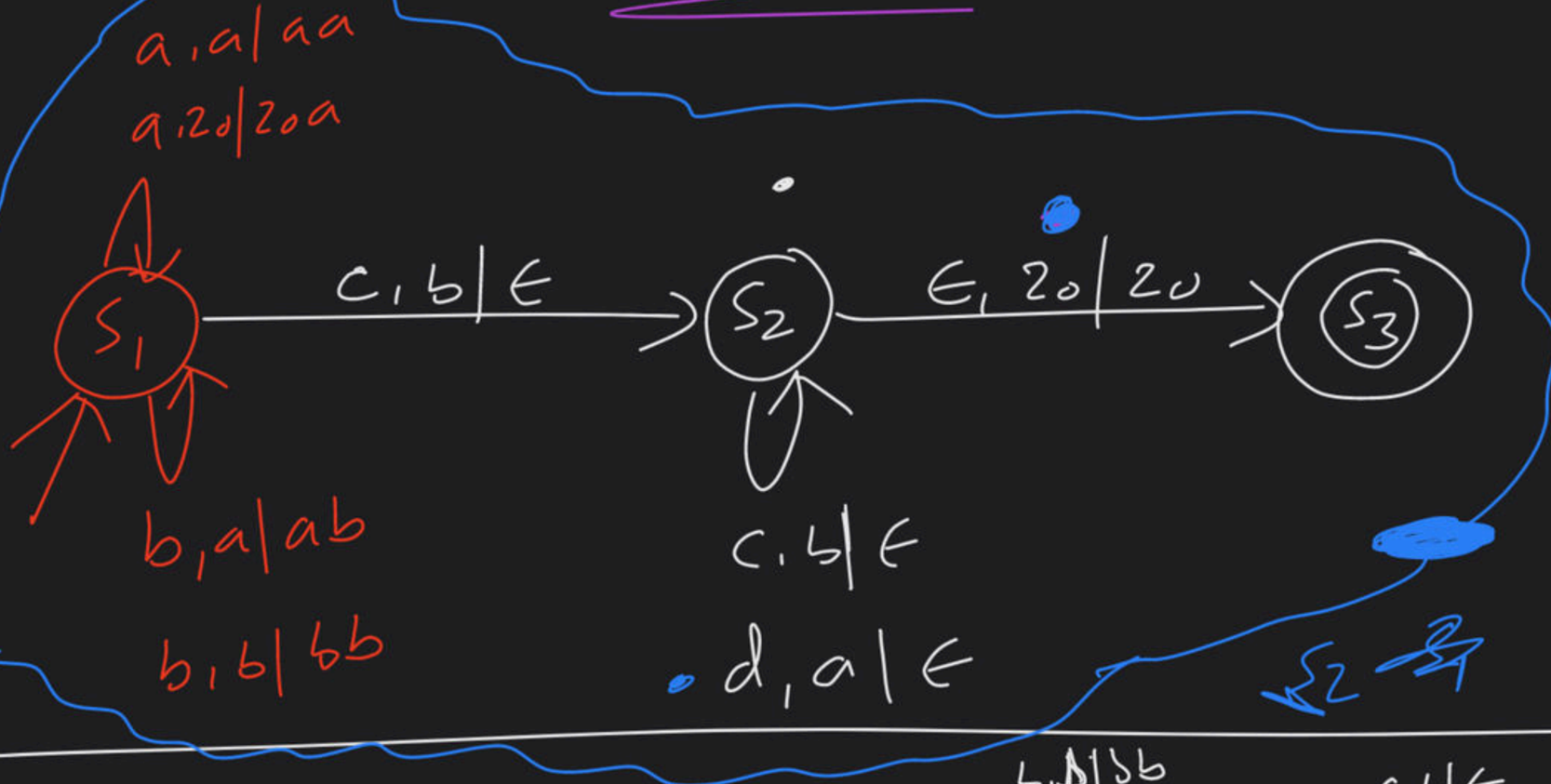
aaabcd

DCFL

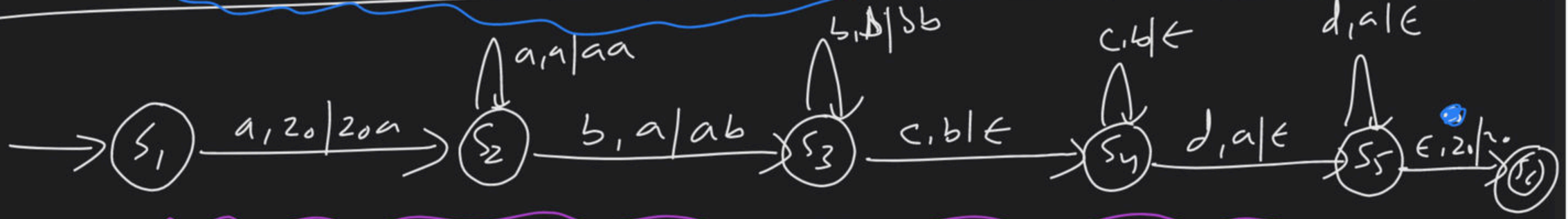
CFL

CSL

REL



abcd



Construct PDA $L = \{a^m b^n c^m d^n \mid m, n \geq 1\}$

With one stack not possible

So not CFL but it is CSL

Construct PDA $L = \{ a^{m+n} b^m c^n \mid m, n \geq 1 \}$

a - push

b - pop

c - pop

no - confusion $\Longrightarrow$ so, DCFL ✓

CFL ✓

CSL ✓

REL ✓

DCFL ?

(1) $a^m b^n c^n d^m$ ✓

(2) $a^m b^n c^m d^n$ ✗

(3) $a^m b^m c^n d^n$ ✓

(4) $a^m b^n c^m d^n$ ✗ DCFL DCFL CSL ✓

① $w w^R \mid w \in (a+b)^*$ ⟹ CFL ✓

② $w c w^R \mid w \in (a+b)^*$ ⟹ DCFL ✓

③ $w w \mid w \in (a+b)^*$ ⟹ CFL ✗ CSL ✓

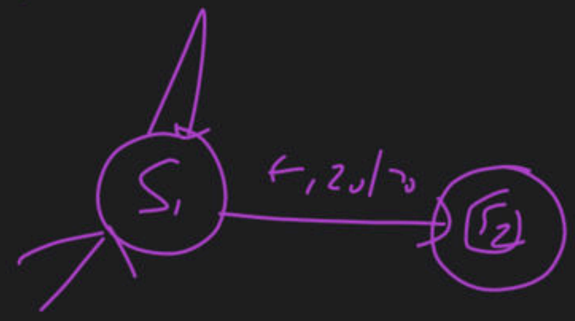
④ $w x w^R \mid w, x \in (a+b)^*$ ⟹ NPDA, CFL ✓ ⟹ CSL ⟹ REL

DCFL

ϵ ✓
a ✓
b ✓
ab ✓
⋮

$(a+b)^*$ ⟹ Regular

$b, Z_0 / Z_0$
$a, Z_0 / Z_0$



PYQs ⟹ 90%

$w x w^R$

$x w w^R$

$w w^R x$

$x_1 w x_2 w^R x_3$

$w x_1 w^R x_2$

$x_1 w w^R x_2$

all regular, $w_1 x \leftarrow (a+b)^b$

$w x w \mid$
$x w w \mid$
$w w x \mid$
$x_1 w w x_2 \mid$

$w_1 x \leftarrow (a+b)^b$

5-minta

RIC

$w x w^R \mid w, x \in (a+b)^+$

6th April

PR&DS

5:30 to 8:30

aaa (x)

aba (x)

abaaba (x)

baabab (x)

x

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

aaba

Regular

DCFL

CFL $\Rightarrow$ CSL

REL

Derick Hoy

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