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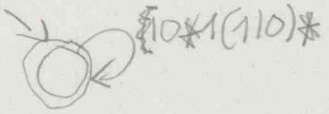
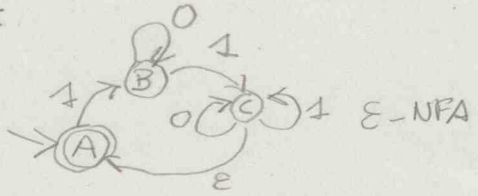
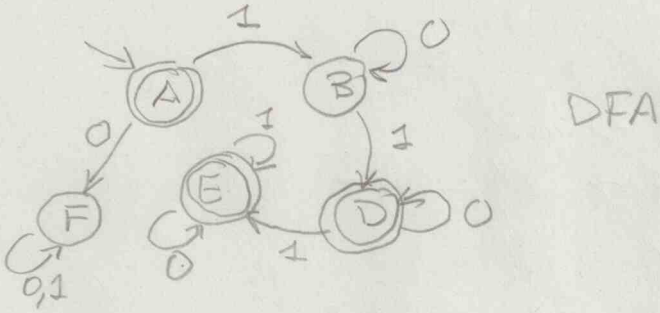
Ex 1

$(10*1(110)*)*$




| | 0 | 1 | |
|---|---|---|---|
| *A | – | B | |
| B | B | {C,A} | D |
| *{C,A} | {C,A} | {B,C,A} | E |
| *{B,C,A} | {B,C,A} | {B,C,A} | |

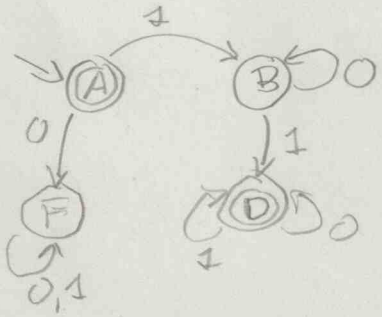



DFA

$\Pi_0$ : {A, D, E}, {B, F}

$\Pi_1$ : {A}, {D, E}, {B}, {F}  D and E are equivalent

minimum-state DFA :



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$\{0^i 1^k 0^j \mid i \geq 1, k \geq 2, j \geq 1, i+j=k, \underset{i \text{ odd}}{k \text{ odd}}, j\}$

$i+j=k \wedge i \text{ odd} \wedge k \text{ odd} \Rightarrow j \text{ even} \quad (j \geq 2, k \geq 3)$

$$0^i 1^k 0^j = 0^i 1^{i+j} 0^j = \underbrace{0^i 1^i}_{A} \underbrace{1^j 0^j}_{B}$$

$S \to AB$
$A \to 0X1$
$X \to 0A1 \mid \varepsilon$
$B \to 1Y0$
$Y \to 1B0 \mid 10$

Alternative solution for A and B

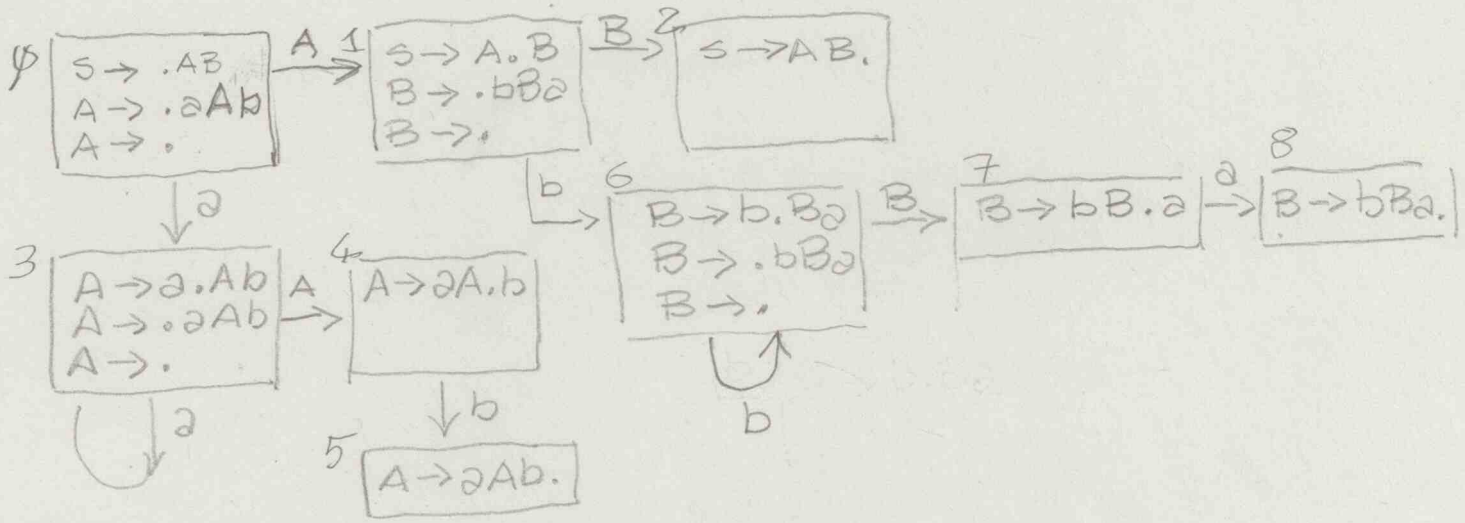
$A \to 00A11 \mid 01$
$B \to 11B00 \mid 1100$

4/7/24 Ex. 3

| | |
|---|---|
| $S \to AB$ | $\emptyset$ |
| $A \to aAb \mid \varepsilon$ | 1,2 |
| $B \to bBa \mid \varepsilon$ | 3,4 |

SLR parsing table

| | nullable | FIRST | FOLLOW |
|---|---|---|---|
| S | T | a, b | $ |
| A | T | a | b, $ |
| B | T | b | a, $ |




| state | ACTION a | ACTION b | ACTION $ | GOTO S | GOTO A | GOTO B |
|---|---|---|---|---|---|---|
| 0 | s3 | r2 | r2 | | 1 | |
| 1 | r4 | s6 | r4 | | | 2 |
| 2 | | | acc | | | |
| 3 | s3 | r2 | r2 | | 4 | |
| 4 | | s5 | | | | |
| 5 | | r1 | r1 | | | |
| 6 | r4 | s6 | r4 | | | 7 |
| 7 | s8 | | | | | |
| 8 | r3 | | r3 | | | |

The grammar is SLR because the SLR parsing table has no conflict.

The grammar is not LR(0) because the LR(0) parsing table has conflicts, for example in state 0 we would have s3/r2 for symbol A (shift/reduce conflict)

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4/7/24 Ex. 4

A problem is undecidable if there is no algorithm that can solve it for any possible input.

Two examples of undecidable problems are the membership problem for type-0 languages and the problem of telling if a context-free grammar is inherently ambiguous or not.