LR parsing (Canonical LR) ≡ CLR

Grammar:-

$S' \to S$
$S \to AA$
$A \to aA \mid b$

#{Grammar already augmented with new start symbol S'}

Collection computation:-

- Compute collection $C = \{I_0, I_1, \dots I_n\}$ where I_i = set of LR(1) items.
- $I_0 = \text{closure}([S' \to .S, \$])$ # ~~[lookahead of S must be \$ for reduction by 0th rule]~~

[a.t. Algorithm for computing closure]

$$= \{[S' \to .S, \$], [S \to .AA, \$], [A \to .aA, a/b], [A \to .b, a/b]\}$$

~~First(\$)~~

~~First(A\$)~~

First(A \$)

- $I_1 = \text{goto}(I_0, S)$

$$= \{[S' \to S., \$]\}$$

~~For the first LR(1) item, just copy the lookahead from the set, it is deriving [here, that set is I_0].~~

- $I_2 = \text{goto}(I_0, A)$

$$= \{[S \to A.A, \$], [A \to .aA, \$], [A \to .b, \$]\}$$

these two are computed by closure operation on $[S \to A.A, \$]$ item.

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- $I_3 = goto(I_0, a)$
  $= closure([A \to a.A, a|b])$
  $= closure([A \to a.A, a]) \cup closure([A \to a.A, b])$

  $= \{ [A \to a.A, a|b],$
  $[A \to .aA, a|b],$
  $[A \to .b, a|b] \}$

- $I_4 = goto(I_0, b)$
  $= closure([A \to b., a/b])$
  $= \{ [A \to b., a|b] \}$

[Note I_3 and I_6 are diff. in look-aheads]

- $I_5 = goto(I_2, A)$
  $= closure([S \to AA., \$])$
  $= \{[S \to AA., \$]\}$

- $goto(I_2, a) = closure([A \to a.A, \$])$
  $= \{ [A \to a.A, \$],$
  $[A \to .aA, \$],$
  $[A \to .b, \$] \} = I_6$

- $goto(I_2, b) = closure([A \to b., \$])$
  $= \{[A \to b., \$]\} = I_7$

- $goto(I_3, A) = closure([A \to aA., a|b])$
  $= \{[A \to aA., a|b]\} = I_8$

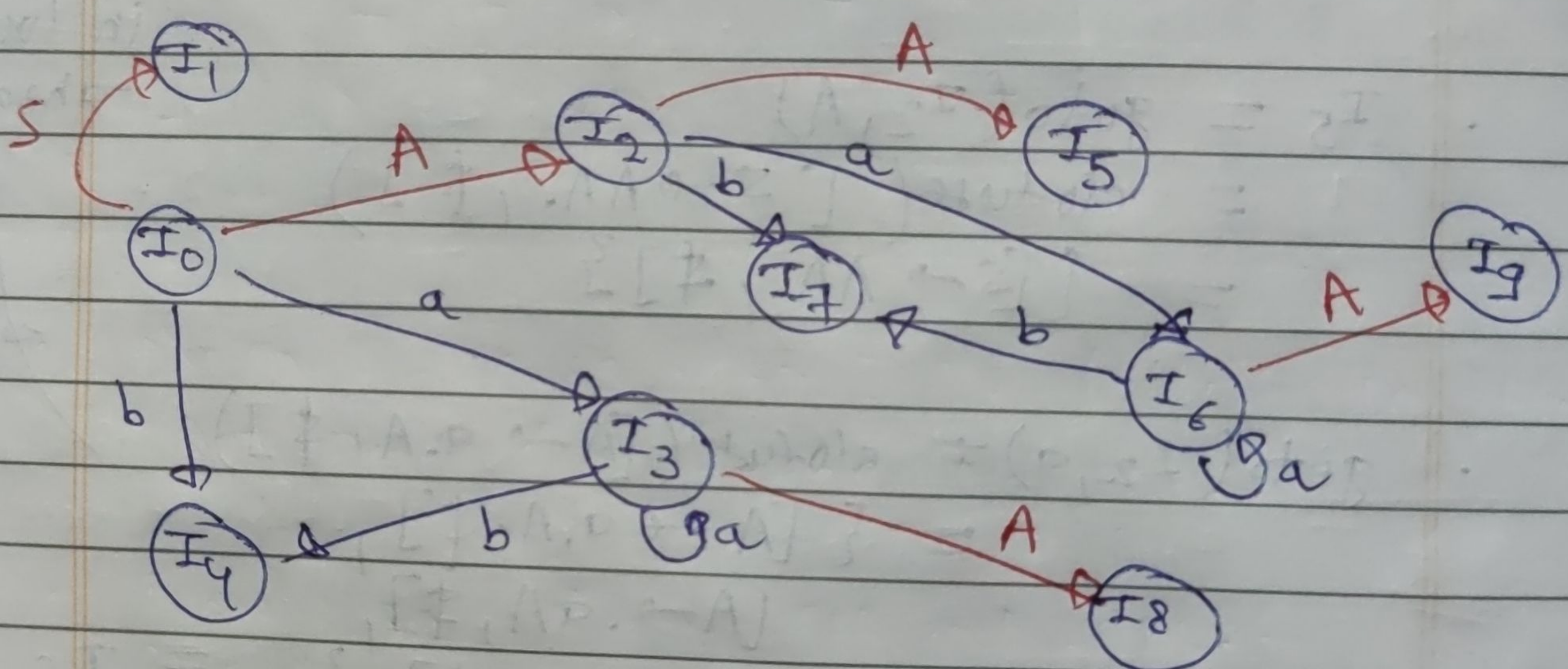
- goto(I_3, a) = I_3 ; goto(I_3, b) = I_4

- goto(I_6, a) = I_6 ; goto(I_6, b) = I_7

- goto(I_6, A) = closure([A → aA. , $])
  = { [A → aA. , $] } = I_9.

There are 10 states in the automaton of CLR parser.

automata :-



$\boxed{\text{Note}}$:- For reduce operation, in action table, now go to every I_i and look for [A → α. , a], and

~~take care~~ of [S' → S. , $]

{ action [i, a] = reduce by (A → α) }

⇒ No conflicts; No multiple entries.
Hence grammar is CLR grammar or LR(1) grammar.

Goto table:-

	S	A
0	1	2
1		
2		5
3		8
4		
5		
6		9
7		
8		
9		

action table:-

	a	b	$
0	S3	S4	
1			accept
2	S6	S7	
3	S3	S4	
4	R3	R3	
5			R1
6	S6	S7	
7			R3
8	R2	R2	
9			R2