Constructing parse table

Augment the grammar

- G is a grammar with start symbol S

- The augmented grammar G' for G has a new start symbol S' and an additional production S' → S

- When the parser reduces by this rule it will stop with accept

LR(0) items

- An LR(0) item of a grammar G is a production of G with a special symbol **".."** at some position of the right side.

- Thus, production A→XYZ gives four LR(0) items

A → .XYZ

A → X.YZ

A → XY.Z

A → XYZ.

- An item indicates how much of a production has been seen at a point in the process of parsing
  - Symbols on the left of "." are already on the stacks
  - Symbols on the right of "." are expected in the input

Start state

- Start state of DFA is an empty stack corresponding to **S' → .S** item
  - This means no input has been seen
  - The parser expects to see a string derived from S

- **Closure of a state** adds items for all productions whose LHS occurs in an item in the state, just after **"."**
  - Set of possible productions to be reduced next
  - Added items have **"."** located at the beginning
  - No symbol of these items is on the stack as yet

Closure operation

- Let I be a set of items for a grammar G

- closure(I) is a set constructed as follows:

    – Every item in I is in closure (I)

    – If A $\rightarrow$ α.Bβ is in closure(I) and B $\rightarrow$ γ is a production then B $\rightarrow$.γ is in closure(I)

- Naturally A $\rightarrow$ α.Bβ indicates that we expect a string derivable from **Bβ** in input

- If B $\rightarrow$ γ is a production then we might see a string derivable from γ at this point
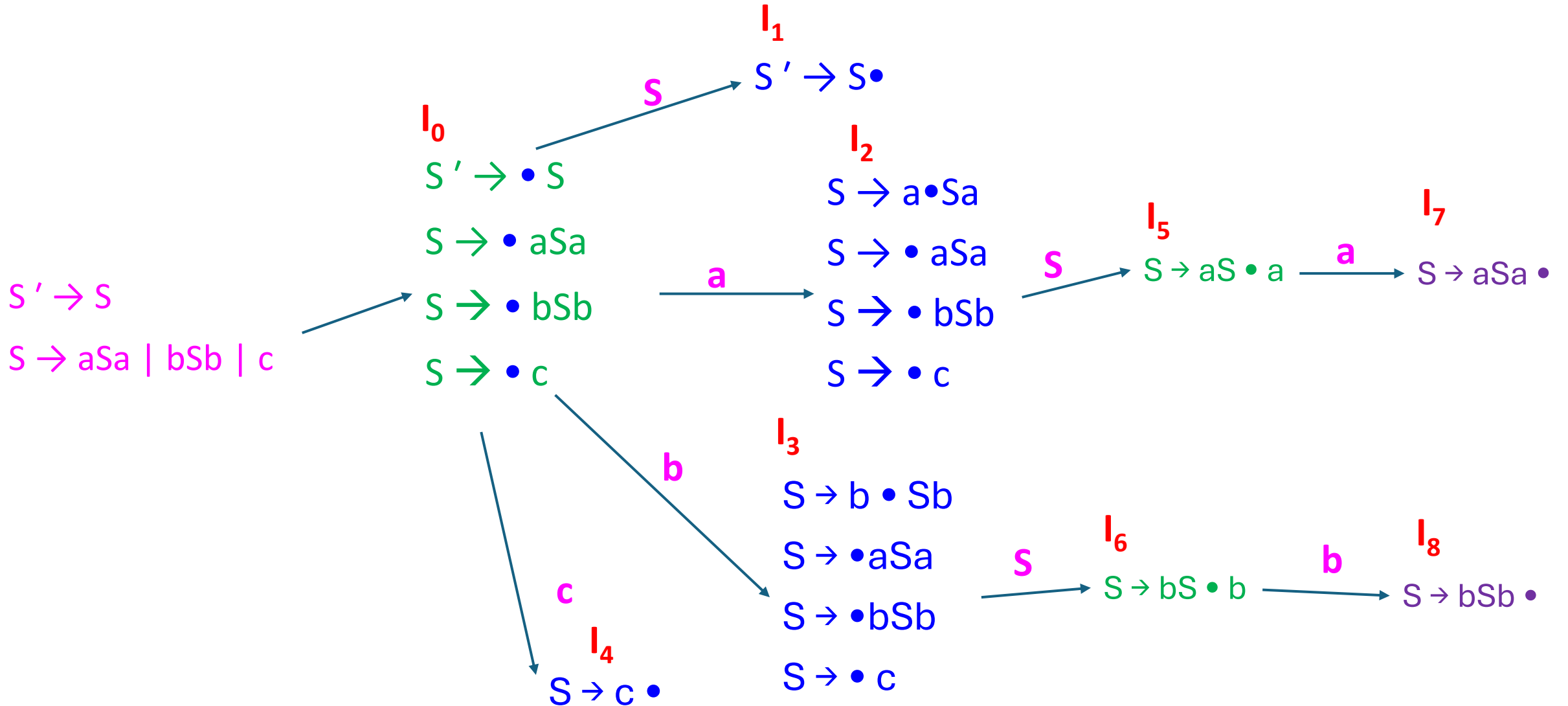
Let's Try An Example

Production Rule: S → aSa | bSb | c

The production rules of the augmented grammar are,

S ′ → S

S → aSa | bSb | c

The states of the LR(0) automaton are the following:

The states of the LR(0) automaton are the following

I_1

$S' \rightarrow S\bullet$

I_0

$S' \rightarrow \bullet S$

$S \rightarrow \bullet aSa$

$S \rightarrow \bullet bSb$

$S \rightarrow \bullet c$

I_2

$S \rightarrow a\bullet Sa$

$S \rightarrow \bullet aSa$

$S \rightarrow \bullet bSb$

$S \rightarrow \bullet c$

I_5

$S \rightarrow aS \bullet a$

I_7

$S \rightarrow aSa \bullet$

$S' \rightarrow S$

$S \rightarrow aSa \mid bSb \mid c$

I_3

$S \rightarrow b \bullet Sb$

$S \rightarrow \bullet aSa$

$S \rightarrow \bullet bSb$

$S \rightarrow \bullet c$

I_6

$S \rightarrow bS \bullet b$

I_8

$S \rightarrow bSb \bullet$

I_4

$S \rightarrow c \bullet$

S   a   b   c   S   a   S   b

Parse Table for the Given Grammer

State	Action				Goto
	a	b	c	$\$$	S
0	s_2	s_3	s_4		1
1				accept	
2	s_2	s_3	s_4		5
3	s_2	s_3	s_4		6
4	r_3	r_3	r_3	r_3	
5	s_7				
6		s_8			
7	r_1	r_1	r_1	r_1	
8	r_2	r_2	r_2	r_2	