Assignment 4

Ex1:

```
(1) S' → S
(2) S → aB
(3) B → S * B
(4) B → ϵ
```

Q1: parsing table

I_0 = **CLOSURE(S' → ·S) = {S' → ·S, S → · aB}**

GOTO(I_0,S) = CLOSURE(S' → S·) = {S' → S·} = I_1

GOTO(I_0,a) = CLOSURE(S → a·B) = {S → a·B, B → ·, B → ·S∗B, S → ·aB} = I_2

I_1 **= {S' → S·}**

GOTO(I_1,$) = accept

I_2 **= {S → a·B, B → ·, B → ·S∗B, S → ·aB}**

GOTO(I_2,B) = CLOSURE(S → aB·) = {S → aB·} = I_3

GOTO(I_2,S) = CLOSURE(B → S·∗B) = {B → S·∗B} = I_4

GOTO(I_2,a) = CLOSURE(S →a·B) = I_2

I_3 **= {S → aB·}**

I_4 **= {B → S·∗B}**

GOTO(I_4,∗) = CLOSURE(B → S∗·B) = {B → S∗·B, B → ·S∗B, B →·, S → ·aB} = I_5

I_5 **= {B → S∗·B, B → ·S∗B, B →·, S → ·aB}**

GOTO(I_5,S) = CLOSURE(B → S·∗B) = I_4

GOTO(I_5,B) = CLOSURE(B → S∗B·) = {B → S∗B·} = I_6

GOTO(I_5,a) = CLOSURE(S → a·B) = I_2

I_6 **= {B → S∗B·}**

LR(0) item sets:

```
S' → ·S
S' → S·
S → ·aB
S → a·B
S → aB·
B → ·S * B
B → S· * B
B → S *· B
B → S * B ·
B → ·
follow(B) = {$,*}
follow(S) = {*,$}
```

STATE	ACTION			GOTO	
	a	*	$	S	B
0	S2			1	
1			acc		
2	S2	r4	r4	4	3
3		r2	r2		
4		S5			
5	S2	r4	r4	4	6
6		r3	r3		

Q2: It is SLR(1)

Q3: aaaa*** can be accepted

Stack	Input	symbol	Action
0	aaaa***		S2
0 2	aaa***	a	S2
0 2 2	aa***	aa	S2
0 2 2 2	a***	aaa	S2
0 2 2 2 2	***	aaaa	r4: B → ϵ, pop 0 state
0 2 2 2 2 3	***	aaaaB	r2: S → aB, pop 2 states
0 2 2 2 4	***	aaaS	S5
0 2 2 2 4 5	**	aaaS*	r4: B → ϵ, pop 0 state
0 2 2 2 4 5 6	**	aaaS*B	r3: B → S * B, pop 3 states
0 2 2 2 3	**	aaaB	r2: S → aB, pop 2 states

Stack	Input	symbol	Action
0 2 2 4	**	aaS	S5
0 2 2 4 5	*	aaS*	r4: B → ϵ, pop 0 state
0 2 2 4 5 6	*	aaS*B	r3: B → S ∗ B, pop 3 states
0 2 2 3	*	aaB	r2: S → aB, pop 2 states
0 2 4	*	aS	S5
0 2 4 5		aS*	r4: B → ϵ, pop 0 state
0 2 4 5 6		aS*B	r3: B → S ∗ B, pop 3 states
0 2 3		aB	r2: S → aB, pop 2 states
0 1		S	Accept

Ex2:

Q1 Parse table

```
(1) S' → S
(2) S → aB
(3) B → S * B
(4) B → ϵ
```

I_0 = **{[S' → ·S,$], [S → ·aB, $]}**

GOTO(I_0,S) = CLOSURE([S' → S·, $]) = {[S' → S·, $]} = I_1

GOTO(I_0,a) = CLOSURE([S → a·B, $]) = {[S → a·B, $], [B → ·,$], [B → ·S∗B,$], [S → ·aB,∗]} = I_2

I_1 = **{[S' → S·, $]}**

GOTO(I_1,$) = accept

I_2 **= {[S → a·B, $], [B → ·,$], [B → ·S∗B,$], [S → ·aB,∗]}**

GOTO(I_2,B) = CLOSURE([S → aB·,$]) = {[S → aB·,$]} = I_3

GOTO(I_2,S) = CLOSURE([B → S·∗B,$]) = {[B → S·∗B,$]} = I_4

GOTO(I_2,a) = CLOSURE([S →a·B,∗]) = {[S →a·B,∗], [B → ·,∗], [B → ·S∗B,∗], [S → ·aB,∗]}= I_5

I_3 **= {[S → aB·,$]}**

I_4 **= {[B → S·∗B,$]}**

GOTO(I_4,∗) = CLOSURE([B → S∗·B,$]) = {[B → S∗·B,$], [B → ·S∗B,$], [B →·,$], [S → ·aB,∗]} = I_6

I_5 **= {[S →a·B,∗], [B → ·,∗], [B → ·S∗B,∗], [S → ·aB,∗]}**

GOTO(I_5,S) = CLOSURE([B → S·∗B,∗]) = {[B → S·∗B,∗]} = I_7

GOTO(I_5,B) = CLOSURE([S →aB·,∗]) = {[S →aB·,∗]} = I_8

GOTO(I_5,a) = CLOSURE([S → a·B,∗]) = I_5

I_6 = **{[B → S∗·B,$], [B → ·S∗B,$], [B →·,$], [S → ·aB,∗]}**

GOTO(I_6,S) = CLOSURE([B → S·∗B,$]) = I_4

GOTO(I_6,B) = CLOSURE([B → S∗B·,$]) = {[B → S∗B·,$]} = I_9

GOTO(I_6,a) = CLOSURE([S → a·B,∗]) = I_5

I_7 = **{[B → S·∗B,∗]}**

GOTO(I_7,∗) = CLOSURE([B → S∗·B,∗]) = {[B → S∗·B,∗], [B → ·S∗B,∗], [B →·,∗], [S → ·aB,∗]} = I_{10}

I_8 **= {[S →aB·,∗]}**

I_9 **= {[B → S∗B·,$]}**

I_{10}= **{[B → S∗·B,∗], [B → ·S∗B,∗], [B →·,∗], [S → ·aB,∗]}**

GOTO(I_{10},S) = CLOSURE([B → S·∗B,∗]) = I_7

GOTO(I_{10},B) = CLOSURE([B → S∗B·,∗]) = {[B → S∗B·,∗]} = I_{11}

GOTO(I_{10},a) = CLOSURE([S → a·B,∗]) = I_5

I_{11} **= {[B → S∗B·,∗]}**

LR(1) item sets:

```
[S' → ·S,$]
[S' → S·,$]
[S → ·aB,$]
[S → a·B,$]
[S → aB·,$]
[S → ·aB,*]
[S → a·B,*]
[S → aB·,*]
[B → ·,$]
[B → ·,*]
[B → ·S*B,$]
[B → S·*B,$]
[B → S*·B,$]
[B → S*B·,$]
[B → ·S*B,*]
[B → S·*B,*]
[B → S*·B,*]
[B → S*B·,*]
```

STATE	ACTION			GOTO	
	a	*	$	S	B
0	S2			1	
1			acc		
2	S5		r4	4	3
3			r2		

STATE	ACTION			GOTO	
4		S6			
5	S5	r4		7	8
6	S5		r4	4	9
7		S10			
8		r2			
9			r3		
10	S5	r4		7	11
11		r3			

Q2：It is LR(1)

Q3：aaaa*** can be accepted

Stack	Input	symbol	Action
0	aaaa***		S2
0 2	aaa***	a	S5
0 2 5	aa***	aa	S5
0 2 5 5	a***	aaa	S5
0 2 5 5 5	***	aaaa	r4: B → ϵ, pop 0 state
0 2 5 5 5 8	***	aaaaB	r2: S → aB, pop 2 states
0 2 5 5 7	***	aaaS	S10
0 2 5 5 7 10	**	aaaS*	r4: B → ϵ, pop 0 state
0 2 5 5 7 10 11	**	aaaS*B	r3: B → S ∗ B, pop 3 states
0 2 5 5 8	**	aaaB	r2: S → aB, pop 2 states
0 2 5 7	**	aaS	S10
0 2 5 7 10	*	aaS*	r4: B → ϵ, pop 0 state
0 2 5 7 10 11	*	aaS*B	r3: B → S ∗ B, pop 3 states
0 2 5 8	*	aaB	r2: S → aB, pop 2 states
0 2 4	*	aS	S6
0 2 4 6		aS*	r4: B → ϵ, pop 0 state
0 2 4 6 9		aS*B	r3: B → S ∗ B, pop 3 states

Stack	Input	symbol	Action
0 2 3		aB	r2: S → aB, pop 2 states
0 1		S	Accept

Ex3:

Q1: parse table

I_0 = **{[S' → ·S,$], [S → ·aB, $]}**

I_1 = **{[S' → S·, $]}**

I_2 = **{[S → a·B, $], [B → ·, $], [B → ·S∗B,$], [S → ·aB,∗]}**

I_5 = **{[S → a·B, ∗], [B → ·, ∗], [B → ·S∗B,∗], [S → ·aB,∗]}**

=> I_{25}= **{[S → a·B, ∗/$], [B → ·, ∗/$], [B → ·S∗B,∗/$], [S → ·aB,∗]}**

I_3 = **{[S → aB·,$]}**

I_8 = **{[S → aB·,∗]}**

=> I_{38}= **{[S → aB·,∗/$]}**

I_4 = **{[B → S·∗B,$]}**

I_7 = **{[B → S·∗B,∗]}**

=> I_{47}= **{[B → S·∗B,∗/$]}**

I_6 = **{[B → S∗·B,$], [B → ·S∗B,$], [B →·,$], [S → ·aB,∗]}**

I_{10}= **{[B → S∗·B,∗], [B → ·S∗B,∗], [B →·,∗], [S → ·aB,∗]}**

=> I_{610}= **{[B → S∗·B,∗/$], [B → ·S∗B,∗/$], [B →·,∗/$], [S → ·aB,∗]}**

I_9 = **{[B → S∗B·,$]}**

I_{11} = **{[B → S∗B·,∗]}**

=> I_{911}= **{[B → S∗B·,∗/$]}**

STATE	ACTION			GOTO	
	a	*	$	S	B
0	S25			1	
1			acc		
25	S25	r4	r4	47	38
38		r2	r2		
47		S610			
610	S25	r4	r4	47	911
911		r3	r3		

Q2 The grammar is LALR(1)

Q3 aaaa*** can be accepted

Stack	Input	symbol	Action
0	aaaa***		S25
0 25	aaa***	a	S25
0 25 25	aa***	aa	S25
0 25 25 25	a***	aaa	S25
0 25 25 25 25	***	aaaa	r4: B → ϵ, pop 0 state
0 25 25 25 25 38	***	aaaaB	r2: S → aB, pop 2 states
0 25 25 25 47	***	aaaS	S610
0 25 25 25 47 610	**	aaaS*	r4: B → ϵ, pop 0 state
0 25 25 25 47 610 911	**	aaaS*B	r3: B → S ∗ B, pop 3 states
0 25 25 25 38	**	aaaB	r2: S → aB, pop 2 states
0 25 25 47	**	aaS	S610
0 25 25 47 610	*	aaS*	r4: B → ϵ, pop 0 state
0 25 25 47 610 911	*	aaS*B	r3: B → S ∗ B, pop 3 states
0 25 25 38	*	aaB	r2: S → aB, pop 2 states
0 25 47	*	aS	S610
0 25 47 610		aS*	r4: B → ϵ, pop 0 state
0 25 47 610 911		aS*B	r3: B → S ∗ B, pop 3 states
0 25 38		aB	r2: S → aB, pop 2 states
0 1		S	Accept