Exam No: _____

GANPAT UNIVERSITY
B. TECH SEM-VII (Computer Engineering)
SECOND INTERNAL EXAMINATION – OCT 2024
2CEIT701: Compiler Design

TIME: 1 Hour **TOTAL MARKS: 20**

Instructions:
1) Figures to the right indicate full marks.
2) Be precise and to the point in your answer.
3) Assume suitable data, if necessary.
4) The text just below marks indicates the Course Outcomes Numbers, (CO) followed by the bloom's taxonomy level of the question, i.e., R: Remembering, U: Understanding, A: Applying, N: Analyzing, E: Evaluating, C: Creating.

Q.1 Consider the following grammar: **[5]**
2C

$$E \rightarrow x \mid \#EA@ \mid ab$$
$$A \rightarrow * EB \mid By \mid \varepsilon$$
$$B \rightarrow \%EAz \mid b \mid \varepsilon$$

Perform:
1. Construct M-Table for LL (1)
2. Parse the string **"#x*x%xbyz@$"** (Show stack steps)

Answer:

NT	First	Follow
E	{x,#,a}	{$,@,*,y,%,z,b}
A	{*, ε,y,%,b}	{@,z}
B	{%,b, ε}	{y,@,z}

NT	a	b	x	y	z	#	@	*	%	$
E	E→ab		E→x			E→#EA@				
A		$A \rightarrow$By		$A \rightarrow$By	$A \rightarrow \varepsilon$		$A \rightarrow \varepsilon$	$A \rightarrow * EB$	$A \rightarrow$By	
B		B → b		B → ε	B → ε		B → ε		$B \rightarrow \%EAz$	

Stack	Input	Action
$	#x*x%xbyz@$	Push E into Stack
$E	#x*x%xbyz@$	E→#EA@
$@AE#	#x*x%xbyz@$	Pop #
$@AE	x*x%xbyz@$	E→x
$@Ax	x*x%xbyz@$	Pop x
$@A	*x%xbyz@$	$A \rightarrow * EB$
$@BE*	*x%xbyz@$	Pop *
$@BE	x%xbyz@$	E→x
$@Bx	x%xbyz@$	Pop x
$@B	%xbyz@$	$B \rightarrow \%EAz$
$@zAE%	%xbyz@$	Pop %

$@zAE	xbyz@$	E→x
$@zAx	xbyz@$	Pop x
$@zA	byz@$	*A* →By
$@zyB	byz@$	B → b
$@zyb	byz@$	Pop b
$@zy	yz@$	Pop y
$@z	z@$	Pop z
$@	@$	Pop @
$	$	Accept

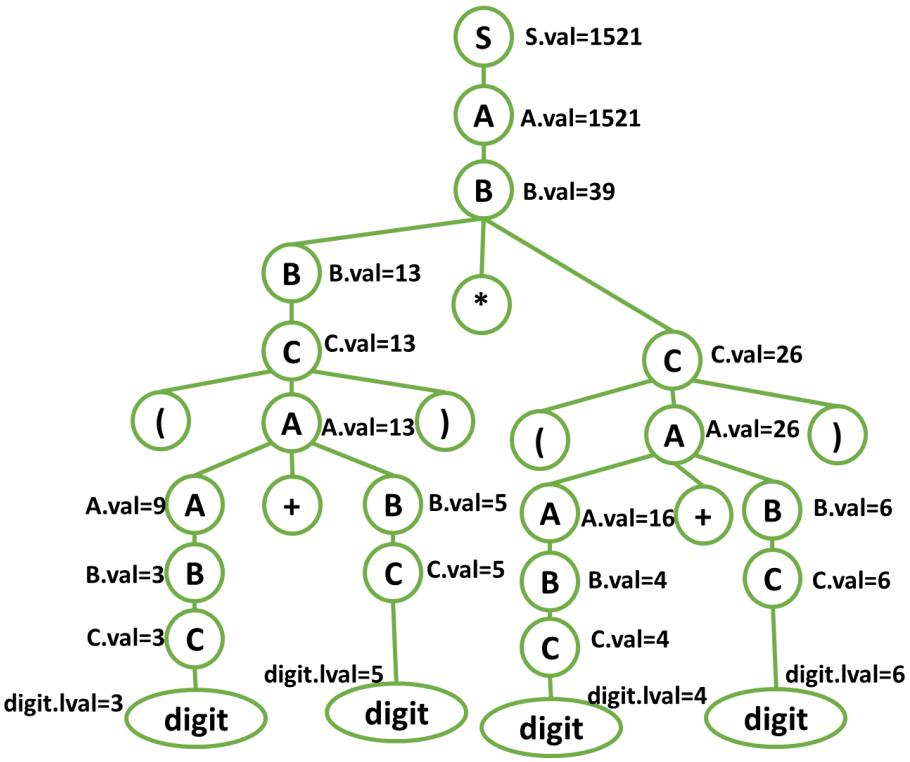
Q.2 Consider the following SDT: **[5] 3A**

S → A	{ S.val = A.val }
A → B	{ A.val = B.val * B.val }
A → A + B	{ A.val = 2*A.val - B.val }
B → C	{ B.val = C.val }
B → B * C	{ B.val = B.val + C.val }
C → (A)	{ C.val = A.val }
C → digit	{ C.val = digit.lval }

Perform following for string (3+5) * (4 +6):

1. Draw Annotated Parse Tree
2. Evaluate the given string
3. Check the given SDT is L-attributed SDT or S- attributed SDT. (Justify your answer)

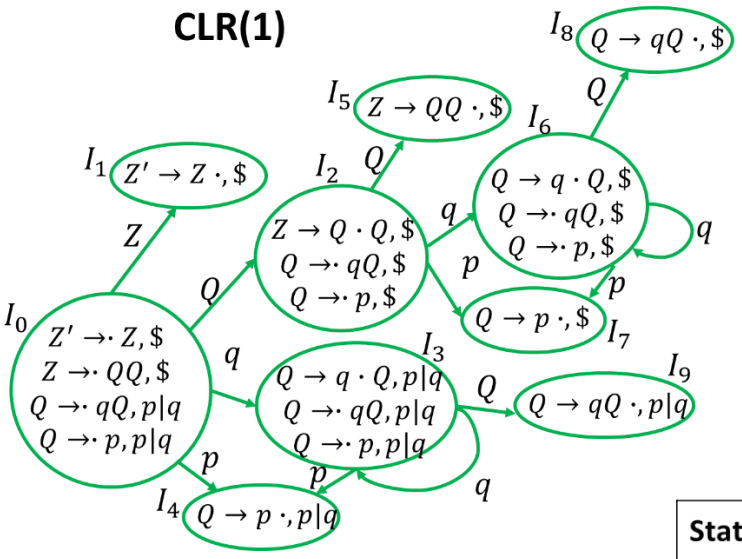
Answer: S-attributted ADT



Q.3 Construct the LALR (1) Parsing table for the following grammar. **[5]**
2C

$$Z \rightarrow QQ$$
$$Q \rightarrow qQ \mid p$$

Answer:

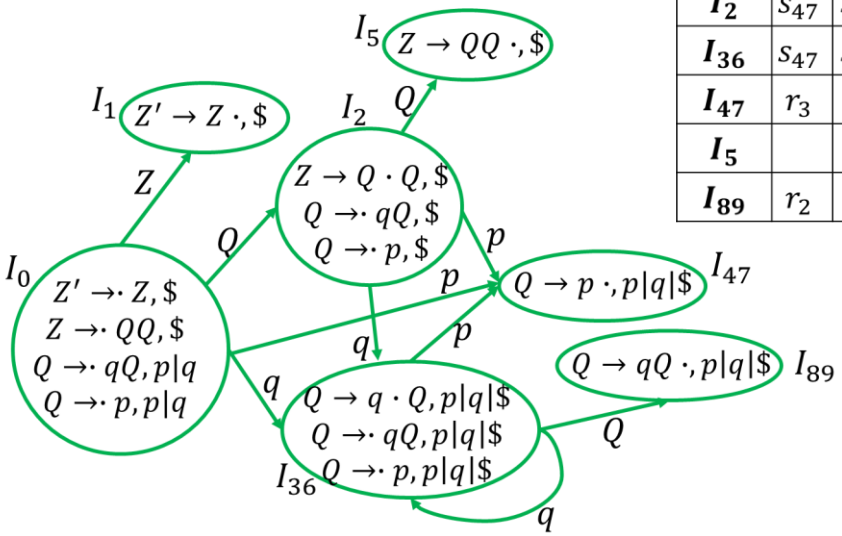


1. $Z \rightarrow QQ$
2. $Q \rightarrow qQ$
3. $Q \rightarrow p$

LALR(1)

By combining, I_4&I_7, I_3&I_6, I_8&I_9

State s	Action			GoTo	
	p	q	$	Z	Q
I_0	s_{47}	s_{36}		1	2
I_1			Accept		
I_2	s_{47}	s_{36}			5
I_{36}	s_{47}	s_{36}			89
I_{47}	r_3	r_3	r_3		
I_5			r_1		
I_{89}	r_2	r_2	r_2		



Q.4 Consider the following grammar: **[5]**
2C

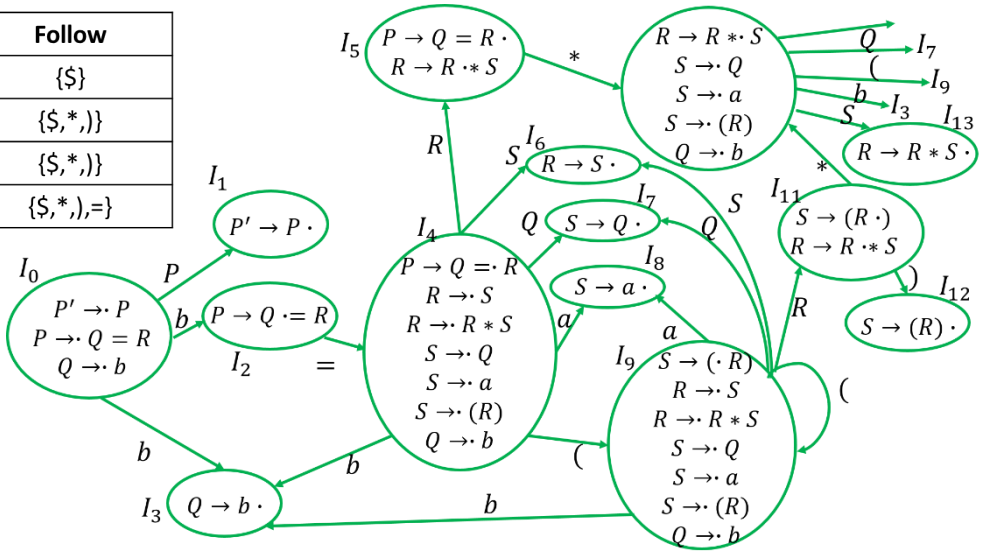
P → Q = R
R → S | R * S
S → Q | a | (R)
Q → b

Perform:

1. Construct SLR (1) parsing table.
2. Perform String Parsing **" b=a*b$"**. (Show stack steps)

Answer:

NT	Follow
P	{$}
R	{$,*,)}
S	{$,*,)}
Q	{$,*,),=}



States	Action							GoTo			
	=	*	a	b	(	)	$	P	R	S	Q
I_0				s_3				1			2
I_1							Accept				
I_2	s_4										
I_3	r_7	r_7				r_7	r_7				
I_4			s_8	s_3	s_9				5	6	7
I_5		s_{10}					r_1				
I_6		r_2				r_2	r_2				
I_7		r_4				r_4	r_4				
I_8		r_5				r_5	r_5				
I_9			s_8	s_3	s_9				11	6	7
I_{10}			s_8	s_3	s_9					13	7
I_{11}		s_{10}				s_{12}					
I_{12}		r_6				r_6	r_6				
I_{13}		r_3				r_3	r_3				

Stack Content	Input	Action
$\$I_0$	b=a*b$	s_3
$\$I_0 b I_3$	=a*b$	$r_7(Q \rightarrow b)$
$\$I_0 Q I_2$	=a*b$	s_4
$\$I_0 Q I_2 = I_4$	a*b$	s_8
$\$I_0 Q I_2 = I_4 a I_8$	*b$	$r_5(S \rightarrow a)$
$\$I_0 Q I_2 = I_4 S I_6$	*b$	$r_2(R \rightarrow S)$
$\$I_0 Q I_2 = I_4 R I_5$	*b$	s_{10}
$\$I_0 Q I_2 = I_4 R I_5 * I_{10}$	b$	s_3
$\$I_0 Q I_2 = I_4 R I_5 * I_{10} b I_3$	$	$r_7(Q \rightarrow b)$
$\$I_0 Q I_2 = I_4 R I_5 * I_{10} Q I_7$	$	$r_4(S \rightarrow Q)$
$\$I_0 Q I_2 = I_4 R I_5 * I_{10} S I_{13}$	$	$r_3(R \rightarrow R*S)$
$\$I_0 Q I_2 = I_4 R I_5$	$	$r_1(P \rightarrow Q=R)$
$\$I_0 P I_1$	$	*Accept*

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