

Assignment 1 - soln

1. a) All string contain last 3rd letter a.

b) All string contain exact 3 b's with 0 or more occurrence of a before or after b.

2. a) $b^*[a^*[b+\epsilon]]^*$

b) $[00+11]^*1[00+11]^*$

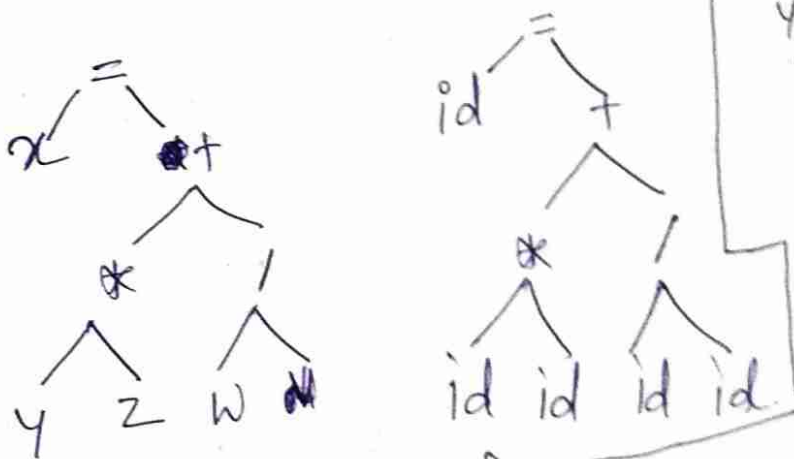
3. $x = y * z + w / v$

Stage 1 = lexical Analysis.

$x, y, z, w, v \rightarrow$ Identifiers

Operators = $=, *, +, /$

Stage 2 :- Syntax Analysis



Stage 3: semantic Analysis
(Type checking)

Stage 4: ICG

$t_1 = y * z$

$t_2 = w / v$

$t_3 = t_1 + t_2$

$x = t_3$

Stage 5 - CO

$t_1 = y * z$

$t_2 = w / v$

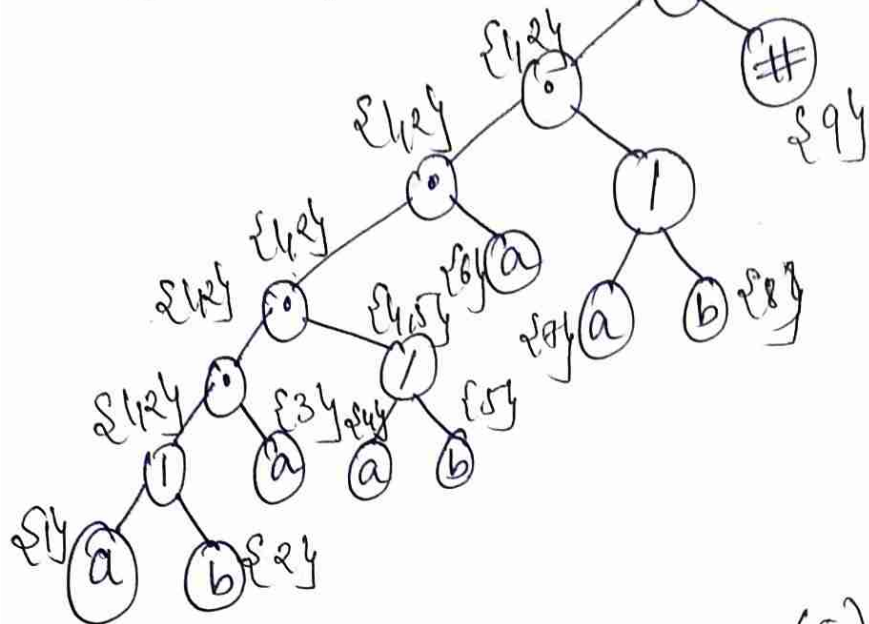
$x = t_1 + t_2$

Stage 6 - Code generation.

~~$t_1 = R_0, t_2 = R_1, x = R_3$~~
 $y = R_0, z = R_1, w = R_2, v = R_3$
 $x = R_4$

MUL R_0, R_1
 DIV R_2, R_3
 ADD R_0, R_2
 MOV R_0, X

4) $(a|b) \ a \ (a|b) \ a \ (a|b) \ \# \ \{1,2\}$
 $\quad \quad \quad 1 \ 2 \quad 3 \ 4 \ 5 \quad 6 \ 7 \ 8 \quad 9 \quad 10$



first pos(sqrt) =
 $\{1, 2\} = A$

$$\text{followpos}(1) = \{3, 4\}$$

11 (2) = ₹ 34

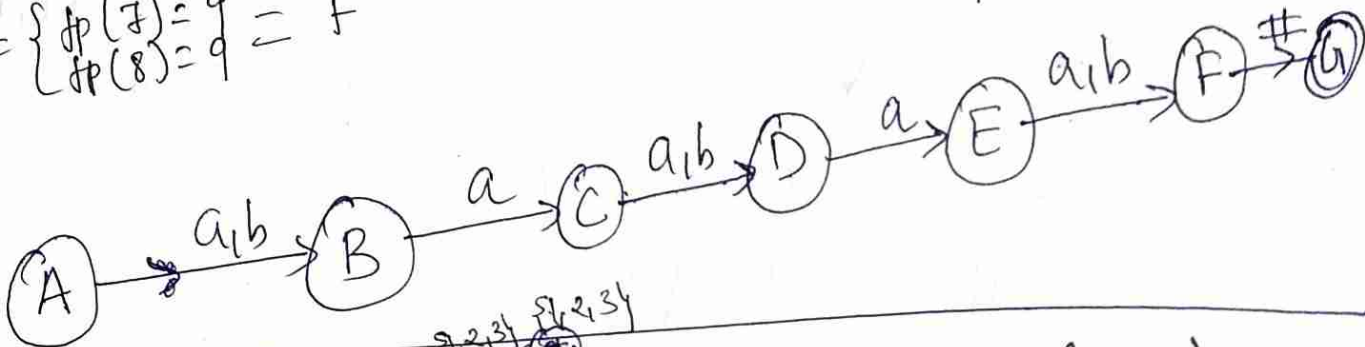
11 (3) = 84,57

11 $(4) = \{6\}$

followpos(s) = {6, 7}

$$wpos(6) = \{718\}$$
$$C(7) = \{94\}$$
$$(8) = \{9\}$$
$$11 \quad (a) = \phi$$
$$C = \begin{cases} \text{fp}(4) = \{6\} \longrightarrow D \\ \text{fp}(5) = \{6\} \longrightarrow D \end{cases}$$
$$D = \{ \text{sp}(6) \} = \{ 718 \} \rightarrow E$$

$F = \{ q_p(q) = \phi \rightarrow \text{final state} \}$

$$A = \begin{cases} \text{fp}(1) = 3 & - B \\ \text{fp}(2) = 3 & - B \end{cases}$$
$$B = \{f(3)\} = \{4, 5\} - C$$
$$E = \left\{ \begin{array}{l} \text{hp}(7) = 9 \\ \text{hp}(8) = 9 \end{array} \right\} = F$$
[illegible]

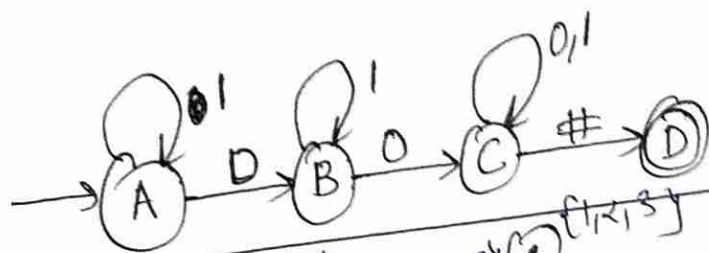
first pos(root) =
21234 = A

$$\begin{aligned} dp(1) &= \{1, 2, 3\} & dp(5) &= \{6, 7\} \\ dp(2) &= \{1, 2, 3\} & dp(6) &= \{6, 7\} \\ dp(3) &= \{4, 5\} & dp(7) &= \{\emptyset\} \\ dp(4) &= \{4, 5\} \end{aligned}$$

$$A = \begin{cases} dp(1) \cup dp(3) = \{1, 2, 3, 4, 5\} \rightarrow B \\ dp(2) = \{1, 2, 3\} \rightarrow A \end{cases}$$

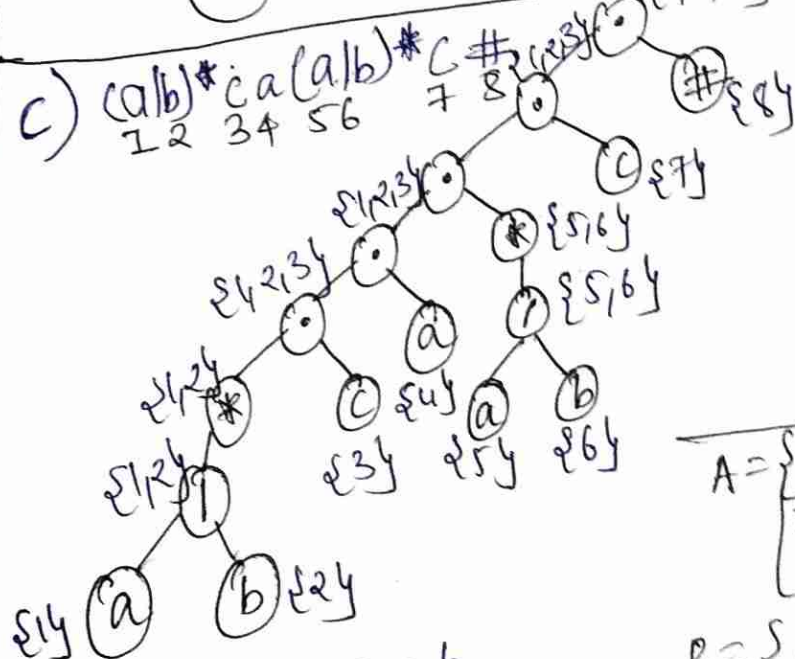
$$B = \begin{cases} dp(1) \cup dp(3) \cup dp(5) = \{1, 2, 3, 4, 5, 6, 7\} \rightarrow C \\ dp(2) \cup dp(4) = \{1, 2, 3, 4, 5\} \rightarrow B \end{cases}$$

$$C = \begin{cases} dp(1) \cup dp(3) \cup dp(5) = \{1, 2, 3, 4, 5, 6, 7\} \rightarrow C \\ dp(2) \cup dp(4) \cup dp(6) = \{1, 2, 3, 4, 5, 6, 7\} \rightarrow C \\ dp(7) = \emptyset = D \rightarrow \text{final state} \end{cases}$$



$$\text{first pos}(\text{root}) = \{1, 2, 3\} \rightarrow A$$

$$c) \begin{matrix} (a|b)^* & a & (a|b)^* & \# & c & \# & (a|b)^* & \# & (a|b)^* \\ \hline 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \end{matrix}$$

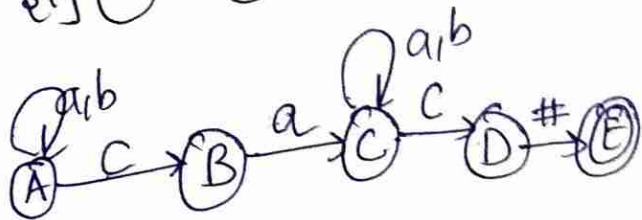


$$\begin{aligned} dp(1) &= \{1, 2, 3\} & dp(5) &= \{5, 6, 7\} \\ dp(2) &= \{1, 2, 3\} & dp(6) &= \{5, 6, 7\} \\ dp(3) &= \{4\} & dp(7) &= \{8\} \\ dp(4) &= \{5, 6, 7\} & dp(8) &= \{\emptyset\} \end{aligned}$$

$$\begin{aligned} A &= \begin{cases} dp(1) = \{1, 2, 3\} \rightarrow A \\ dp(2) = \{1, 2, 3\} \rightarrow A \\ dp(3) = \{4\} \rightarrow B \end{cases} \\ B &= \begin{cases} dp(4) = \{5, 6, 7\} \rightarrow C \end{cases} \end{aligned}$$

$$C = \begin{cases} dp(5) = \{5, 6, 7\} = C \\ dp(6) = \emptyset = C \\ dp(7) = \{8\} \rightarrow D \end{cases}$$

$$D \begin{cases} dp(8) = \emptyset \rightarrow \text{accepted} \end{cases}$$



Name	type	size (byte)	Dimension	line of Declaration	line of Usage	Address
a	int	4	-	1	-	---
b	int	4	-	1	-	---
i	int	4	-	4	5	---
j	int	4	-	4	5	---
k	int	4	-	4	6	---

,	symbol	comma, (separator)
int	keyword	type
b	identifier	variable name
)	symbol	parenthesis
;	symbol	semicolon
void	keyword	Return type
main	identifier	function name
(symbol	parenthesis
)	symbol	parenthesis
{	symbol	parenthesis
int	keyword	type
i	identifier	variable name
=	symbol	assign. operator
7	literal	constant value
,	symbol	comma (separator)
j	identifier	variable name
=	symbol	assign. operator
3	literal	constant value
,	symbol	comma (separator)
k	identifier	variable name
;	symbol	semicolon
k	identifier	variable name
=	symbol	assign. operator
add	identifier	function name
(symbol	parenthesis
i	identifier	variable name
,	symbol	comma (separator)
j	identifier	variable name
)	symbol	parenthesis
;	symbol	semicolon
printf	identifier	function name
(symbol	parenthesis
"%.d"	literal	formatted string
,	symbol	comma (separator)
k	identifier	variable name
)	symbol	comma
;	symbol	semicolon
{	symbol	parenthesis