A1-sol

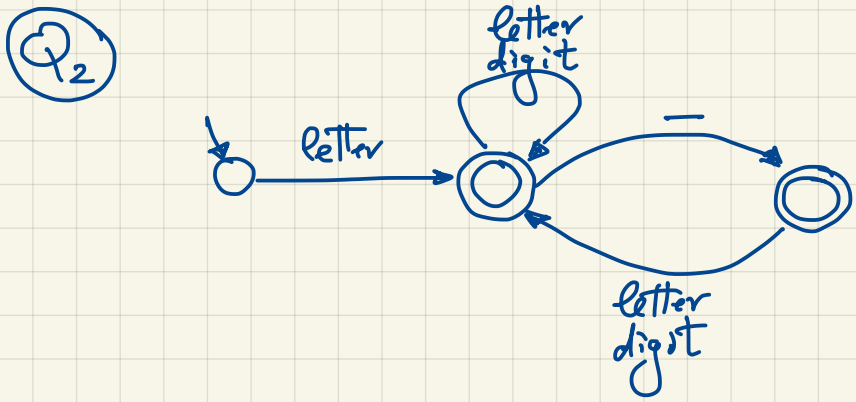
(CS3342 - win. 2024)

Q1

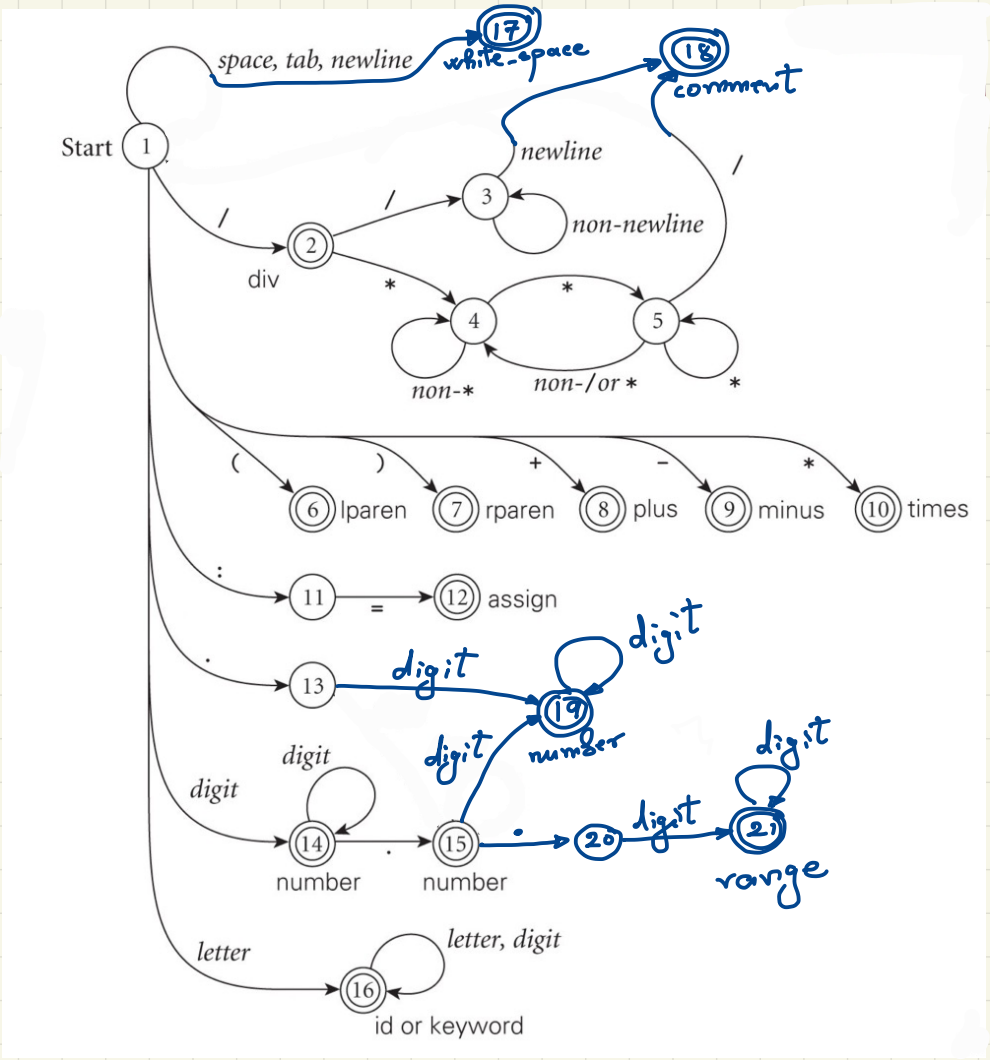
$===(\Sigma-\{\backslash n\})^*\backslash n$ — first line

$\left(\left(\underbrace{\varepsilon + = + ==}_{\text{has only } != \text{ but } <3} + \underbrace{(\Sigma-\{\backslash n\})^*(\Sigma-\{=,\backslash n\})(\Sigma-\{\backslash n\})^*}_{\text{has a character} \neq '='}\right)\backslash n\right)^*$ — middle lines

$====^*\backslash n$ — last line

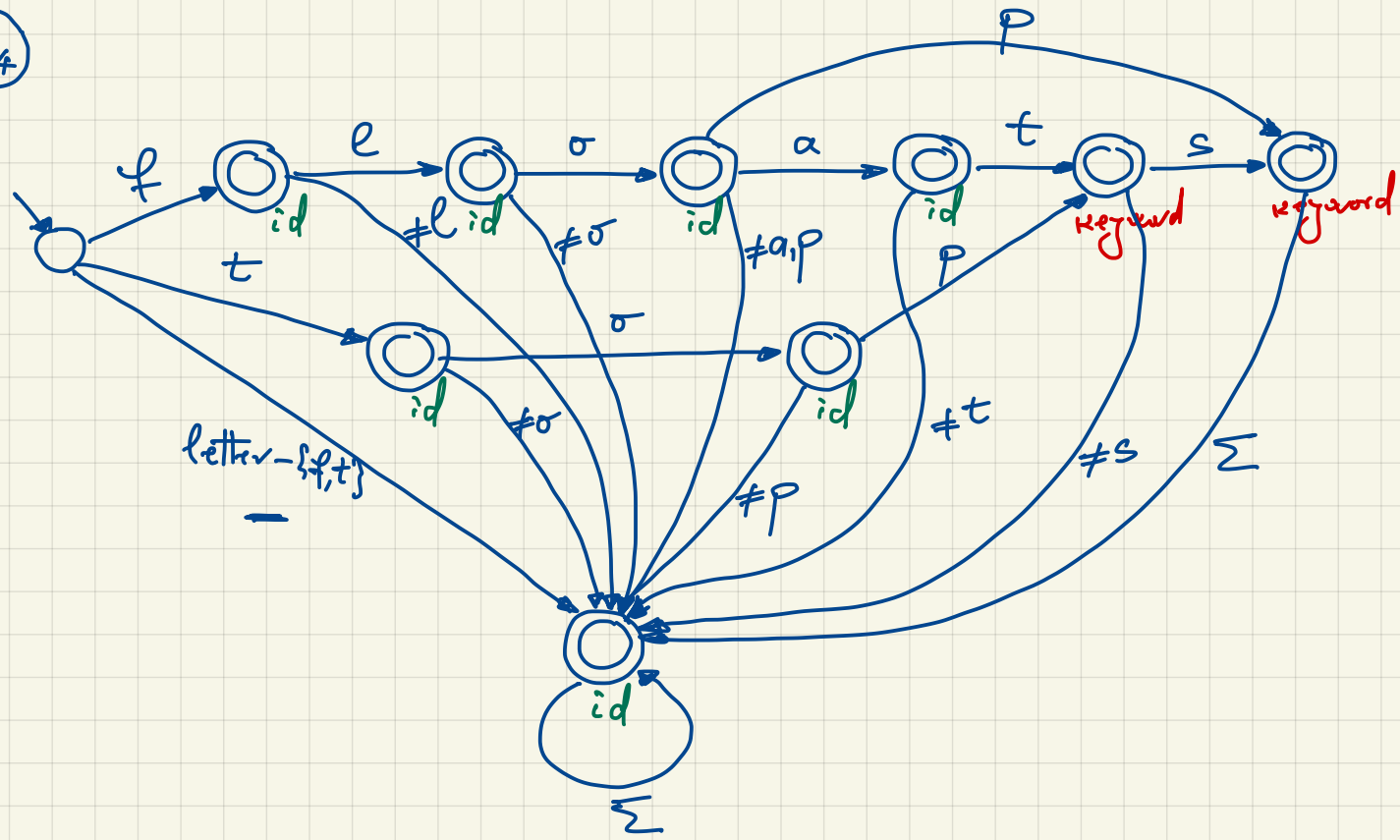

Q_2
letter
digit
letter
_
letter
digit

Q3



State	space, tab	newline	/	*	(	)	+	-	:	=	.	digit	letter	other	token_tab
	Current input character														
1	17	17	2	10	6	7	8	9	11	–	13	14	16	–	
2	–	–	3	4	–	–	–	–	–	–	–	–	–	–	div
3	3	18	3	3	3	3	3	3	3	3	3	3	3	3	
4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	
5	4	4	18	5	4	4	4	4	4	4	4	4	4	4	
6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	lparen
7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	rparen
8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	plus
9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	minus
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	times
11	–	–	–	–	–	–	–	–	–	12	–	–	–	–	
12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	assign
13	–	–	–	–	–	–	–	–	–	–	–	19	–	–	
14	–	–	–	–	–	–	–	–	–	–	15	14	–	–	number
15	–	–	–	–	–	–	–	–	–	–	20	19	–	–	number
16	–	–	–	–	–	–	–	–	–	–	–	16	16	–	identifier
17	17	17	–	–	–	–	–	–	–	–	–	–	–	–	white_space
18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	comment
19	–	–	–	–	–	–	–	–	–	–	–	19	–	–	number
20	–	–	–	–	–	–	–	–	–	–	–	21	–	–	
21	–	–	–	–	–	–	–	–	–	–	–	21	–	–	range

Q4



$\Sigma = \{ \_, a, b, \ldots, z, 0, 1, \ldots, 9 \}$

Q5 (a)

X	FIRST(X)	FOLLOW(X)
P	if, other	$\emptyset$
S	if, other	$$
M	if, other	else, $$
O	else	$$
T	if, other	$$

P	PREDICT(P)
1	if, other
2	if
3	other
4	if
5	other

P	PREDICT(P)
6	else
7	$$
8	if
9	other

(b) The grammar is LL(1) because there are no productions with the same LHS that share a token in their PREDICT sets.

(c) G is not a correct grammar for if..then..else statements as it cannot generate the following valid string:

if (e) then other else if (e) then other else other $$ (*)

Parsing this string gives the only derivation:

$P \Rightarrow^{1} \underline{S}\$\$ \Rightarrow^{2}$ if (e) then $\underline{M}O\$\$ \Rightarrow^{5}$ if (e) then other $\underline{O}\$\$$

$\Rightarrow^{6}$ if (e) then other else $\underline{T}\$\$$

$\Rightarrow^{8}$ if (e) then other else $\underline{\text{if}}$ (e) then $\underline{T}\$\$$

$\Rightarrow^{9}$ if (e) then other else if (e) then other $$ ← which is different from the given string (*)

Therefore, G does not contradict the claim that there is no top-down grammar for if..then..else statements.