CS323 Written Assignment 3 Sample Answer

Exercise 1

grammar G:

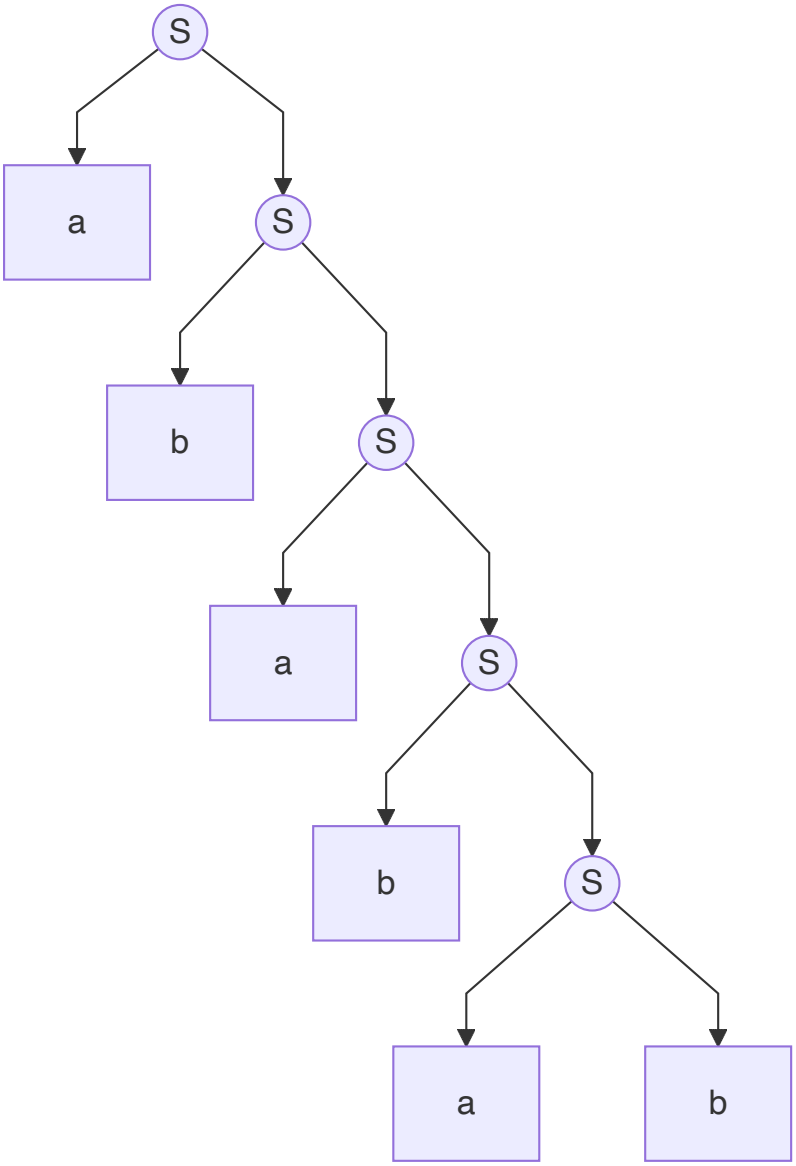
$S \to aS \mid bS \mid ab$

The leftmost derivation:

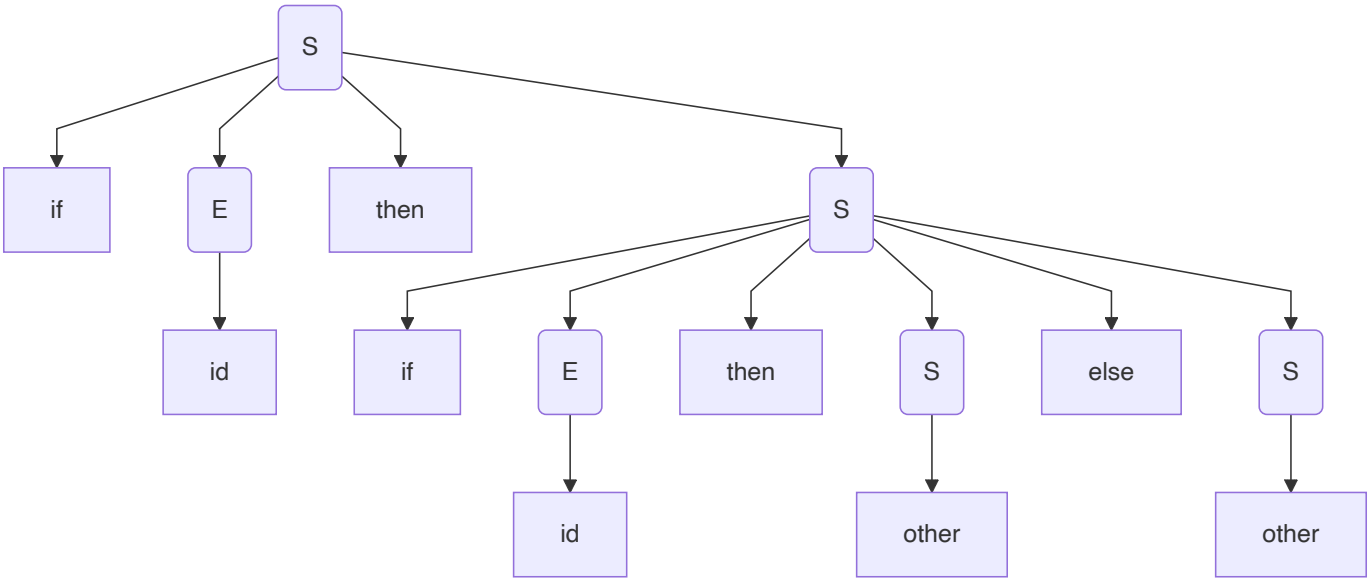
$S \implies aS \implies abS \implies abaS \implies ababS \implies ababab$

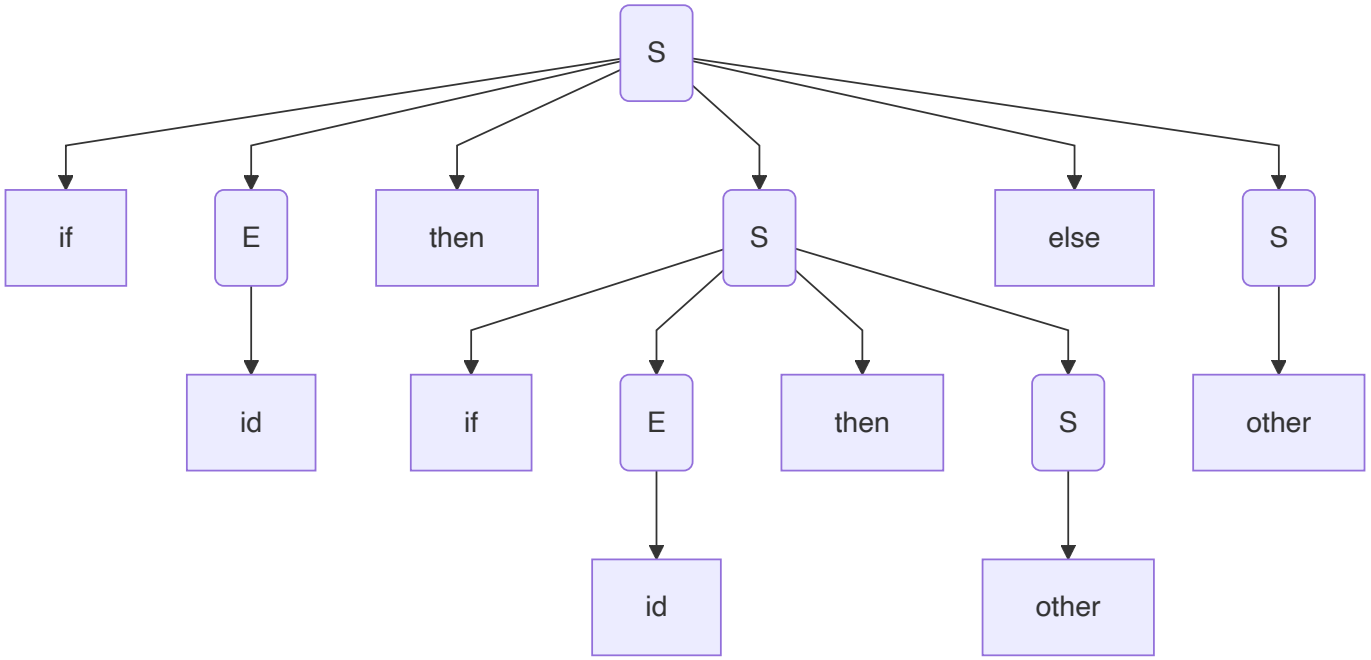
The rightmost derivation:

$S \implies aS \implies abS \implies abaS \implies ababS \implies ababab$



Exercise 2





Exercise 3

$S \rightarrow 0S0 \mid 1S1 \mid 0 \mid 1 \mid \epsilon$

Exercise 4

(1)

All non-terminals: E, X, T, Y, F, Z, P

FIRST(E) = { (, a, b }, FOLLOW(E) = {), $ }

FIRST(X) = { +, ε }, FOLLOW(X) = {), $ }

FIRST(T) = { (, a, b }, FOLLOW(T) = { +,), $ }

FIRST(Y) = { (, a, b, ε }, FOLLOW(Y) = { +,), $ }

FIRST(F) = { (, a, b }, FOLLOW(F) = { (, a, b, +,), $ }

FIRST(Z) = { *, ε }, FOLLOW(Z) = { (, a, b, +,), $ }

FIRST(P) = { (, a, b }, FOLLOW(P) = { (, a, b, +,), *, $ }

(2)

	+	*	(	)	a	b	$
E			E → TX		E → TX	E → TX	
X	X → +E			X → ε			X → ε
T			T → FY		T → FY	T → FY	
Y	Y → ε		Y → T	Y → ε	Y → T	Y → T	Y → ε
F			F → PZ		F → PZ	F → PZ	
Z	Z → ε	Z → *Z	Z → ε	Z → ε	Z → ε	Z → ε	Z → ε
P			P → (E)		P → a	P → b	

The grammar is LL(1).

(3)

Step	Matched	Stack	Input	Action
1		E$	(a*+b)+b$	
2		TX$	(a*+b)+b$	Output E→TX
3		FYX$	(a*+b)+b$	Output T→FY
4		PZYX$	(a*+b)+b$	Output F→PZ
5		(E)ZYX$	(a*+b)+b$	Output P→(E)
6	(	E)ZYX$	a*+b)+b$	Match (
7	(	TX)ZYX$	a*+b)+b$	Output E→TX
8	(	FYX)ZYX$	a*+b)+b$	Output T→FY
9	(	PZYX)ZYX$	a*+b)+b$	Output F→PZ
10	(	aZYX)ZYX$	a*+b)+b$	Output P→a
11	(a	ZYX)ZYX$	*+b)+b$	Match a

12	(a	*ZYX)ZYX$	*+b)+b$	Output Z→*Z
13	(a*	ZYX)ZYX$	+b)+b$	Match *
14	(a*	YX)ZYX$	+b)+b$	Output Z→ε
15	(a*	X)ZYX$	+b)+b$	Output Y→ε
16	(a*	+E)ZYX$	+b)+b$	Output X→+E
17	(a*+	E)ZYX$	b)+b$	Match +
18	(a*+	TX)ZYX$	b)+b$	Output E→TX
19	(a*+	FYX)ZYX$	b)+b$	Output T→FY
20	(a*+	PZYX)ZYX$	b)+b$	Output F→PZ
21	(a*+	bZYX)ZYX$	b)+b$	Output P→b
22	(a*+b	ZYX)ZYX$	)+b$	Match b
23	(a*+b	YX)ZYX$	)+b$	Output Z→ε
24	(a*+b	X)ZYX$	)+b$	Output Y→ε
25	(a*+b	)ZYX$	)+b$	Output X→ε
26	(a*+b	ZYX$	+b$	Match)
27	(a*+b)	YX$	+b$	Output Z→ε
28	(a*+b)	X$	+b$	Output Y→ε
29	(a*+b)	+E$	+b$	Output X→+E
30	(a*+b)+	E$	b$	Match +
31	(a*+b)+	TX$	b$	Output E→TX
32	(a*+b)+	FYX$	b$	Output T→FY
33	(a*+b)+	PZYX$	b$	Output F→PZ
34	(a*+b)+	bZYX$	b$	Output P→b
35	(a*+b)+b	ZYX$	$	Match b
36	(a*+b)+b	YX$	$	Output Z→ε
37	(a*+b)+b	X$	$	Output Y→ε
38	(a*+b)+b	$	$	Output X→ε