ASSIGNMENT 4

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1. **Eliminate left recursion in the following grammar:**

S --> SX
S --> SSb
S --> XS
S --> a

SOLUTION:

Original grammar:

S --> SX
S --> SSb
S --> XS
S --> a

α1 = X, α2 = Sb, β1 = XS, β2 = a

Modified grammar

S --> XSS' | aS'
S' --> XS' | SbS' | ε

2. **Consider the A-rules:**

A --> aB | b | CBB

FIRST(aB) = { a }
FIRST(b) = { b }
FIRST(CBB) = { a, b, c }

There are common terminals in these firsts, so A rules FAIL the pairwise disjointness test.

Consider B-rules:

B --> aB | ba | aBb

first(aB) = { a }
first(ba) = { b }
first(aBb) = { a }

There are common terminals in these firsts, so B rules FAIL the pairwise disjointness test.

Consider C-rules:

C --> aaA | b | caB

first(aaA) = { a }
first(b) = { b }
first(caB) = { c }

There are no common terminals in these firsts, so C rules PASS the disjointness test.

Overall, the grammar FAILS the disjointness tests because at least one non-terminal FAILS the disjointness tests.

3. **(id + id) * id**

   (id + id(* id

(id + id) * id

Stack	Input	Action
0	(id + id) * id$	S4
0(4	id + id) * id$	S5
0(4id5	+ id) * id$	R6 (Use GOTO [4,F]) F -> id
0(4F3	+ id) * id$	R4 (Use GOTO [4,T]) T -> F
0(4T2	+ id) * id$	R2 (Use GOTO [4,E]) E -> T
0(4E8	+ id) * id$	S6
0(4E8+6	id) * id$	S5
0(4E8+6id5	) * id$	R6 (Use GOTO [6,F]) F -> id
0(4E8+6F3	) * id$	R4 (Use GOTO [6,T]) T -> F
0(4E8+6T9	) * id$	R1 (Use GOTO [4,E]) E -> E + T
0(4E8	) * id$	S11
0(4E8)11	* id$	R5 (Use GOTO [0,F]) F -> (E)
0F3	* id$	R4 (Use GOTO [0,T]) T -> F
0T2	* id$	S7
0T2*7	id$	S5
0T2*7id5	$	R6 (Use GOTO [7,F]) F -> id
0T2*7F10	$	R3 (Use GOTO [0,T]) T -> T * F
0T2	$	R2 (Use GOTO [0,E]) E -> T
0E1	$	ACCEPT

E 2=> T
 3=> T * F
 6=> T * id
 4=> F * id
 5=> (E) * id
 1=> (E + T) * id
 4=> (E + F) * id
 6=> (E + id) * id
 2=> (T + id) * id
 4=> (F + id) * id

6=> (id + id) * id

(id + id(* id

Stack	Input		Action
0	(id + id(* id$		S4
0(4	id + id(* id$		S5
0(4id5	+ id(* id$		R6 (Use GOTO [4,F]) F -> id
0(4F3	+ id(* id$		R4 (Use GOTO [4,T]) T -> F
0(4T2	+ id(* id$		R2 (Use GOTO [4,E]) E -> T
0(4E8	+ id(* id$		S6
0(4E8+6	id(* id$	S5	
0(4E8+6id5	(* id$		ERROR; blank entry for ACTION(5,'(')