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CS354: ProgLang; Kennington
WF, 1030-1145

Editor's note: We are working on our concision, here, after an editorial on assignment 1.

108: 2.12 - A & B

G → S $$

S → A M

M → S | epsilon

A → a E | b A A

E → a B | b A | epsilon

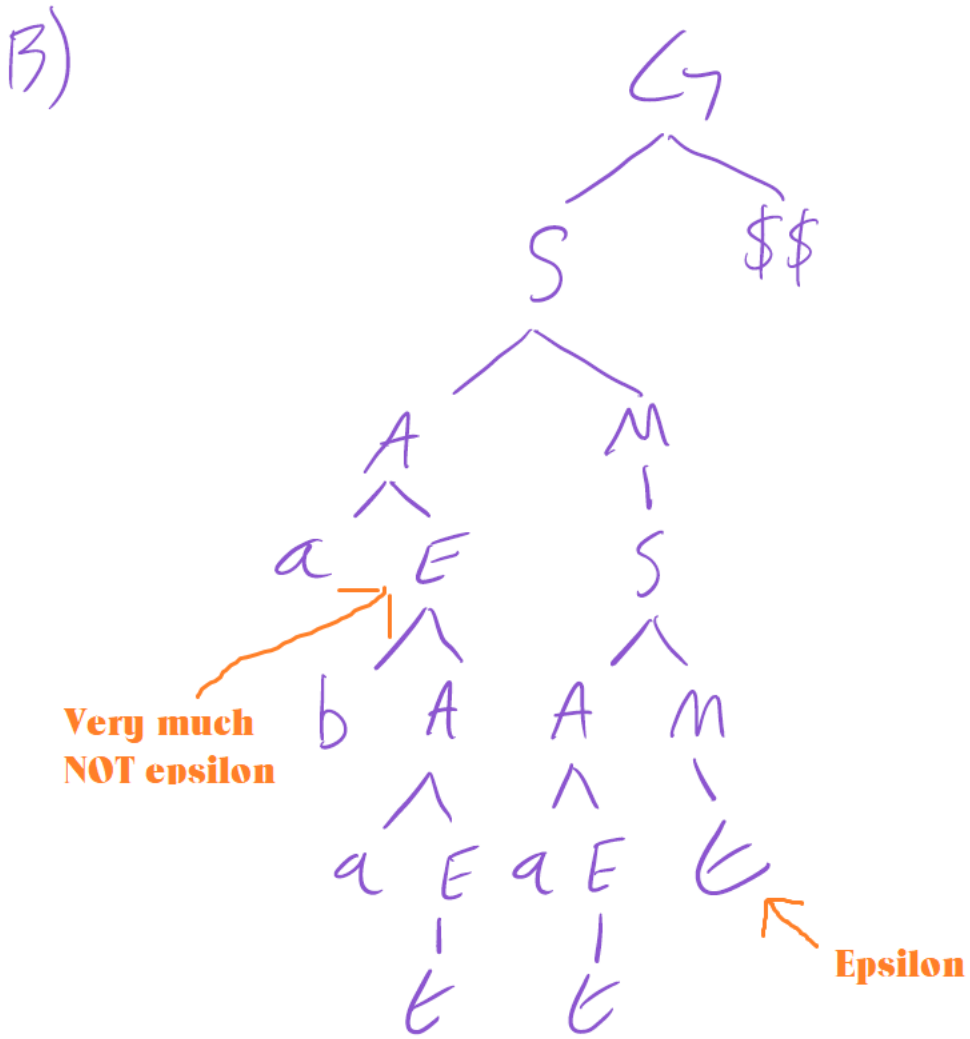
B → b E | a B B

(a) Describe in English the language that the grammar generates (e.g., "this makes a bunch of a's and b's that.....")

This is a simple (meaning no loops/jumps), language over the characters {a, b}, which also accepts empty string inputs (specifically classed as M's or E's). It separates input into "parts of speech", so to speak: G's (which is the entire unit, what would be the "program" in our usual context, denoted by the end marker, "$$"), which is made up of S's, which are themselves made up of A and M tokens. M's can contain S's or empty elements. A tokens are 'a' characters paired with E tokens, OR 'b' characters paired with double A tokens. E's are composed of an 'a' followed by B tokens, OR 'b' followed by A tokens, and can also consist of nothing (empty strings/tokens). B tokens are a 'b' paired with an E token, or an 'a' paired with dual B's.

I think.

(b) Show a parse tree for the string a b a a



108: 2.13 - A & B

stmt → assignment

→ subr call

assignment → id := expr

subr call → id (arg list)

expr → primary expr tail

expr tail → op expr

→ epsilon

primary → id

→ subr call

→ (expr)

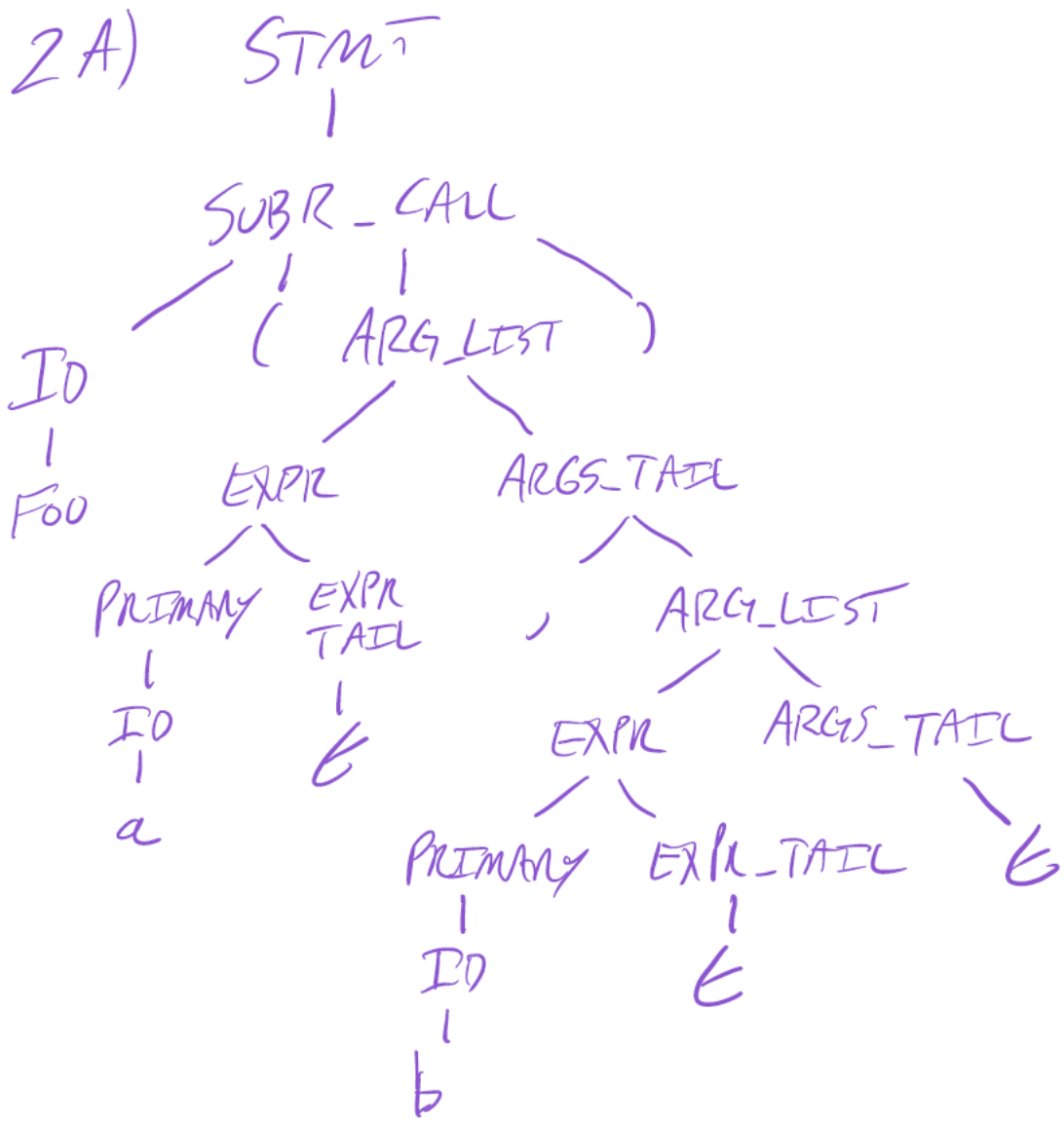
op → + | - | * | /

arg list → expr args tail

args tail → , arg list

→ epsilon

(a) construct a tree for the parse string foo(a, b)



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  (b) Give a canonical (right-most) derivation of the same string
stmt -> subr call
     -> id (args list)
     -> id (expr args tail)
     -> id (expr , arg list)
     -> id (expr , expr args tail)
     -> id (expr, expr epsilon)
     -> id (expr, primary expr tail epsilon)
     -> id (expr, primary expr tail)
     -> id (expr, primary epsilon)
     -> id (expr, primary)
     -> id (expr, id)
     -> id (primary expr tail , id)
     -> id (primary epsilon, id)
     -> id (primary , id)
     -> id (id , id)
      (foo) (a) (b)
```

109: 2.17 - Extend the grammar of Figure 2.25 to include if statements and while loops, along the lines suggested by the following examples:

abs := n

if n < 0 then abs := 0 - abs fi

sum : = 0

read count

while count > 0 do

read n

sum := sum + n

count := count - 1

od

write sum

Addition

stmt -> IF cond THEN stmt_list FI

-> WHILE cond DO stmt_list OD

cond -> Factor boolop Factor

boolop -> <

-> >

-> <=

-> >=

-> ==

-> !=