BU CS320 Assignment 6: Context Free Grammars

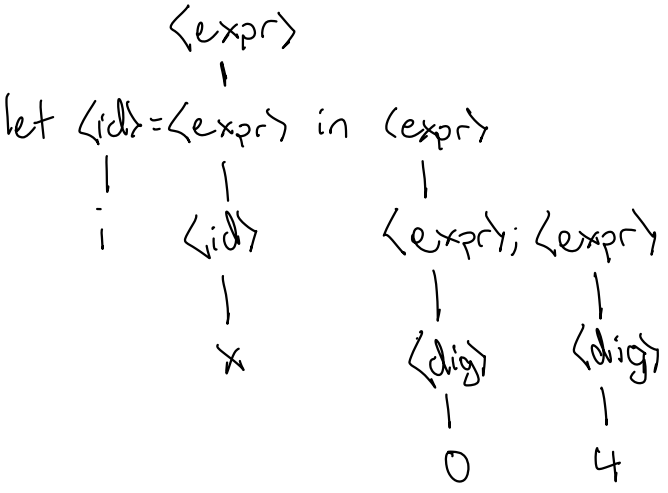
November 6, 2023

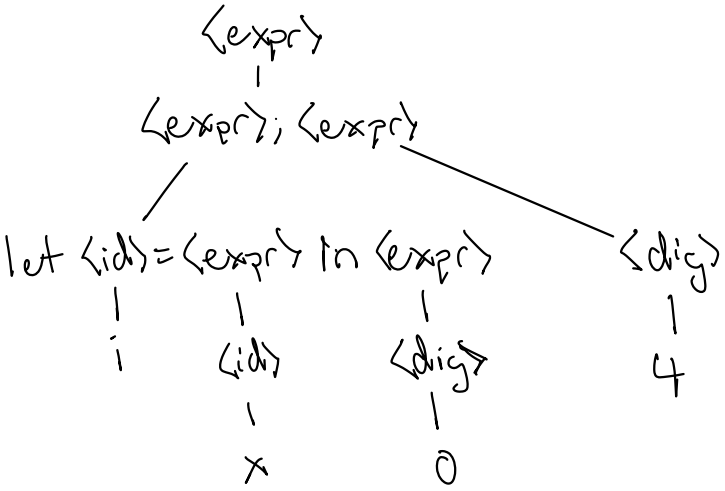
1. Given the following grammar where $\langle expr \rangle$ is the starting symbol:

$\langle id \rangle$	::=	a | b | c | ... | z
$\langle dig \rangle$	::=	0 | 1 | 2 | ... | 9
$\langle expr \rangle$	::=	() | $\langle dig \rangle$ | $\langle id \rangle$
	|	let $\langle id \rangle$ = $\langle expr \rangle$ in $\langle expr \rangle$
	|	$\langle expr \rangle$; $\langle expr \rangle$
	|	begin $\langle expr \rangle$ end

Demonstrate the grammar above is ambiguous.

We can draw 2 distinct parse trees for the sequential form
let i = x in 0;4





2. Modify the grammar (reproduced below) to be unambiguous. Hint: There is not just one way.

⟨*id*⟩	::=	a | b | c | ... | z
⟨*dig*⟩	::=	0 | 1 | 2 | ... | 9
⟨*expr*⟩	::=	() | ⟨*dig*⟩ | ⟨*id*⟩
	|	let ⟨*id*⟩ = ⟨*expr*⟩ in ⟨*expr*⟩
	|	⟨*expr*⟩ ; ⟨*expr*⟩
	|	begin ⟨*expr*⟩ end

⟨id⟩ ::= a | b | c | ... | z

⟨dig⟩ ::= 0 | 1 | 2 | ... | 9

⟨expr⟩ ::= ⟨sub⟩ | ⟨sub⟩ ; ⟨expr⟩

⟨sub⟩ ::= () | ⟨dig⟩ | ⟨id⟩

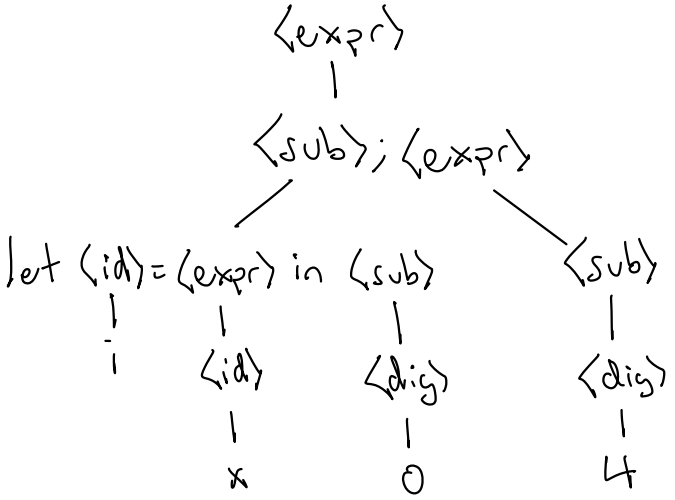
| let ⟨id⟩ = ⟨expr⟩ in ⟨sub⟩

| begin ⟨expr⟩ end

We make the grammar unambiguous by breaking symmetry and committing to one choice

3. Demonstrate your modified grammar fixes the previously shown ambiguity.

Let us contruct the sequential form let i=x in 0;4, only this time using the modified grammar.



There is now only parse tree corresponding to the sequential form, and we have fixed the ambiguity found in problem 1.