

# CS410 Midterm Exam

[Bono  
Fall 06]

## Solution

### Problem 1

action  $[s, a] = \text{shift } s'$

push  $s'$  on the stack  
(don't shift  $a$ )

action  $[s, a] = \text{reduce } A \rightarrow \alpha$

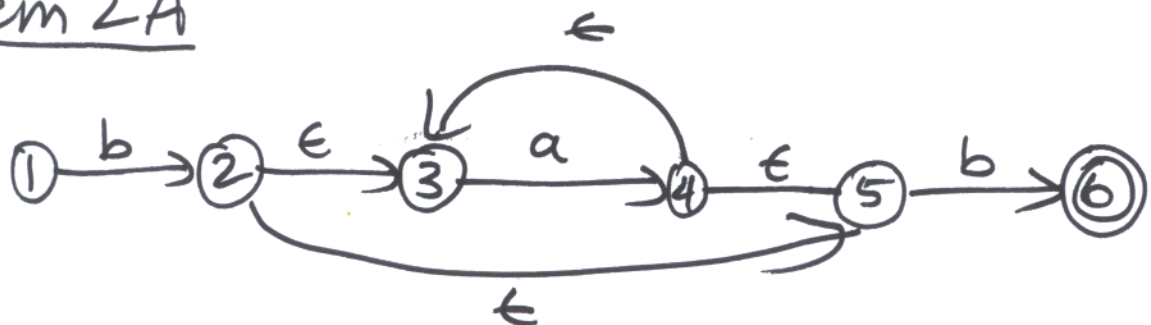
1. pop  $|\alpha|$  states off the stack

2. Suppose  $s'$  is the state now on top of the stack.

Push state  $s''$ , where

$s'' = \text{goto}[s', A]$ .

### Problem 2A



Problem 2b

	a	b
[1]	-	[235]
[235]	[345]	[6]
[345]	[345]	[6]
[6]	-	-

Problem 3 (many correct answers)

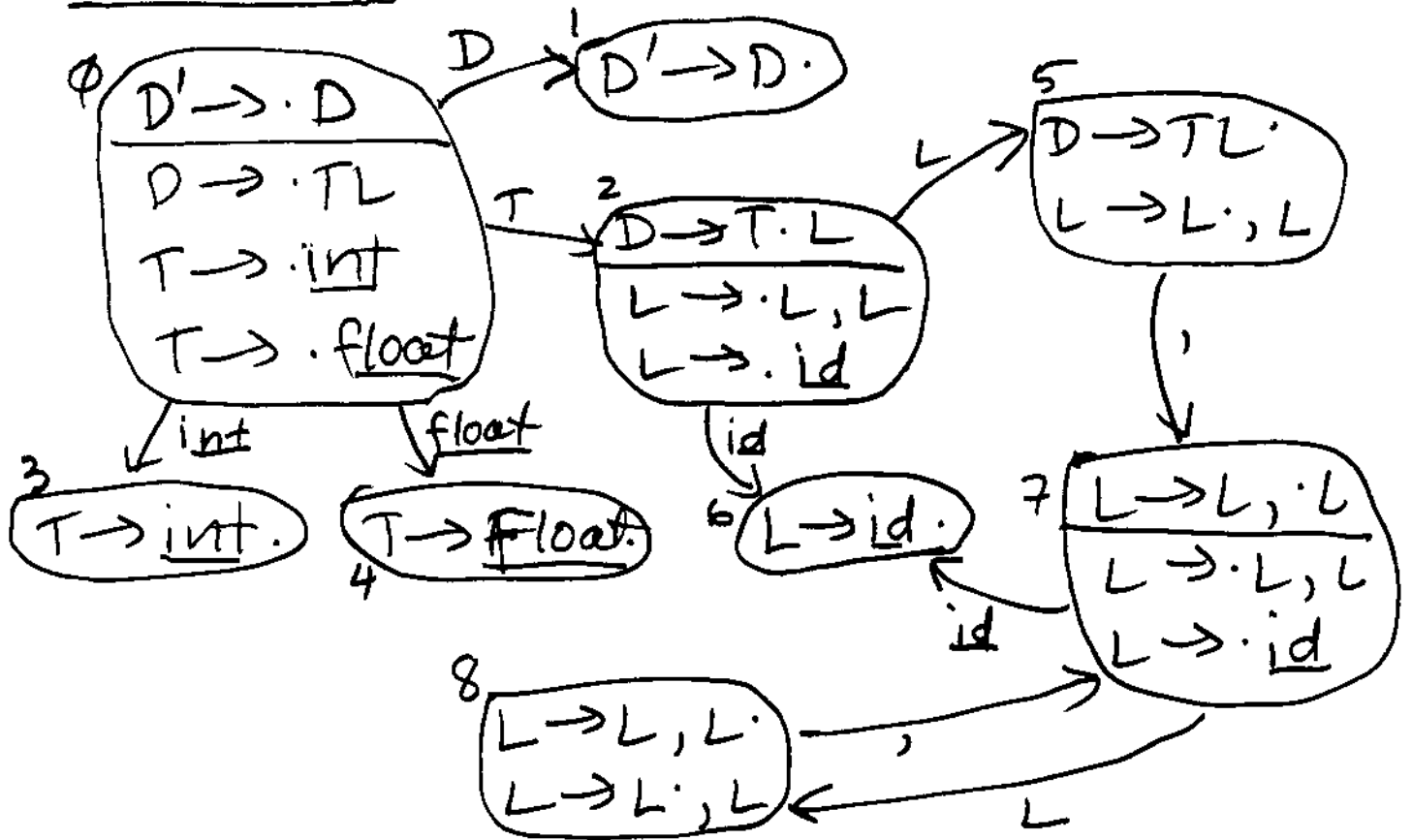
stmt  $\rightarrow a = b$   
 $\mid \{sL\}$

$sL \rightarrow \epsilon$   
 $\mid sL \text{ stmt}$

Problem 4

- ... int a#b;    (L) invalid lexeme '#'
- Blob y;    (S) 'Blob' not defined
- ... (x+10)    (P) invalid formal param def.
- ... (z + true);    (S) bool is invalid operand type for '+'.
- ... return z 20;    (P) extra tokens after return expression

Problem 5a



Problem 5b

$FOL(D') = \{ \$ \}$

$FOL(D) = \{ \$ \}$

$FOL(T) = FIR(L)$   
 $= \{ id \}$

$FOL(L) = \{ ', ' \} \cup FOL(D) = \{ ', ' , \$ \}$

$FIR(L) = \{ id \}$

$FIR(T) = \{ \underline{int}, \underline{float} \}$

$FIR(D) = FIR(T) = \{ \underline{int}, \underline{float} \}$

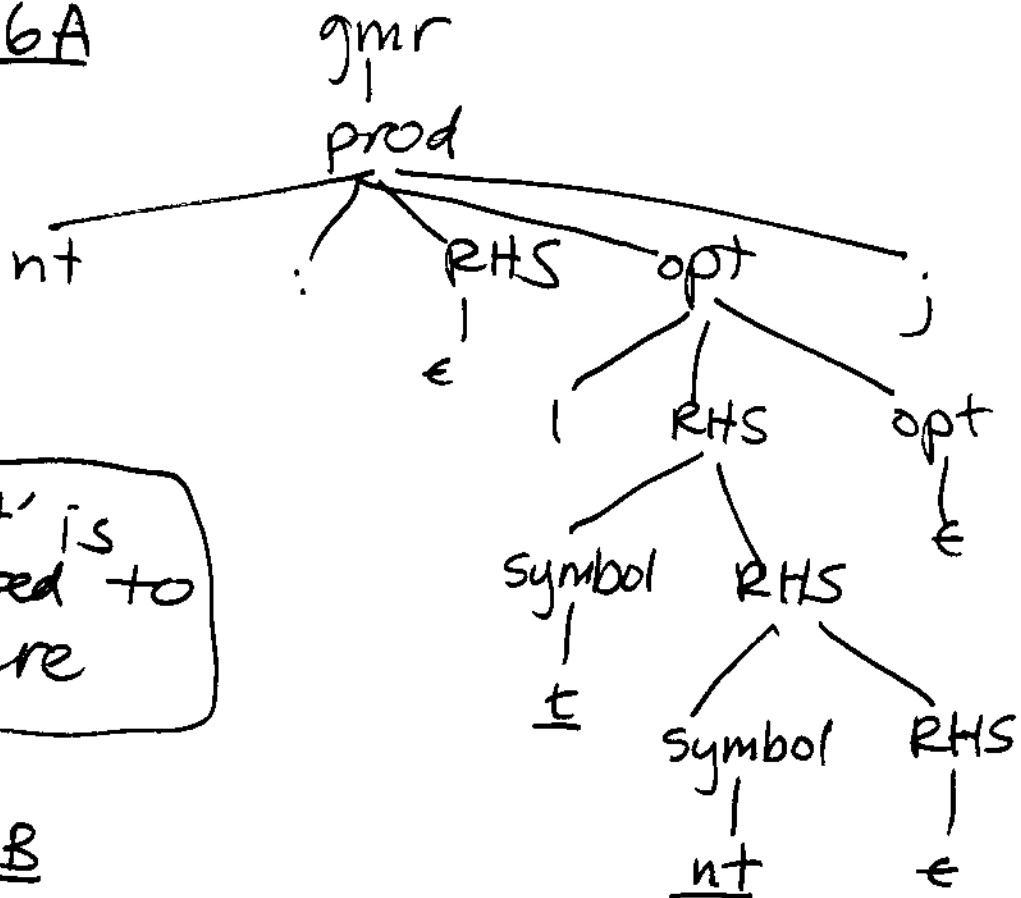
$FIR(D') = FIR(D) = \{ \underline{int}, \underline{float} \}$

Problem 5c Conflict in

action [8, ','] =  $\rightarrow$  shift + 7 (from DFA, above)

$\rightarrow$  reduce  $L \rightarrow L, L$

(reduce because  $FOL(L)$  contains ',')

Problem 6A

Note:

'optRHSList' is abbreviated to 'opt' here

Problem 6B

$$\text{gmr} \rightarrow \text{prod} \quad \{ \text{gmr.empty} = \text{prod.empty}; \}$$

$$\text{gmr} \rightarrow \text{gmr}, \text{prod} \quad \{ \text{gmr.empty} = \text{gmr}. \text{empty} \parallel \text{prod.empty}; \}$$

$$\text{prod} \rightarrow \text{nt} : \text{RHS opt};$$

$$\{ \text{prod.empty} = \text{RHS.empty} \parallel \text{opt.empty}; \}$$

$$\text{RHS} \rightarrow \text{symbol RHS}_1 \quad \{ \text{RHS.empty} = \text{false}; \}$$

$$\text{RHS} \rightarrow \epsilon \quad \{ \text{RHS.empty} = \text{true}; \}$$

$$\text{symbol} \rightarrow \underline{\epsilon}$$

$$\text{symbol} \rightarrow \text{nt}$$

$$\text{opt} \rightarrow '|' \text{RHS opt};$$

$$\{ \text{opt.empty} = \text{RHS.empty} \parallel \text{opt}. \text{empty}; \}$$

$$\text{opt} \rightarrow \epsilon \quad \{ \text{opt.empty} = \text{false}; \}$$

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