

Compilers & Programming Languages

SOFE 3960U

Assignment #2

Jason Runzer

100520993

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(A1)

New Grammar

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```

prog      : stmt-list
stmt-list : stmt A
A         : stmt-list |  $\epsilon$ 
stmt      : PRINT expr | PRINT string
string    : BEGINQUOTE charlist ENDQUOTE
charlist  : LETTER charlist |  $\epsilon$ 
expr      : term C
C         : + term C | - term C |  $\epsilon$ 
term      : factor D
D         : * factor D | / factor D |  $\epsilon$ 
factor    : ( expr ) | NUM

```

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(A2)

Left factored grammar

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```

prog      : stmt-list
stmt-list : stmt A
A         : stmt-list |  $\epsilon$ 
stmt      : PRINT B
B         : expr | string
string    : BEGINQUOTE charlist ENDQUOTE
charlist  : LETTER charlist |  $\epsilon$ 
expr      : term C
C         : + term C | - term C |  $\epsilon$ 
term      : factor D
D         : * factor D | / factor D |  $\epsilon$ 
factor    : ( expr ) | NUM

```

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(A3)

First Sets

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$\text{First}(\text{prog}) = \{\text{PRINT}\}$   
 $\text{First}(\text{stmt-list}) = \{\text{PRINT}\}$   
 $\text{First}(A) = \{\text{PRINT}\}$   
 $\text{First}(\text{stmt}) = \{\text{PRINT}\}$   
 $\text{First}(B) = \{(\text{, BEGINQUOTE, NUM})\}$   
 $\text{First}(\text{string}) = \{\text{BEGINQUOTE}\}$   
 $\text{First}(\text{charlist}) = \{\text{LETTER}, \epsilon\}$   
 $\text{First}(\text{expr}) = \{(\text{, NUM})\}$   
 $\text{First}(C) = \{+, -, \epsilon\}$   
 $\text{First}(\text{term}) = \{(\text{, NUM})\}$   
 $\text{First}(D) = \{*, /, \epsilon\}$   
 $\text{First}(\text{factor}) = \{(\text{, NUM})\}$

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(A4)

Follow Sets

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$\text{Follow}(\text{prog}) = \{\$ \}$   
 $\text{Follow}(\text{stmt-list}) = \{\$ \}$   
 $\text{Follow}(A) = \text{Follow}(\text{stmt-list}) = \{\$ \}$   
 $\text{Follow}(\text{stmt}) = \{\text{PRINT}, \$ \}$   
 $\text{Follow}(B) = \{ \}$   
 $\text{Follow}(\text{string}) = \{ \}$   
 $\text{Follow}(\text{charlist}) = \{\text{ENDQUOTE}\}$   
 $\text{Follow}(\text{expr}) = \{ \}$   
 $\text{Follow}(C) = \text{Follow}(\text{expr}) = \{ \}$   
 $\text{Follow}(\text{term}) = \text{First}(c) + \text{Follow}(\text{expr}) + \text{First}(D) - \{ \epsilon \} = \{+, -, *, /, \epsilon \}$   
 $\text{Follow}(D) = \text{Follow}(\text{term}) = \{+, -, \epsilon \}$   
 $\text{Follow}(\text{factor}) = \text{First}(D) + \text{Follow}(\text{term}) - \{ \epsilon \} = \{+, -, *, /, \epsilon \}$

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(A5)

Non-Ter minal Symbol	Input Symbol											
	PRINT	BEGINQUOTE	ENDQUOTE	LETTER	+	-	*	/	(	)	NUM	\$
prog	stmt-list											
stmt-list	stmt A											
A	stmt-list											$\epsilon$
stmt	PRINT B											
B		string							expr			
string		BEGINQUOTE charlist ENDQUOTE										
charlist			$\epsilon$	LETTER charlist								
expr									term C		term C	
C					+ term C	- term C				$\epsilon$		$\epsilon$
term									factor D		factor D	
D					$\epsilon$	$\epsilon$	* factor D	/ factor D		$\epsilon$		$\epsilon$
factor									( expr )		NUM	

(A6)

(A6)

