CSC215

Math and Computer Science

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& TECHNOLOGY

Infix, Prefix, and Postfix

- Different ways to represent mathematical expressions
- Operator between 2 operands

  Infix: 3 + 4
- Operator followed by 2 operands

  Prefix: +34
- 2 operands followed by Operator

  Postfix: 34+

Why Bother?

3 + 4 * 5 = 35 or 23 ??????

Which is it?

How would I make it 35

(3 + 4) * 5 = 35

Need associativity and precedence rules with infix.

Prefix

+3*45	or	*+345
+ 3 *45		* +34 5
+ 3 20		* 7 5
23		35

- No need for precedence rules or associativity
- Each operator will have 2 operands and are evaluated as they are encountered

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Postfix

345*+	or	34+5*
3 45* +		34+ 5 *
3 20 +		7 5 *
23		35

- No need for precedence rules or associativity
- Each operator will have 2 operands and are evaluated as they are encountered

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Convert Infix to Prefix- Recursive Descent

3 * 4 + 9 / 3		find last operator
↑		
+ E1 E2		split- op left right
E1 = 3*4	E2 = 9/3	repeat
↑	↑	
* E3 E4	/ E5 E6	split- op left right
E3 = 3 E4 = 4	E5 = 9 E6 = 3	stop when only operands remain
E1 = *34	E2 = /93	substitute in appropriate values
+ *34 /93		

Note: Operands stay in the same order, only the operators move.

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Convert Infix to Prefix- Fully Parenthesis

3 * 4 + 9 / 3	Add ()'s to equation
((3 * 4) + (9 / 3))	move operators and remove ()'s
((3 * 4) + (9 / 3))	move the * to the front of the expression
(*34 + (9 / 3))	move the / to the front of the expression
(*34 + /93)	move the + to the front of the expression
+*34/93	Convert expression when no more ()'s left

Note: Operands stay in the same order, only the operators move.

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Convert Infix to Postfix- Recursive Descent

3 * 4 + 9 / 3		find last operator
↑		
E1 E2 +		split- left right op
E1 = 3*4	E2 = 9/3	repeat
↑	↑	
E3 E4 *	E5 E6 /	split- left right op
E3 = 3 E4 = 4	E5 = 9 E6 = 3	stop when only operands remain
E1 = 34*	E2 = 93/	substitute in appropriate values
34* 93/ +		

Note: Operands stay in the same order, only the operators move.

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Convert Infix to Postfix- Fully Parenthesis

3 * 4 + 9 / 3	Add ()'s to equation
((3 * 4) + (9 / 3))	move operators and remove ()'s
((3 * 4) + (9 / 3))	move the * to the end of the expression
(34* + (9 / 3))	move the / to the end of the expression
(34* + 93/)	move the + to the end of the expression
34*93/+	Convert expression when no more ()'s left

Note: Operands stay in the same order, only the operators move.

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Convert to Prefix and Postfix

A – B + C * D / E	+-AB/*CDE	AB-CD*E/+
A + B * C / D – E * F	-+A/*BCD*EF	ABC*D/+EF*-
A * B + C * D / E + F	++*AB/*CDEF	AB*CD*E/+F+
A * (B + C) – E	-*A+BCE	ABC+*E-

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Evaluating Prefix Expressions (+)

+ * 3 4 / 9 3

Have operator, must have 2 operands, (operand can be prefix)

+ _____ _____

Move to next item in expression

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Evaluating Prefix Expressions (*)

+ * 3 4 / 9 3

Have operator, must have 2 operands, (operand can be prefix)

* _____ _____

Move to next item in expression

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Evaluating Prefix Expressions (*)

+ * 3 4 / 9 3

Is a digit, done evaluating the 1st operand

* 3 _____

Move to next item in expression

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Evaluating Prefix Expressions (*)

+ * 3 4 / 9 3

Is a digit, done evaluating the 2nd operand

* 3 4

Do the multiplication and that is the 1st operand for the +

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Evaluating Prefix Expressions (+)

+ * 3 4 / 9 3

Is a digit, done evaluating the 2nd operand

+ 12 _____

Move to next item in the expression and evaluate 2nd operand for +

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Evaluating Prefix Expressions (/)

+ * 3 4 / 9 3

Have operator, must have 2 operands, (operand can be prefix)

/ _____ _____

Move to next item in the expression

Evaluating Prefix Expressions (/)

+ * 3 4 / 9 3

Is a digit, Done evaluating 1st operand for the /

/ 9 _____

Move to next item in the expression

Evaluating Prefix Expressions (/)

+ * 3 4 / 9 3

Is a digit, Done evaluating 2nd operand for the /

/ 9 3

Do the division and that is the 2nd operand for the +

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Evaluating Prefix Expressions (+)

+ * 3 4 / 9 3

+ 12 3

Have 2 operands for the +, do the operation

15

No more operators or operands, done

Evaluating Postfix Expressions (+)

3 4 * 9 3 / +

Is an operator, need 2 operands for to evaluate the +

_____ _____ +

Move back one spot in expression and evaluate

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Evaluating Postfix Expressions (/)

3 4 * 9 3 / +

Is an operator, need 2 operands for to evaluate the +

_____ _____ /

Move back one spot in expression and evaluate

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Evaluating Postfix Expressions (/)

3 4 * 9 3 / +

Is a digit, done evaluating 2nd expression for the /

_____ ___3___ /

Move back one spot in expression and evaluate

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Evaluating Postfix Expressions (/)

3 4 * 9 3 / +

Is a digit, done evaluating 1st expression for the /

9 3 /

Have 2 operands for the /, do the operation

Evaluating Postfix Expressions (+)

3 4 * 9 3 / +

Is a digit, done evaluating 2nd operand for the +

_____ __3__ +

Move back one spot in expression and find 1st operand

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Evaluating Postfix Expressions (*)

3 4 * 9 3 / +

Is an operand, need 2 operands for to evaluate the *

_____ _____ *

Move back one spot in expression and find 2nd operand

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Evaluating Postfix Expressions (*)

3 4 * 9 3 / +

Is a digit, done evaluating the 2nd operand for the *

_____ __4__ *

Move back one spot in expression and find 1st operand

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Evaluating Postfix Expressions (*)

3 4 * 9 3 / +

Is a digit, done evaluating the 1st operand for the *

3 4 *

Have 2 operands for the *, do the operation

Evaluating Postfix Expressions (+)

3 4 * 9 3 / +

12 3 +

Have 2 operands for the +, do the operation

15

No more operators or operands, done

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Evaluate the Following

*+458		837+*	
	72		80
+*45+78		65*96++	
	35		45
+/*9739		196*24*++	
	30		63
/+1+*96*429		79*3/9+6/	
	7		5

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Shortcut to Evaluate prefix

/+1+*96*429	Find operator followed by 2 digits and evaluate
/+1+*96*429	
/+1+54*429	Repeat
/+1+5489	Repeat
/+1629	Repeat
/639	Repeat
7	No more operators, done

Blue: represents an operand with more than one digit

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Shortcut to Evaluate Postfix

79*3/9+6/	Find 2 digits followed by operator and evaluate
79*3/9+6/	
633/9+6/	Repeat
219+6/	Repeat
306/	Repeat
5	No more operators, done

Blue: represents an operand with more than one digit

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