Linked Lists and Stacks

Snarf the code for today

Announcements

• Piazza
  • code must be private

• APT set 3 - due tomorrow

• Exam review - Wednesday
  • come with questions

• Exam - Friday
Today

- Write a data structure from scratch!
  - Stack implemented with a Linked List

- Practice with stacks

- Practice with linked lists

- Write a simple calculator

Stacks

- Why do you care?
  - Call stack (how your programs are run)
    - Help with recursion (after exam)

  - Expression evaluation (today)

  - Backtracking (an a couple of weeks)
Order of Operations

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$

• How does a computer know order of operations?

Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$
• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)
• $4 \times 5 \div 2 + 5 \times 6 + 7 - 5 = ?$

• compare operators
  • if higher or same priority

2/10/13
Stacks

• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

• compare operators
  • if higher or same priority
    • pop #

\[ \begin{array}{c|c}
5 & \times \\
4 & \\
\end{array} \]

Stacks

• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

• compare operators
  • if higher or same priority
    • pop #
    • pop #

\[ \begin{array}{c|c}
4 & 5 \\
4 & \times \\
\end{array} \]
Stacks

- \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

- compare operators
  - if higher or same priority
    - pop #
    - pop #
    - pop operation

\[4 \times 5\]

Numbers Operators

\[4 \times 5\]

2/10/13

Stacks

- \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

- compare operators
  - if higher or same priority
    - pop #
    - pop #
    - pop operation
    - push answer

\[4 \times 5\]

2/10/13

\[4 \times 5\]

20

Numbers Operators

2/10/13
• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

20 /
Stacks

• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

Numbers

 Operators

2 20 /
Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 =$?

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

20 / 2

Numbers Operators

2/10/13
- \( 4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ? \)

- compare operators
  - if higher or same priority
    - pop #
    - pop #
    - pop operation
    - push answer
    - push operation

- \( 20 / 2 \)
  - 10
  - +

- \( 5 \)
  - 10
  - +
Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 =$?

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

2/10/13 Numbers Operators

5 10

2/10/13

Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 =$?

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

2/10/13 Numbers Operators

6 5

10
Stacks

- \( 4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ? \)

- compare operators
  - if higher or same priority
    - pop #
    - pop #
    - pop operation
    - push answer
    - push operation

6
5
10

• 4 * 5 / 2 + 5 * 6 + 7 - 5 = ?

- compare operators
  - if higher or same priority
    - pop #
    - pop #
    - pop operation
    - push answer
    - push operation

5 * 6
30
10

+ +
Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

Numbers

Operators

7

30

10

+ +  

Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

Numbers

Operators

7

30

10

- + +
Stacks

• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

• compare operators
  • if higher or same priority
    • pop #
    • pop #
    • pop operation
    • push answer
    • push operation

Numbers

\begin{array}{c}
5 \\
7 \\
30 \\
10 \\
\end{array}

Operators

\begin{array}{c}
- \\
+ \\
+ \\
\end{array}

Stacks

• \(4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?\)

7 - 5

\begin{array}{c}
5 \\
7 \\
30 \\
10 \\
\end{array}

Operators

\begin{array}{c}
- \\
+ \\
+ \\
\end{array}
• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$

$7 - 5$

2

30

10

+  

+  

30 + 2

2

30

10

+  

+  
Stacks

- \( 4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ? \)

30 + 2

32

10

+  

Stacks

- \( 4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ? \)

10 + 32

32

10

+  

2/10/13
Stacks

• $4 \times 5 / 2 + 5 \times 6 + 7 - 5 = ?$

The answer to life the universe and everything

Numbers

Operators

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