**Programming Assignment #3**

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**Design:**

This program was designed to implement a postfix calculator with user-created variables. The program takes in an expression of the form “Variable = Number Number Operator Number Operator Number Operator...” where “Variable” is any string made of letters, “Number” is any integer, and “Operator” is either +, -, /, \*, or ^. The operators stood for basic arithmetic actions (addition, subtraction, division, multiplication, and exponential, respectively). The postfix calculator used a stack (FILO) to store and compute the values. The variables that the user created were stored in a linked list.

**Implementation:**

The program was implemented without variable functionality at first, and once the computation functionality was perfected using the stack class, the linked list class was implemented. No sample code was used, but pseudocode from the Assignment 3 Description was used as a skeleton for the main function. Instead of using an infinite while loop and a break statement for when the user gave the stop-condition (“#”), a while loop was used with the condition that it terminated when the stop-condition was given. This design decision was made because break statements are lazy most of the time. The program took about 4 days to complete.

**Testing:**

The assignment compiled and ran on a computer using Netbeans 8.0.1 on Linux Mint XFCE. Normal inputs were strings consisting of the structure given in the Design paragraph; abnormal inputs involved dividing by zero, using variables that hadn't been initialized yet in the computations, and numbers and operators in a strange order that caused stack overflow/underflow.

**Summary:**

Overall, the assignment was a success. The program successfully outputs the correct values, and the user can declare and use variables without problem. When the user inputs something improper, the program gives useful and descriptive error statements. The program took 4 days to complete.

**Test Case 1:**

---POSTFIX CALCULATOR---

Enter # to quit; enter ? to see list of variables.

> Sum = 3 9 +

Sum = 12

> Difference = 3 9 -

Difference = -6

> Product = 3 9 \*

Product = 27

> Quotient = 3 9 /

Quotient = 0

> ?

---BEGIN PRINT---

Quotient = 0

Product = 27

Difference = -6

Sum = 12

---END PRINT---

> #

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(program exited with code: 0)

Press return to continue

**Test Case 2:**

---POSTFIX CALCULATOR---

Enter # to quit; enter ? to see list of variables.

> A = 3 4 \* 0 /

Division by zero is prohibited

> A = B 3 \*

Invalid expression. Value of B is unknown

> ?

---BEGIN PRINT---

---END PRINT---

> #

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(program exited with code: 0)

Press return to continue

**Test Case 3:**

---POSTFIX CALCULATOR---

Enter # to quit; enter ? to see list of variables.

> A = 3 -

Stack underflow. Invalid expression

> A = 3 4 5 6 7 8 9 0 3 4 5 6

Stack overflow. Invalid expression

Stack overflow. Invalid expression

A = 4

> ?

---BEGIN PRINT---

A = 4

---END PRINT---

> #

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(program exited with code: 0)

Press return to continue