

Assignment One

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Problem One

Compiling and running programs on the command line.

- Open a command line window and compile the Java program with the 'javac' compiler.
- Verify that you have a compiled program using the 'dir' command (on Windows).
- Run the compiled program using the 'java' virtual machine.
- Compile and link the C++ program using the GNU C++ compiler.
- Verify that you have an executable file of the program.
- Execute the executable program.
- Show all your work.

The screenshot shows a terminal window with two separate compilation and execution processes. The top process is for a Java program named 'Trapezoid Area Computer'. The bottom process is for a C++ program named 'Trapezoid Area Computer'.

```
12 import java.util.Scanner;
13
14 class TrapezoidArea {
15     public static void main(String[] args) {
16         Scanner input = new Scanner(System.in);
17         System.out.println("Trapezoid Area Computer");
18         System.out.print("Enter the top base of Trapezoid: ");
19         int top_base = input.nextInt();
20         System.out.print("Enter the bottom base of Trapezoid: ");
21         int bottom_base = input.nextInt();
22         System.out.print("Enter the height of Trapezoid: ");
23         int height = input.nextInt();
24         double area = ((top_base + bottom_base)/2) * height;
25         System.out.println("The area of the Trapezoid is: " + area);
26     }
27 }
```

```
11 #include <stdio.h>
12
13 int main()
14 {
15     printf("Trapezoid Area Computer\n");
16     int top_base, bottom_base, height;
17     scanf("%d", &top_base);
18     printf("Enter the top base of Trapezoid: ");
19     scanf("%d", &bottom_base);
20     printf("Enter the height of Trapezoid: ");
21     scanf("%d", &height);
22     double area = ((top_base + bottom_base)/2)*height;
23     printf("The area of the Trapezoid is: %f", area);
24     return 0;
25 }
```

The terminal output shows the execution of both programs. The Java program prompts for the top base, bottom base, and height, and then calculates the area. The C++ program prompts for the top base, bottom base, and height, and then calculates the area. Both programs output the area of the trapezoid.

Problem Two

Rewrite the BNF of Example 3.4 to give + precedence over * and force + to be right associative.

$$\begin{aligned} \langle assignment \rangle &\mapsto \langle id \rangle = \langle expression \rangle \\ \langle id \rangle &\mapsto A \\ \langle id \rangle &\mapsto B \\ \langle id \rangle &\mapsto C \\ \langle expression \rangle &\mapsto \langle expression \rangle * \langle term \rangle \\ \langle expression \rangle &\mapsto \langle term \rangle \\ \langle term \rangle &\mapsto \langle factor \rangle + \langle term \rangle \\ \langle term \rangle &\mapsto \langle factor \rangle \\ \langle factor \rangle &\mapsto \langle expression \rangle \\ \langle factor \rangle &\mapsto \langle id \rangle \end{aligned}$$

Problem Three

Using the grammar in Example 3.4, show a parse tree and a leftmost derivation for each of the following statement: $A = B * (C * (A + B))$

Derivation

$$\begin{aligned} \langle assignment \rangle &\mapsto \langle id \rangle = \langle expression \rangle \\ &\mapsto A = \langle expression \rangle \\ &\mapsto A = \langle id \rangle * \langle expression \rangle \\ &\mapsto A = B * \langle expression \rangle \\ &\mapsto A = B * (\langle expression \rangle) \\ &\mapsto A = B * (\langle id \rangle * \langle expression \rangle) \\ &\mapsto A = B * (C * \langle expression \rangle) \\ &\mapsto A = B * (C * (\langle expression \rangle)) \\ &\mapsto A = B * (C * (\langle id \rangle + \langle expression \rangle)) \\ &\mapsto A = B * (C * (A + \langle expression \rangle)) \\ &\mapsto A = B * (C * (A + \langle id \rangle)) \\ &\mapsto A = B * (C * (A + B)) \end{aligned}$$

Parse Tree

