Program Design & Testing Document for Program 4
Lyell C Read

Additions in RED, Removals in GREY

Problem Statement

The problem asks me to create a program that can fulfil the following requirements: (source: canvas / Justin Goins):

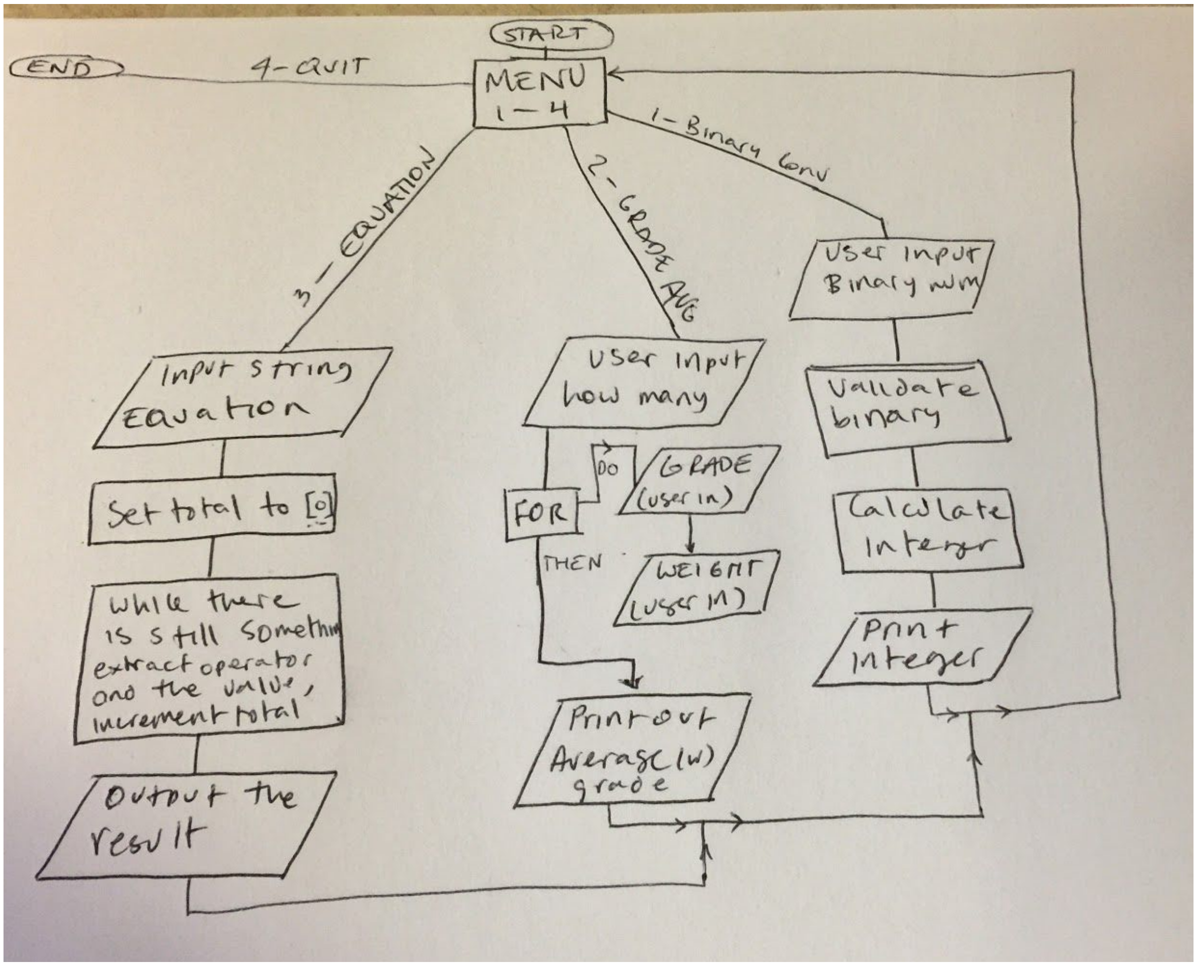
- Clarification (10/23/18): Your code should detect cases where the number or ordering of operands is incorrect. For example, the calculation "6 + 4.125 + 7 9" would display an error, as would "6 + / 6".
- There should be spaces between each operand and operator.
- The input should be taken as a string.
- There should not be competing precedence. Everything will be calculated left to right.
- The binary conversions will only handle unsigned, positive values.
- The grade calculator should prompt for the number of grades to be entered, collect those grades
- from the user and average them. The user should also be given an option to calculate a weighted
- average. For this option the program will need to take a weight from the user and multiply it by
- the average. If you are unfamiliar with weighted averages, see the introduction at: https://www.wikihow.com/Calculate-Weighted-Average (Links to an external site.)Links to an external site.
- Your program should handle all input errors such as a user putting in an invalid character or
- number.
- All function bodies must be 15 lines of code or less, including main(). Whitespace and
- lines with just curly braces do not count in the line count.
- No global variables or goto functions.

To summarize the above, the program will have to evaluate and error check an input in the form 4 - 2 / 44 - 2.3 as a string. The program will also convert unsigned binaries, and calculate grades using a weighted average. Also, there will be an option to average the grades in an unweighted manner (could just substitute 1/grade_num for weight).

Understanding the Problem

The problem asks for a program that can convert binary input to integer output, that can evaluate string equations (presented as “9 + 3 / 5”) and that can calculate the average grade using a weighted score system. The hardest constraint will be that all functions will have to be under 15 LOCs.

Devising a Plan



Pseudo Code (Simplified)

```
menu ():
    List 4 options
    Seek user input
    Call appropriate function for user input, or exit() if 4 (see diagram)

Binary to integer:
    For every digit in the binary number,
        check that it is either a 1 or a 0 - otherwise, break
    For every digit starting with the highest index (len-1)
```

```
        multiply by the appropriate quantity of 2^x
    Add these together and print the value,
    break
```

```
next-operator (eq):
    Copy off the first digit of the eq
    Remove the first 2 digits of the eq (operator and space)
    Return the first digit of the equation which is the operator
```

```
Next-integer (eq):
    While the value after the first one (index [0]) is an integer:
        Flag += 1
    Copy off all the digits from 0 --> flag
    Remove all the digits from 0-->flag+1 (to account for the space)
    Return the number
```

```
Evaluate:
    Total = next-integer (strips the initial number, and leaves the operator there, while also making a base)
    While there's still something left as part of eq:
        Operand is the return of next-operator
        Integer is the return of next-integer
        Depending on what operator is, perform the operation on total and integer
    Print total which is the outcome value
```

```
Evaluate:
    Call strtok on the string with a space as the 'delimiting character'
    If the result of the first call of strtok is not an integer, or is blank, toss up an error.
    Set the first result of strtok to total, this will be our 'base'
    Define that we are expecting to see an operator next
    While there are still 'pieces' of the equation left
        If i am expecting an operator and strtok returns an operator
            Store that operator in a char
        Otherwise, if I am expecting a number, check that it is only made of numbers
            If it is, call a separate function (because of the lines/function requirement) to do the appropriate operation stored in the char earlier on the total
            Update total accordingly
        Otherwise, there must be an error.
            Print that out
            Return something so parent function knows of failure.
        Flip the indicator of operator or integer
    Return something to tell the parent we made success
```

Weighted grade calculator (uses mostly doubles)

```
Ask user for num, which is how many grades they want to enter
grade=0
For num:
    If user has selected to do unweighted:
        weight=(1/num)
    Else
        Ask for weight
    Ask for grade
    Grade += (100*(weight/100 * grade/100))
Print grade
```

Predicted Results

Value	What Should Happen	Does This Happen
“”	Error - nothing entered	yes
“2”	2	yes
“oasdjfasone”	Error - improper formatting	yes
“9 + 9 / 73234”	0	yes
“99 + 11 * 100”	11000	yes
“9/ 2 + 5”	Error - improper formatting	yes
“ 9 9 / 4 + 1”	Error - expected an operator	yes
27.2 / 6.5 85	Error	yes
b28 * 3.5	Error	yes
2.4 / cat	Error	yes
(empty string)	Error	yes
5.8w + 2.5	Error	yes
5.4 * 24 +	Error	yes
5.4 * 24 + / 25	Error	yes