CSC 173 Project 2
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I used Sublime Text as the text editor.
All codes and tests are run on Fedora Linux in docker for Mac.

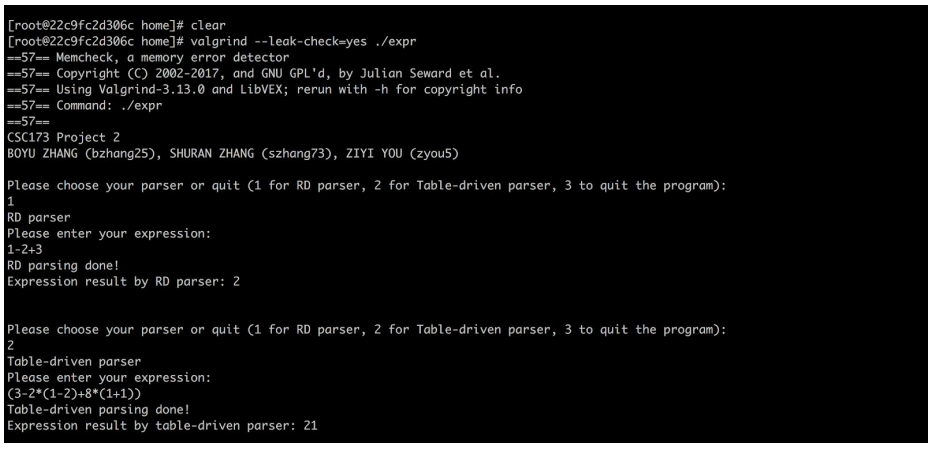
To build my project:

1. Change to my working dictionary "CSC173_proj2_Boyu_Zhang" through the terminal of Fedora.
2. Please copy and paste the following command (all three assignment are in expr.c):
   gcc -std=c99 -Wall -Werror -o expr expr.c

To run my project:

1. Under working dictionary, "CSC173_proj2_Boyu_Zhang", copy and paste the following command: ./expr
2. Following the prompts: choose the parser or quit → enter the expression
3. I created the "read-eval-print loop" Prof. Ferguson required, so you can test as much expression as you want on any assignment. Enter "3" to quit.
4. All the arithmetic rule are the same as FOCS and UNIX calculator 'bc'. For example, 2/10 will yield 0.
5. 'printTree(TREE tree, int space)' function prints the tree to standard output, i.e., the form Prof. Ferguson required. It is called after each parsing automatically no matter which parser you choose.
6. 'CalculateTree' function evaluates the parse tree and computes the value of subexpressions as appropriate and printing the final result. It is called after each parsing automatically no matter which parser you choose.

Demos:
Some common expressions for two parsers:



Some complex expressions, negative numbers, and relatively big numbers:

```
[root@22c9fc2d306c home]# valgrind --leak-check=yes ./expr
==59== Memcheck, a memory error detector
==59== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==59== Using Valgrind-3.13.0 and LibVEX; rerun with -h for copyright info
==59== Command: ./expr
==59==
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Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
1
RD parser
Please enter your expression:
(56-458*(21-987/(45+98))+7*(132-956))
RD parsing done!
Expression result by RD parser: -12582


Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
2
Table-driven parser
Please enter your expression:
(56-458*(21-987/(45+98))+7*(132-956))
Table-driven parsing done!
Expression result by table-driven parser: -12582


Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
3
Program terminated!
==59==
==59== HEAP SUMMARY:
==59==     in use at exit: 0 bytes in 0 blocks
==59==   total heap usage: 1,663 allocs, 1,663 frees, 39,536 bytes allocated
==59==
```

‘printTree(TREE tree, int space)’ function for 1-2+3

```
1-2+3
E
 T
  F
   N
    D
     1
    n
     e
  f
   e
 t
  -
  T
   F
    N
     D
      2
     n
      e
   f
    e
  t
   +
   T
    F
     N
      D
       3
      n
       e
    f
     e
   t
    e
```

Valgrind Tests:

ALL CLEAR FOR ALL FUNCTIONS

```
==47==
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Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
1
RD parser
Please enter your expression:
(3-2*(1-2)+8*(1+1))
RD parsing done!
Expression result by RD parser: 21


Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
2
Table-driven parser
Please enter your expression:
1234+5678-9800
Table-driven parsing done!
Expression result by table-driven parser: -2888


Please choose your parser or quit (1 for RD parser, 2 for Table-driven parser, 3 to quit the program):
3
Program terminated!
==47==
==47== HEAP SUMMARY:
==47==     in use at exit: 0 bytes in 0 blocks
==47==   total heap usage: 721 allocs, 721 frees, 18,336 bytes allocated
==47==
==47== All heap blocks were freed -- no leaks are possible
==47==
==47== For counts of detected and suppressed errors, rerun with: -v
==47== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
[root@22c9fc2d306c home]#
```