Fall 2010
Introduction to C - Programming Assignment #5
Due date: November 17, 2010, 11:59pm

Objectives
1. Learn how to design a program using functions.
2. Review of if statements and loops.

Note: In this assignment, you are required to write one program.

Problem: First Prototype of a Car Computer
You have had a blast designing various different components of your car's computer system. Now, instead of creating any new functionality to the program, you will unify the work you have done into one single program that manages the different programs that your car's computer can run.

In particular, you will write a menu-driven program (the details of this will be discussed in class) that provides the user with the following options:

1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo (a wheel) to the display.
4) Play a multiplication game for the kids.
5) Print a visual display of the recent fuel efficiency in five minute intervals.
6) Quit

Each of these options will mimic Program 3A, Program 2B, Program 3B, Program 3C, and Program 4B, respectively. Thus, please consult these descriptions with respect to the functionality of your program. All input specifications and output specifications will remain the exact same as in the previous write-ups of these problems.

Implementation Requirements
The main program will read the input and will invoke different functions to carry out the above subtasks (note that the main program will pass the proper values to each function). You will have to write several functions in your program and these functions must adhere to the function prototypes, pre-conditions and post-conditions specified below.

```
/* Pre-condition:
     None
   Post-condition:
     Prints the menu.
*/
void printmenu();

/* Pre-condition:
     triplength: is a positive multiple of 5
```

```
        radius: represents the length of the radius of
             the wheels of the car, in inches.
     Post-condition:
        Asks the user about the number of revolutions and
        fuel used for each 5 minute interval of the trip
        and calculates and prints out the fuel efficiency
        for each of these intervals and the whole trip
        overall. Finally, the overall rating for the trip's
        fuel efficiency is printed.
     Notes:
        This function corresponds to Program 3A.
        This function invokes (uses/calls) the findfueleff
        and printrating functions.
*/
void tripfueleff(int triplength, double radius);


/* Pre-conditions:
        radius: represents the length of the radius of a
             car wheel, in inches,
        numrevs: represents the number of revolutions
             the wheels of the car have gone through in
             a period of time,
        gas: represents the amount of gas, in gallons, the
             car used in that same period of time.
     Post-conditions:
        Returns the fuel efficiency of the car during
        the interval specified by the input parameters,
        in miles per gallon. If no gas is used during the
        time period specified, 0 is returned if the car
        didn't move and MAX_MPG (100) is returned if the car
        did move during the time span.
*/
double findfueleff(double radius, double numrevs,
                    double gas);

/* Pre-condition:
        mpg: is the miles per gallon a car gets during a trip.
     Post-condition:
        An adjective (poor, average, good, excellent) will
        be printed to the screen corresponding to the
        input parameter.
*/
void printrating(double mpg);

/* Pre-condition:
        timetowork: represents the amount of time in
```

```
                minutes it takes to get to work,
          startdrive: represents how many minutes before
                work you start to drive there,
          rememberitem: represents how many minutes into
                the drive you remember that you left an item
                at home.
      Post-condition:
        Determines whether or not the user should go back
        home to pick up the item (i.e., if there is time
        to pick up the item), and prints the appropriate
        message.
      Note:
        This function corresponds to Program 2B.
*/
void getitem(int timetowork, int startdrive,
             int rememberitem);


/* Pre-condition:
        2 < innerradius < outerradius < 30
      Post-condition:
        A wheel with an outer radius of outerradius number
        of characters and with an inner radius of innerradius
        number of characters will get printed to the screen.
      Note:
        This function corresponds to Program 3B.
*/
void printlogo(int outerradius, int innerradius);


/* Pre-conditions:
        problemcount > 0
      Post-condition:
        Executes the multiplication game with problemcount
        problems and returns the number of seconds it took
        to correctly solve the problemcount problems.
      Note:
        This function corresponds to Program 3C.
*/
int multgame(int problemcount);


/* Pre-conditions: ifp points to the beginning of a valid
        file containing data about this trip. The format of
        this file specifies the format described in program 4.
      Post-condition: A graph will be printed out to the
        screen in the format specified by Program 4B, exactly
        how an 2007 Prius prints its fuel efficiency graph.
*/
void printfuelgraph(FILE* ifp);
```

You may add more functions to your program if you'd like. The functions listed above are required but, other than that, there are no implementation requirements.

References

CKnights: Sections 10, 12 and 13

Output Sample

Below is one sample output of running the program. Note that this sample is NOT a comprehensive test. You should test your program with different data than is shown here based on the specifications given above. In the sample run below, for clarity and ease of reading, the user input is given in *italics* while the program output is in bold.

Sample Run

Which of the following options would you like?
1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
1

How long is your trip, in minutes?
10
What is the radius of your tires, in inches?
15

During time interval #1, how many revolutions did your car's tires make?
10000
During time interval #1, how many gallons of gas did your car use?
0.75
Time 0-5 minutes: Your car averaged 19.83 miles per gallon.

During time interval #2, how many revolutions did your car's tires make?
20000
During time interval #2, how many gallons of gas did your car use?
0.50
Time 5-10 minutes: Your car averaged 59.50 miles per gallon.

For the whole trip, your car averaged 35.70 mpg.
Your car gets average gas mileage.

Which of the following options would you like?
1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
2

```
How long does it take to drive to work (in minutes)?
30
How many minutes before work did you start?
60
How many minutes did it take to realize you forgot an item?
10
Go back home and pick up the item.
You will arrive at work with 10 minutes to spare.

Which of the following options would you like?
1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
3

Enter the outer radius of your wheel?
14
Enter the inner radius of your wheel?
6

          * * * * * * * * * *
        * * * * * * * * * * * * * *
       * * * * * * * * * * * * * * * *
      * * * * * * * * * * * * * * * * * *
     * * * * * * * * * * * * * * * * * * * *
    * * * * * * * * * * * * * * * * * * * * * *
   * * * * * * * * * * * * * * * * * * * * * * *
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  * * * * * * * * *$$$$$$$$$* * * * * * * * *
  * * * * * * * *$$$$$$$$$$$$* * * * * * * *
  * * * * * * * *$$$$$$$$$$$$* * * * * * * *
  * * * * * * * *$$$$$+$$$$$* * * * * * * *
  * * * * * * * *$$$$+++$$$$* * * * * * * *
  * * * * * * * *$$$$$+$$$$$* * * * * * * *
  * * * * * * * *$$$$$$$$$$$$* * * * * * * *
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  * * * * * * * * *$$$$$$$* * * * * * * * * *
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   * * * * * * * * * * * * * * * * * * * * * * *
    * * * * * * * * * * * * * * * * * * * * * *
     * * * * * * * * * * * * * * * * * * * *
      * * * * * * * * * * * * * * * * * *
       * * * * * * * * * * * * * * * *
        * * * * * * * * * * * * * *
          * * * * * * * * * *
```

Which of the following options would you like?
1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
4

How many problems do you want?
5
Answer: 3x9 = *27*

Answer: 4x6 = *42*
Incorrect, try again.
Answer: 4x6 = *24*

Answer: 12x11 = *132*

Answer: 8x2 = *16*

Answer: 7x5 = *35*

You completed 5 problems in 17 seconds.

Which of the following options would you like?
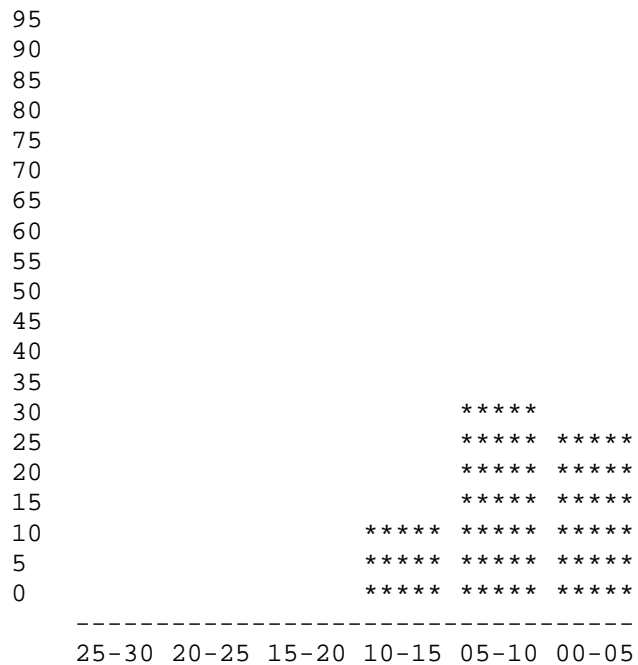1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
5

What is the name of the input file with the trip data?
sample.txt

Here is your graph!

```
95
90
85
80
75
70
65
60
55
50
45
40
35
30                    *****
25                    ***** *****
20                    ***** *****
15                    ***** *****
10              ***** ***** *****
5               ***** ***** *****
0               ***** ***** *****
        ---------------------------------
      25-30 20-25 15-20 10-15 05-10 00-05
```

Which of the following options would you like?
1) Calculate fuel efficiency for a trip.
2) Determine whether or not to go back home and pick up an item.
3) Print the car logo to the display.
4) Play the multiplication game.
5) Print a visual display of the recent fuel efficiency.
6) Quit
6

Thank you for using the car computer!

Deliverables
One source file:
      1) *carcomp.c*, for your solution

This file is to be submitted over WebCourses.

Restrictions
Although you may use other compilers, your program must compile and run using gcc or Dev C++. Please use either your Olympus account or Dev C++ to develop your programs. Your program should include a header comment with the following information: your name, course number, section number, assignment title, and date. Also, make sure you include comments throughout your code describing the major steps in solving the problem.

Grading Details
Your program will be graded upon the following criteria:
1) Your correctness.
2) Using the same exact function prototypes given in the assignment.
3) Your programming style and use of white space. Even if you have a plan and your program works perfectly, if your programming style is poor or your use of white space is poor, you could get 10% or 15% deducted from your grade.
4) Compatibility to Dev C++ (in Windows). If your program does not compile in this environments, you will get a **sizable** deduction from your grade.