CptS 121 - Program Design and Development

Lab 7: Pointers and Output Parameters

Assigned: Week of October 9, 2023
Due: At the end of the lab session

I. Learner Objectives:

At the conclusion of this programming assignment, participants should be able to:
- Utilize output parameters and pointers in a C program
- Apply the dereference or indirection C operator
- Distinguish between the 3 usages of the '*' operator (multiplication, pointer declaration, and dereferencing)
- Discuss advantages and disadvantages of applying pointers in a C program
- Determine how the use of pointers may affect modular design

II. Prerequisites:

Before starting this programming assignment, participants should be able to:
- Create and utilize compound conditions
- Compose iterative statements
- Compose decision statements
- Apply top-down design
- Programmatically open, process, and close files

III. Overview & Requirements:

This lab, along with your TA, will help you navigate through applying output parameters (pointers) in C. Once again we will take a modular approach to designing solutions to the problem below. As part of the lab you will need to decide which C selection structure and iterative structure is best suited for a particular function. You will have the option to use "if", "switch", "while", "do-while", and/or "for" statements for the below problems.

Labs are held in a "closed" environment such that you may ask your TA questions. Please use your TAs knowledge to your advantage. You are required to move at the pace set forth by your TA. Have a great time! Labs are a vital part to your education in CptS 121 so work diligently.

Tasks:

1. With your team, complete project 8 on page 371 of the Hanly & Koffman text. Before you implement any code, please use the whiteboard to design your program. You should consider using flowcharts in your design.

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InternetLite is an ISP that charges customers a flat rate of $7.99 for up to 10 hours of connection time. Additional hours or partial hours are charged at $1.99 each. Write a function charges () that computes the total charge for a customer based on the number of hours of connection time used in a month. The function should also calculate the average cost per hour of the time used, so use two output parameters (pointers) to send back these results indirectly. Write a second function round_money () that takes a real number as an input argument and returns as the function the value the number rounded to two decimal places. Write a main () that takes data from an input file and produces an output file. The input data file format is as follows:

Line 1: current month and year as two integers
Other lines: customer number (a 5-digit number) and number of hours used

2. With your team, complete project 11 on page 340 of the Hanly & Koffman (7th ed.) text. Note: the 8th ed. version of the problem is slightly different. Once again, before you implement any code, please use the whiteboard to design your program.

After studying gross annual revenues of Broadway shows over a 20-year period, you model the revenue as a function of time:

$R(t) = 203.265 \times (1.071)^t$, where R is in millions of dollars and t is the years since 1984. Create the following functions to implement this model:

revenue - calculates R given the input parameter t. R is an output parameter.
predict - predicts the year in which revenues (in millions) will first equal or exceed the value of the input parameter. For example, predict(200) would return 1984. The year should be returned through an output parameter.

Write a main () function that calls predict () to determine when revenues will likely exceed $1 trillion. Then create an output file that contains a table of estimated revenues for all the year from 1984 through the year when revenues should exceed $1 trillion.

IV. Submitting Labs:

- You are not required to submit your lab solutions. However, you should keep them in a folder that you may continue to access throughout the semester.

V. Grading Guidelines:

- This lab is worth 10 points. Your lab grade is assigned based on completeness and effort. To receive full credit for the lab you must show up on time, complete at least two-thirds of the problems, and continue to work on the problems until the TA has dismissed you.