

# Functions

Workshop 6 (out of 10 marks - 3% of your final grade)

In this workshop, you will code a modular C-language program.

## LEARNING OUTCOMES

Upon successful completion of this workshop, you will have demonstrated the abilities:

- to code a function for each module of a program
- to return the result of a function's operations
- to call a function with several arguments of different type
- to describe to your instructor what you have learned in completing this workshop and explain modularity in terms of the reusability of logic

## SUBMISSION POLICY

The "in-lab" section is to be completed during your assigned lab section. It is to be completed and submitted by the end of the workshop period. If you attend the lab period and cannot complete the in-lab portion of the workshop during that period, ask your instructor for permission to complete the in-lab portion after the period. If you do not attend the workshop, you can submit the "in-lab" section along with your "at-home" section (with a penalty; see below). The "at-home" portion of the lab is due on the day that is two days before your next scheduled workshop (23:59).

All your work (all the files you create or modify) must contain your name, Seneca email and student number.

You are responsible to back up your work regularly.

## Late submission penalties:

- In-lab portion submitted late, with at-home portion: 0 for in-lab. Maximum of 70/70 for at-home and reflection

- If any of in-lab, at-home or reflection portions is missing the mark will be zero.

## IN-LAB: (30%)

Download or clone workshop 6 (**WS04**) from <https://github.com/Seneca-144100/IPC-Workshops>

Write this section of your code in **rental.c** provided with the visual studio template project inside **in\_lab** folder. In this workshop segment, you will implement **rental charges** and **rental status display** functionality for vehicle rentals and will use C functions to add modularity to your solution.

### Overview

The **rental.c** template file has already implemented the following:

- Displays the following menu list inside a do-while loop construct:
  - 1.) Rental Status
  - 2.) Apply Charges
  - 0.) Log out
- Captures user input for the above options and stores to an **int** variable named “option”
- Ability to iterate multiple menu choices (until 0 is entered) with required selection construct to direct process flow to the required logic/functionality (using switch). Refer to the comments for each case to identify the functionality required.
- Displays an error message for invalid menu option selections in the **default** case
- Initial output information for menu options 1 and 2 is provided with the relevant formatting.
- The template program has two rental accounts already defined and initialized with the following information using a **struct Rental** array named **vRent**. **struct Rental** has three member variables named **int id**, **double baseDay** and **double earnings**.

id	baseDay	earnings
123	9.95	0
124	19.95	0

- Case-2 has implemented the following, required to apply charges to the relevant rental account:
  - Prompts the user to input a vehicle **ID** number
  - Searches through all Rentals (**vRent** array) to find whether the Vehicle **ID** exists. If it exists, the matching array index is stored to a variable named **flag**. If it is not found, an error message is displayed.

You are required to complete the following functionality.

### Define and Implement **addPositive** Function

- Prototype a C function called **addPositive** with two input parameters “**double amount** and **double newAmount**” before the main function
- Implement **addPositive** function anywhere below its prototype definition with two input parameters “**double amount** and **double newAmount**”. This function adds the values of both input parameters only if **newAmount** is a positive value; otherwise, **amount** value is unaltered. This function returns the resulting **amount** as a **double**.

### Implement “Rental Info Display” functionality in Case 1

- Display “**id** and **earnings**” of the **struct Rental** array using a loop construct. Use the following formatting for the **printf** statement.

**%8d %10.21f**  $\leftrightarrow$  (*id, earnings*)

- After completing the display, enter a newline using a **printf** statement.

### Implement “Apply rental charges” functionality in Case 2

- If the Rental **ID** is found in **vRent** array, then do the following, inside “**if** (flag **!= -1**)” code block:
  - Prompt and capture the duration in days of the car rental.
  - Calculate the **base price** by multiplying the duration (days) and **baseDay** rate (e.g: 9.95 or 19.95) for the rental
  - Prompt and capture traveled distance in kilometers of the car rental.
  - Calculate the **kilometer cost** of the rental as per the following chart.

**distRate1** and **distRate2** are defined at the beginning of the template file.

Description	Variable Name	Rate / km
Rate per Kilometer from 0km to 100km (inclusive)	<b>distRate1</b>	0.69
Rate per Kilometer above 100km	<b>distRate2</b>	0.49

- Add the “**base price**” and “**kilometer cost**” and store to a temporary **double** variable named **charge**

- Call the **addPositive** function supplying it with the current **earnings** for the rental and **charge** (calculated above) as arguments assigning the returned result back to **earnings**
- Display a message showing the **base price**, **kilometer cost** and the **new earnings** (base + kilometer cost) with the following formatting:

```
%6.21f %6.21f %6.21f ←→ (base price, kilometer cost, earnings)
```

- Please refer to the sample output below for exact message contents and formatting

## PROGRAM COMPLETION

Your program is complete, if your output matches the following output. Numbers/ text in red color shows the user's input.

```
***** Rental Vehicle Management App *****
```

```
1.) Rental Status
2.) Apply Charges
0.) Log out
```

```
Please enter an option to continue: 2
```

```
-- Rental Charges --
```

```
Enter vehicle ID: 123
Enter Rental Period (in Days): 2
Enter kilometers driven: 125
```

```
Base    kmCost Total
=====
19.90   81.25 101.15
```

```
1.) Rental Status
2.) Apply Charges
0.) Log out
```

```
Please enter an option to continue: 2
```

```
-- Rental Charges --
```

```
Enter vehicle ID: 124
Enter Rental Period (in Days): 3
Enter kilometers driven: 79
```

```
Base    kmCost Total
=====
59.85   54.51 114.36
```

```
1.) Rental Status
2.) Apply Charges
0.) Log out
```

Please enter an option to continue: 2

-- Rental Charges --

Enter vehicle ID: 125

ERROR: Vehicle ID does not exist.

- 1.) Rental Status
- 2.) Apply Charges
- 0.) Log out

Please enter an option to continue: 1

-- Rental Vehicle Status --

ID#	Earnings
123	101.15
124	114.36

- 1.) Rental Status
- 2.) Apply Charges
- 0.) Log out

Please enter an option to continue: 0

## IN\_LAB SUBMISSION:

To test and demonstrate execution of your program use the same data as the output example above or any information needed.

If not on matrix already, upload your [rental.c](#) to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account: (replace profname.proflastname with your professors Seneca userid)

```
~profname.proflastname/submit 144_w6_lab <ENTER>
```

and follow the instructions.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.

## AT\_HOME: (30%)

The [rental2.c](#) template file has already implemented the following ([rental2.c](#) is an extension of [rental.c](#)):

- Changed the value of `noVehicles` to 3.

- Increased the content of the **vRent** array to 3 rentals as following:

id	baseDay	earnings
123	9.95	0
124	19.95	0
125	29.95	0

- Expanded the menu list to include options 3 & 4 after option 2 with the following
  - o Apply Taxes to All Rentals
  - o Apply Gift Card
- Have created two switch-cases for option 3 & 4 after case 2. Initial output information for menu options 3 and 4 is provided with the relevant formatting.
- Case-4 has also implemented the following required to apply Gift Card amount to the relevant rental account:
  - o Prompt the user to input a vehicle **ID** number
  - o Search through all Rentals (**vRent** array) to find whether the Vehicle **ID** exists. If it exists, the matching array index is stored to a variable named **flag**. If it is not found, an error message is displayed

You are required to complete the following functionality.

Copy Case-1 and Case-2 contents as required from [rental.c](#) to [rental2.c](#) along with your user variables. See comments in [rental2.c](#) for more information.

### Define and Implement **taxCalc** Function

- Prototype a C function called **taxCalc** with two input parameters “**double price** and **double rate**” before the main function. See comments in [rental2.c](#) to see where to place the prototype function.
- Implement **taxCalc** function anywhere below its prototype definition with two input parameters “**double price** and **double rate**”. This function calculates the taxes for the **price** using the **rate** given. This function returns the resulting **taxes** as a **double**.

### Define and Implement **subtractPositive** Function

- Prototype a C function called **subtractPositive** with two input parameters “**double amount** and **double newAmount**” before the main function. See comments in [rental2.c](#) to see where to place the prototype function.
- Implement **subtractPositive** function anywhere below its prototype definition with two input parameters “**double amount** and **double newAmount**”. This function subtracts **newAmount** from **amount** parameter only if **newAmount** is a positive-value; otherwise, **amount** value is unaltered. This function returns the resulting **amount** as a **double**.

### Implement “Apply Discount” functionality in Case 2

- Display the following after the call to **addPositive** function with **earnings** and **charge**  

```
> Apply Discount: <
```
- Prompt the user to input ‘Y’ or ‘y’ to apply discount. If the input is either ‘Y’ or ‘y’ call **subtractPositive** function with current **earnings** for the rental and **discount** (**double discount** is defined at the beginning of the **main** function in [rental2.c](#)) as arguments and assign the returned result back to **earnings**.
- Modify the display message to include **discount status** and **new total** (base + kilometer cost – discount) with the following formatting

```
%6.2lf %6.2lf %10c %6.2lf ↔ (base price, kilometer cost, discount status, earnings)
```

### Implement “Apply Taxes” functionality in Case 3

- Iterate all rental vehicles using a loop construct. For each vehicle, call **taxCalc** function with current **earnings** and **taxRate** (**double taxRate** is defined at the beginning of the main function) as arguments and assign the returned result to a temporary variable called **double taxes**
- Then call **addPositive** function with the current **earnings** and **taxes** (calculated above) as arguments and assign the returned result back to **earnings** for the respective rental.
- After completing the display, enter a newline using a **printf** statement.

## Implement “Apply Gift Card” functionality in Case 4

- Display the following inside **if** (flag **!=** -1) code block:

```
> Enter Gift Card Amount: <
```

- Prompt the user to input a gift card amount
- Call **subtractPositive** function with current **earnings** and the above gift card amount and assign the returned result back to **earnings**.

## Program completion

Your program is complete if your output matches the following output. Numbers/ text in red color shows the user's input.

```
***** Rental Vehicle Management App *****
```

```
1.) Rental Status
2.) Apply Charges
3.) Apply Taxes to All Rentals
4.) Apply Gift Card
0.) Log out
```

```
Please enter an option to continue: 2
```

```
-- Rental Charges --
```

```
Enter vehicle ID: 123
Enter Rental Period (in Days): 2
Enter kilometers driven: 125
Apply Discount: Y
```

```
Base   kmCost DiscStatus Total
=====
19.90  81.25           Y  96.15
```

```
1.) Rental Status
2.) Apply Charges
3.) Apply Taxes to All Rentals
4.) Apply Gift Card
0.) Log out
```

```
Please enter an option to continue: 2
```

```
-- Rental Charges --
```

```
Enter vehicle ID: 124
Enter Rental Period (in Days): 3
Enter kilometers driven: 60
Apply Discount: N
```



```
Base    kmCost DiscStatus Total
=====
59.85  41.40              N 101.25
```

- 1.) Rental Status
- 2.) Apply Charges
- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 2

-- Rental Charges --

Enter vehicle ID: 125  
Enter Rental Period (in Days): 1  
Enter kilometers driven: 223  
Apply Discount: Y

```
Base    kmCost DiscStatus Total
=====
29.95 129.27              Y 154.22
```

- 1.) Rental Status
- 2.) Apply Charges
- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 1

-- Rental Vehicle Status --

```
ID#      Earnings
-----
      123      96.15
      124     101.25
      125     154.22
```

- 1.) Rental Status
- 2.) Apply Charges
- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 3

-- Apply Taxes To all Accounts--

```
ID#      Earnings    Taxes
-----
      123     109.61    13.46
      124     115.42    14.18
      125     175.81    21.59
```

- 1.) Rental Status
- 2.) Apply Charges

- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 4

-- Apply Gift Card --

Enter vehicle ID: 125  
Enter Gift Card Amount: 23  
Discount Applied

- 1.) Rental Status
- 2.) Apply Charges
- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 1

-- Rental Vehicle Status --

ID#	Earnings
123	109.61
124	115.42
125	152.81

- 1.) Rental Status
- 2.) Apply Charges
- 3.) Apply Taxes to All Rentals
- 4.) Apply Gift Card
- 0.) Log out

Please enter an option to continue: 0

## AT-HOME REFLECTION (40%)

Please provide brief answers to the following questions in a text file named [reflect.txt](#).

- 1) In 3 or 4 sentences explain the term “function” and briefly discuss the need for functions in any language?
- 2) Comment on the modularity and reusability of the **addPositive** and **subtractPositive** functions. (*Hint*: Each function was called twice for different purposes each time)
- 3) In 2 or 3 sentences explain how to send data to and receive data from functions?

**Note: when completing the workshop reflections it is a violation of academic policy to cut and paste content from the course notes or any other published source, or to copy the work of another student.**

## AT\_HOME SUBMISSION:

To test and demonstrate execution of your program use the same data as the output example above.

If not on matrix already, upload your [rental2.c](#) and [reflect.txt](#) to your matrix account. Compile and run your code and make sure everything works properly.

Then run the following script from your account (replace profname.proflastname with your professors Seneca userid):

```
~profname.proflastname/submit 144_w6_home <ENTER>
```

and follow the instructions.

Please note that a successful submission does not guarantee full credit for this workshop.

If the professor is not satisfied with your implementation, your professor may ask you to resubmit. Resubmissions will attract a penalty.