

CPE 150 Laboratory 5: Control Structures III

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Summer 2017

1 Objectives

- To understand basic problem-solving techniques.
- To be able to develop algorithms through the process of top-down stepwise refinement.
- To be able to use the `switch` selection structure to choose among alternative actions.
- To be able to use the `do/while` repetition structures to execute statement in a program repeatedly.
- To understand counter-controlled repetition and sentinel-controlled repetition.
- To be able use the increment, decrement, assignment and logical operators.
- To be able to use `break` and `continue` program control statements.

2 Lab Exercise 1 - The Speed of Sound in Gases

When sound travels through a gas, its speed depends primarily on the density of the medium. The less dense the medium, the faster the speed will be. The following table shows the approximate speed of sound at 0 degrees centigrade, measured in meters per second, when traveling through carbon dioxide, air, helium, and hydrogen.

Medium	Speed (Meters per Second)
Carbon Dioxide	258.0
Air	331.5
Helium	972.0
Hydrogen	1,270.0

Write a program that displays a menu allowing the user to select one of these four gases. After a selection has been made, the user should enter the number of seconds it took for the sound to travel in this medium from its source to the location at which it was detected. The program should then report how far away (in meters) the source of the sound was from the detection location.

[*Optional: Input Validation*] Check that the user has selected one of the available menu choices. Do not accept times less than 0 seconds or more than 30 seconds.

3 Lab Exercise 2 - Payroll

A company pays its employees as managers (who receive a fixed weekly salary), hourly workers (who receive a fixed hourly wage for up to the first 40 hours they work and time and a half, i.e., 1.5 times their hourly wage, for overtime hours worked), commission workers (who receive \$250 plus 5.7% of their gross weekly sales), and pieceworkers (who receive a fixed amount of money per item for each of the items they produce - each pieceworker in this company works on only one type of item). Write a program to compute the weekly pay for each employee. You do not know the number of employees in advance. Each type of employee has its own pay code. Managers have paycode 1, hourly workers have paycode 2, commission workers have paycode 3 and pieceworkers have paycode 4. Use a `switch` structure to compute each employee's pay, based on the employee's paycode. Within `switch`, prompt the user (i.e., the payroll clerk) to enter the appropriate facts your program needs to calculate each employee's pay based on that employee's paycode. Sample output is provided next.

```
Enter paycode (-1 to end): 3
Commission worker selected.
Enter gross weekly sales: 4000
Commission Worker's pay is $ 478.00

Enter paycode (-1 to end): 2
Hourly worker selected.
Enter the hourly salary: 4.50
Enter the total hours worked: 20
Worker's pay is $ 90.00

Enter paycode (-1 to end): 4
Piece worker selected.
Enter number of pieces: 50
Enter wage per piece: 3
Piece Worker's pay is $ 150.00

Enter paycode (-1 to end): -1

Total number of managers paid      : 0
Total number of hourly workers paid : 1
Total number of commission workers paid: 1
Total number of piece workers paid   : 1
```

4 Lab Exercise 3 - Vending Machine

Write a program that simulates a hot beverages vending machine software. The program constantly prompts the user with a menu to select a hot beverage and then prompt him/her for the desired quantity and displays the due amount. Your program must use a `switch` statement to make a selection between the different beverages. The program must use a `do-while` loop to repeat the selection menu until the user selects the item *E* from the menu as follows.

```
Hot Beverage Menu
A: Coffee      $ 1.00
B: Tea        $ 0.75
C: Hot Chocolate $ 1.25
D: Cappuccino $ 2.50
Enter the beverage A,B,C, or D you desire or Enter E to end.
```

5 Postlab Exercise

To make telephone numbers easier to remember, some companies use letters to show their telephone number. For example, using letters, the telephone number 438-5626 can be shown as GET LOAN. In some cases, to make a telephone number meaningful, companies might use more than seven letters. For example, 225-5466 can be displayed as CALL HOME, which uses eight letters. Write a program that prompts the user to enter a telephone number expressed in letters using a `do-while` loop and outputs the corresponding telephone number in digits. Output the `-` (hyphen) after the third digit. Allow the user to use both uppercase and lowercase letters. Moreover, your program should process as many telephone numbers as the user wants.