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**CIS115 Introduction to Programming and Logic**

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LAB 02 **UNDERSTANDING VARIABLES AND USING PYCHARM**

# Objectives

In this lab assignment, students will learn:

- How to execute a program by hand

- How to keep track of variables duration programming execution

- How to use PyCharm to create Python programs

- How to write Python programs to display text

# Goals

In this lab assignment, students will demonstrate the abilities to:

- Execute a program by hand

- Keep track of variables duration programming execution

- Use PyCharm to create Python programs

- Write Python programs to display text

# Instruction for Problem 1 - 5

In Lab 01 you designed algorithms for 5 programs. In this lab, you are asked to execute your algorithms by hand and record the values of the variables with the test cases provided. The following is an example.

In Lab 01 we designed the following algorithm to determine BTU needed to cool a room:

Step 1: Input the length of the room

Step 2: Input the width of the room

Step 3: Input the height of the room

Step 4: Calculate volume = length \* width \* height

Step 5: Calculate BTU needed = volume \* 3.5

Step 6: Display BTU needed

Let’s execute this program by hand with this test case: room length = 15, room width = 11 and room height =10. Create a table to show how the value of each variable changes during program execution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Step | Room length | Room width | Room height | Room volume | BTU needed |
| Input room length | 15 |  |  |  |  |
| Input room width | 15 | 11 |  |  |  |
| Input room height | 15 | 11 | 10 |  |  |
| Calculate volume = length \* width \* height | 15 | 11 | 10 | 1650 |  |
| Calculate BTU needed = volume \* 3.5 | 15 | 11 | 10 | 1650 | 5775 |
| Display BTU needed | 15 | 11 | 10 | 1650 | 5775 |

For problem 1 – 5, please type and save your answers in a single Microsoft Word document. Submit the file to Blackboard for credit.

## Problem 1

You wrote pseudocode for the following problem:

*Mary is a big fan of tropical fish. She has a few tanks of fish at home. To maintain a healthy environment for the fish, she needs to add conditioner to the water once a week. The amount of conditioner added is determined by the volume of water in the tank. According to the direction on the bottle, she has to add 1 teaspoon of conditioner per 100 cubic inches of water. She wants a program to calculate the amount of conditioner to add to each tank. All tanks are rectangular. The program will ask for the length, width and height of the tank. It will calculate and display the amount of conditioner to add. [Note: volume = length \* width \* height]*

Execute your pseudocode by hand and create a table to show how the values of the variables change during program execution. Please use the following test case: tank length = 20, tank width = 12 and tank height =15.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Step | Tank width | Tank length | Tank height | Tank volume | Conditioner needed |
| Input tank width | 12 |  |  |  |  |
| Input tank length | 12 | 20 |  |  |  |
| Input room height | 12 | 20 | 15 |  |  |
| Calculate volume = length \* width \* height | 12 | 20 | 15 | 3600 |  |
| Calculate conditioner needed = volume \* .01 | 12 | 20 | 15 | 3600 | 36 |
| Display conditioner needed | 12 | 20 | 15 | 3600 | 36 |

## Problem 2

You wrote pseudocode for the following problem:

*The retirement account of each employee in a company receives money from two sources each month. First, each employee contributes 6% of his salary to his own retirement account. Second, the company also makes a contribution equal to 3 % of the employee’s salary to the account. For example, suppose the monthly salary of an employee is $2000. The employee’s own contribution will be $120, while the company’s contribution will be $60. They need a program to manage the retirement accounts. The user will enter the monthly salary of an employee. The program will calculate and display the following items: amount of money contributed by the employee each month, amount of money contributed by the company each month, total contribution each month (i.e. the sum of employee’s and company’s contributions). Use 6% and 3% directly in the algorithm to calculate employee’s and company’s contributions. There is no need to ask the user to enter these rates.*

Execute your pseudocode by hand and create a table to show how the values of the variables change during program execution. Please use the following test case: monthly salary = 2000.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Salary | Employee  Contribution | Company contribution | Total contribution |
| Input salary | 2000 |  |  |  |
| Calculate employee contribution = salary \* 0.06 | 2000 | 120 |  |  |
| Calculate company contribution = salary \* 0.03 | 2000 | 120 | 60 |  |
| Calculate total contribution = employee contribution + company contribution | 2000 | 120 | 60 | 180 |
| Display employee contribution | 2000 | 120 | 60 | 180 |
| Display company contribution | 2000 | 120 | 60 | 180 |
| Display total contribution | 2000 | 120 | 60 | 180 |

## Problem 3

You wrote pseudocode for the following problem:

*All jackets in a store are on sale now. They need a program to process discounts. The user will enter the original price of a jacket and the discount percentage using a decimal (for example: if it is 25% off, the user should enter 0.25; if it is 30% off, the user should enter 0.30, etc). The program will use the original price and the discount percentage entered by the user to calculate the sale price (i.e. the reduced price). It will all calculate sales tax and total amount due. Sales tax is 7% of sale price. Display sale price, sales tax and total amount due.*

Execute your pseudocode by hand and create a table to show how the values of the variables change during program execution. Please use the following test case: original price = 200, discount percentage = 0.20 (i.e. 20%)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Step | Original price | Discount | Sale discount amount | Sale price | Sale tax | Total amount | Display sale price, sale tax, total amount |
| Input original price | 200 |  |  |  |  |  |  |
| Input decimal discount | 200 | .20 |  |  |  |  |  |
| Calculate sale discount amount = original price \*decimal discount | 200 | .20 | 40 |  |  |  |  |
| Calculate sale price = original price – sale discount | 200 | .20 | 40 | 160 |  |  |  |
| Calculate sales tax = sale price \* 0.7 | 200 | .20 | 40 | 160 | 11.2 |  |  |
| Calculate total amount due = sales price + sales tax | 200 | .20 | 40 | 160 | 11.2 | 171.2 |  |
| Display sales price | 200 | .20 | 40 | 160 | 11.2 | 171.2 | 160 |
| Display sales tax | 200 | .20 | 40 | 160 | 11.2 | 171.2 | 11.2 |
| Display total amount due | 200 | .20 | 40 | 160 | 11.2 | 171.2 | 171.2 |

## Problem 4

You wrote pseudocode for the following problem:

*A group of high school students are selling pizza and soda during a basketball game to raise fund for a field trip. Pizza is $3.50 per slice and soda is $1.25 per cup. Design a program to do the following. Ask the user to enter number of cups of soda and number of slices of pizza ordered by the customer. The program will calculate and display the total amount due from the customer.*

Execute your pseudocode by hand and create a table to show how the values of the variables change during program execution. Please use the following test case: slices of pizza = 4, cups of soda = 2

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Number of slices of pizza | Number of soda cups | Amount due |
| Input number of pizza slices | 4 |  |  |
| Input number of soda cups | 4 | 2 |  |
| Calculate amount due = (number of slices of pizza \* 3.5) +(number of soda cups \*1.25) | 4 | 2 | 16.5 |
| Display amount due | 4 | 2 | 16.5 |

## Problem 5

You wrote pseudocode for the following problem:

*A company is sending its employees to receiving training on some new equipment. The training includes two parts: part A and part B. The cost for attending part A is $100 while the cost for part B is $150. There are three options for each attendee:*

*Option A: Attend part A only*

*Option B: Attend part B only*

*Option C: Attend both part A and part B*

*Attendees who choose option C get a 20% discount. Write a program to calculate how much training fee the company needs to pay in total. The program should ask the user to enter the number of people who choose option A, option B and option C, respectively. It will calculate and display the total training fee the company needs to pay.*

Execute your pseudocode by hand and create a table to show how the values of the variables change during program execution. Please use the following test case: number of people who only attend part A = 12, number of people who only attend part B = 10, number of people who attend both parts = 20

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | People who attended part A | People who attended part B | People who attended part A and B | Training fee for people who attended part A | Training fee for people who attended part B | Training fee for people who attendant part A and B before discount | Discount amount for people who attended part A and B | Training fee for people who attendant part A and B after discount | Total training fee | Total training fee |
| Input number of people who attended part A | 12 |  |  |  |  |  |  |  |  |  |
| Input number of people who attended part B | 12 | 10 |  |  |  |  |  |  |  |  |
| Input number of people who attended part A and B | 12 | 10 | 20 |  |  |  |  |  |  |  |
| Calculate total training fee for people who attended part A = number of people who attended part A \*100 | 12 | 10 | 20 | 1200 |  |  |  |  |  |  |
| Calculate number of people who attended part B = number of people who attended part B \*150 | 12 | 10 | 20 | 1200 | 1500 |  |  |  |  |  |
| Calculate total training fee for people who attended part A and B before discount =number of people who attended part A and B \* 250 | 12 | 10 | 20 | 1200 | 1500 | 5000 |  |  |  |  |
| Calculate discount amount for people who attended part A and B = total training fee for people who attended part A and B \*0.02 | 12 | 10 | 20 | 1200 | 1500 | 5000 | 100 |  |  |  |
| Calculate total amount due by the company for people who attended part A and B after discount = total training fee for people who attended part A and B- discount amount for people who attended part A and b | 12 | 10 | 20 | 1200 | 1500 | 5000 | 100 | 4900 |  |  |
| Calculate total training fee = total training fee for people who attended part A + total training fee for people who attended part B + total amount due by the company for people who attended part A and B after discount | 12 | 10 | 20 | 1200 | 1500 | 5000 | 100 | 4900 | 7600 |  |
| Display total training fee | 12 | 10 | 20 | 1200 | 1500 | 5000 | 100 | 4900 | 7600 | 7600 |

# Instruction for Problem 6 - 8

For each of the problems, write a Python program to display text. The following is an example.

Write a Python program to display the following output:

Impatience never commanded success.

Answer:

print(**'Impatience never commanded success.'**)

For problem 6 to 8, please use PyCharm to type and test your programs. Submit the Python files to Blackboard for credit. You should submit 3 Python files, one for each problem.

## Problem 6

Write a Python program to display the following output:

A light heart lives long.

## Problem 7

Write a Python program to display the following output:

Love is not a thing to understand.

Love is not a thing to feel.

Love is not a thing to give and receive.

Love is a thing only to become

And eternally be.

## Problem 8

Write a Python program to display the following output:

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|

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[Hint: Consider this picture as 7 lines of text. Write a statement to display each line.]

# Grading rubric for Problem 1 - 5

List variables in the table [4 points]

Showing correct values in the table [10 points]

# Grading rubric for Problem 6 - 8

Writing correct Python statements [10 points]