**Module 4 Lab: Decisions and Boolean Logic**

This lab accompanies Chapter 3 - Control Statements and Program Development in *Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and The Cloud*

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**Module 4 Lab Part 1 –Logical Operators and Dual Alternative Decisions**

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| Critical Review  The logical AND operator and the logical OR operator allow you to connect multiple Boolean expressions to create a compound expression.  The logical NOT operator reverses the truth of a Boolean expression.  When using the AND operator, both conditions must be true in order for the statements within an if to process.  When using the OR operator, either condition must be true in order for the statements within an if to process.  A dual alternative decision structure will execute one group of statements if its Boolean expression is true, or another group if its Boolean expression is false.  The general structure of an if-then-else statement is  If condition Then  *Statement*  *Statement*  *Etc.*  Else  *Statement*  *Statement*  *Etc.*  End If |

This lab requires you to think about possible true and false conditions using if statements.

**Step 1:** Consider the following values set to variables.

* myAge = 32
* yourAge = 18
* myNumber = 81
* yourNumber = 17
* votingAge = 18

**Step 2:** Based on the values to the variables in Step 1, what is the expected output? Hint: The output will be either what is printed to the screen, or nothing. (Reference: Logical Operators, page 189).

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| **The condition** | **Expected Output** |
| If myAge == 31 AND yourAge < myAge Then  Display "My age is 31 and your age is less than that"  End If | *(No Output)* |
| If myAge <= 35 AND myAge >= 32 Then  Display "My age is between 32 and 35"  End If | My age is between 32 and 35 |
| If yourAge == votingAge OR yourAge > votingAge Then  Display "You can vote"  End If | You can vote |
| If myNumber == 83 OR yourNumber == 83 Then  Display "One of our numbers is 83"  End If | *(No Output)* |

**Step 3:** Based on the values to the variables in Step 1, what is the expected output? (Reference: Dual Alternative Decision Structures, page 167).

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| --- | --- |
| **The condition** | **Expected Output** |
| If myAge == 31 AND yourAge < myAge Then  Display "My age is 31 and your age is less than that"  Else  Display "Our ages do not qualify"  End If | Our ages do not qualify |
| If myAge <= 35 AND myAge >= 32 Then  Display "My age is between 32 and 35"  Else  Display "My age is not within that range"  End If | My age is between 32 and 35 |
| If yourAge == votingAge OR yourAge > votingAge Then  Display "You can vote"  Else  Display "You cannot vote"  End If | You can vote |
| If myNumber == 83 OR yourNumber == 83 Then  Display "One of our numbers is 83"  Else  Display "83 is not our numbers"  End If | 83 is not our numbers |

**Module 4 Lab Part 2 – Pseudocode: Dual Alternative Decisions**

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| Critical Review  A dual alternative decision structure will execute one group of statements if its Boolean expression is true, or another group if its Boolean expression is false.  The general structure of an if-then-else statement is:  If condition Then  Statement  Statement  Etc.  Else  Statement  Statement  Etc.  End If |

This lab requires you to think about the steps that take place in a program but write actual python code by filling in the blanks.

The company wants a program to modify their bonus portion to include different levels and types and eliminate the day off program. The program description is as follows:

A retail company assigns a $6,000 store bonus if monthly sales are more than $110,000; else if monthly sales are greater than or equal to $100,000 the store bonus is $5,000, else if monthly sales are greater than or equal to $90,000 the store bonus is $4,000, else if monthly sales are greater than or equal to $80,000, the store bonus is $3,000 otherwise a $0 amount or no store bonus is awarded. They are using a percent of sales increase to determine if employees get individual bonuses. If sales increased by an amount greater than or equal to 5% (0.05) then all employees get $75, else if sales increased by an amount greater than or equal to 4%, employees get $50, else if sales increased by an amount greater than or equal to 3% employees get $40 otherwise they get $0.

**Step 1:** To accommodate the changes to the program, create the additional variables needed.

* Create a variable named storeAmount to hold the store bonus amount.
* Create a variable named empAmount to hold the individual bonus amount.
* Create a variable named salesIncrease to hold the percent of increase.

This is the main function that you need to fill in the ???? with the variable names listed above:

# declare local variables

monthlySales = 0 # monthly sales amount

????? = 0 # store bonus amount

????? = 0 # employee bonus amount

????? = 0 # percent of sales increase

prompt = ?????? # prompt will be a string literal

# include code to get the monthly Sales

# include code to get the Increase in Sales

# include code to Calculate the Store Bonus

# include code to Calculate the Employee Bonus

# include code to print out all the results

**Step 2:** The first section in the program is to get the monthly Sales.

# This code gets the monthly sales

monthlySales = float(input(prompt))

**Step 3:** The next section in the program calculates the store bonus. Write an if-then-else statement that will set the bonus amounts to those in the description at the beginning. Set the variable storeAmount based on the values of the monthlySales variable. Complete the missing lines.

# This code determines the storeAmount bonus

if monthlySales >= 110000:

storeAmount = 6000

elif monthlySales >= 100000:

storeAmount = 5000

elif monthlySales >= 90000:

storeAmount = 4000

elif monthlySales >= 80000:

storeAmount = 3000

else:

storeAmount = 0

**Step 4:** The next section of code will ask the user to enter the percent of sales increase in decimal format. This code sets the variable salesIncrease. Complete the missing lines.

# This code gets the percent of increase in sales

salesIncrease = float(input(‘Enter percent of sales increase’))

salesIncrease = salesIncrease / 100

**Step 5:** Write code that will determine individual bonuses. Use the values given in the description at the beginning. This section will set the value of empAmount using the salesIncrease variable. Fill in the blanks.

# This code determines the empAmount bonus

if salesIncrease >= .05:

empAmount = 75

elif salesIncrease >= .04:

empAmount = 50

elif salesIncrease >= .03:

empAmount = 40

else:

empAmount = 0

**Step 6:** Write code that will print the store bonus and the employee bonus amount.

# This code prints the bonus information

print("The store bonus amount is $", storeAmount)

print("The employee bonus amount is $", empAmount)

if (storeAmount == 6000 ) and (empAmount == 75):

print('Congrats! You have reached the highest bonus amounts possible! ')

**Module 4 Lab Part 3 – Pseudocode: Nested Decision Structures**

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| Critical Review  To test more than one condition, a decision structure can be nested inside another decision structure. This structure can become very complex, and often an if-then-else-if statement is used instead.  The general structure of the if-then-else-if statement is:  If condition\_1 Then  *Statement*  *Statement*  *Etc.*  Else If condition\_2 Then  *Statement*  *Statement*  *Etc*.  *Insert as many Else If clauses as necessary*  Else  *Statement*  *Statement*  *Etc.*  End If  A case structure lets the value of a variable or an expression determine which path of execution the program will take. This is often used as an alternative to a nested if else decision. |

**Module 4 Lab Part 4 – Python Code**

**Step 1:** Start Visual Studio Code. Prior to entering code, save your file by clicking on File and then Save. Select your location and save this file as *CIS\_YourName\_Lab4.py*. Be sure to include the .py extension.

**Step 2:** Document the first few lines of your program to include your name, the date, and a brief description of what the program does.

**Step** **3:** Start your program with the following code and fill in the ??? and replace the various functions listed here with the functions you completed in the previous steps.

# Module 4 Lab-4

# Add your name here

# Add the date here

# Describe what the program does here

# declare local variables

monthlySales = 0 # monthly sales amount

????? = 0 # store bonus amount

????? = 0 # employee bonus amount

????? = 0 # percent of sales increase

prompt = ?????? # prompt will be a string literal

# This code gets the monthly sales

monthlySales = float(input(prompt))

# This code determines the store bonus

if monthlySales >= 110000:

storeAmount = 6000

elif \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

elif \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

elif \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

else:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# This code gets the percent of increase in sales

salesIncrease = float(input(\_\_\_\_\_\_\_\_\_\_\_))

salesIncrease = salesIncrease / 100

# This code determines the employee bonus

if salesIncrease >= .05:

empAmount = \_\_\_\_

elif salesIncrease >= \_\_\_\_:

empAmount = \_\_\_\_

elif salesIncrease >= \_\_\_\_\_:

empAmount = \_\_\_\_

else:

empAmount = \_\_\_\_

# This code prints the bonus information

print("The store bonus amount is $", \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

print("The employee bonus amount is $", \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

if (\_\_\_\_\_\_\_\_ == 6000 ) \_\_\_ (empAmount == \_\_\_\_):

print('Congrats! You have reached the highest bonus amounts possible! ')

**Step 4:** Click Run to see how your program processes. Test the following values to verify the expected output.

|  |  |
| --- | --- |
| **Input Values** | **Expected Output** |
| monthlySales = 120500  salesIncrease = 5 | The store bonus amount is $ 6000  The employee bonus amount is $ 75  Congrats! You have reached the highest bonus amounts possible! |
| monthlySales = 93400  salesIncrease = 5 | The store bonus amount is $4000  The employee bonus amount is $75 |
| monthlySales = 75000  salesIncrease = 1.5 | The store bonus amount is $0  The employee bonus amount is $0 |
| monthlySales = 82000  salesIncrease = 3.6 | The store bonus amount is $3000  The employee bonus amount is $40 |
| monthlySales = 125000  salesIncrease = 4.5 | The store bonus amount is $6000  The employee bonus amount is $50 |

**Step** **5: Submit this completed word document and .py source code file to D2L.**

Sample Output/result should look like:

