CT874/CT5177 - Programming-1
Fall 2024 – Assignment 03

The Total Assignment is of 30 Marks. However, the marks entered in the marking sheet will be in percentage i.e. out of 100 points. All the hints are marked in red. Question 03 is easier than question 04. In question 03 you are only required to write java code, while the pseudocode is already given. While in question 04 you have to do both parts and is marked out of 10. For question 1 and 2 you just need to write the correct answer and not the full code.

1. **(5 - Marks - Dangling-else Problem**) The Java compiler always associates an else with the immediately preceding if unless told to do otherwise by the placement of braces ({and}). This behavior can lead to what is referred to as the **dangling-else problem**.

```
1  if (x > 5)
2     if (y > 5)
3        System.out.println("x and y are > 5");
4  else
5     System.out.println("x is <= 5");
```

The indentation of the nested statement appears to indicate that if x is greater than 5, the nested if statement determines whether y is also greater than 5. If so, the statement outputs the string "x and y are > 5". Otherwise, it appears that if x is not greater than 5, the else part of the if...else outputs the string "x is <= 5". Beware! This nested if...else statement does not execute as it appears. The compiler actually interprets the statement as

```
1  if (x > 5)
2     if (y > 5)
3        System.out.println("x and y are > 5");
4     else
5        System.out.println("x is <= 5");
```

in which the body of the first if is a *nested* if...else. The outer if statement tests whether x is greater than 5. If so, execution continues by testing whether y is also greater than 5. If the second condition is *true*, the proper string—"x and y are > 5"—is displayed. However, if the second condition is *false*, the string "x is <= 5" is displayed, even though we know that x is greater than 5. Equally bad, if the outer if statement's condition is *false*, the inner if...else is skipped and nothing is displayed. **For this exercise, add braces to the preceding code snippet to force the nested if...else statement to execute as it was originally intended.**

2. ***(10 Marks - Another Dangling*-else *Problem)*** Based on the dangling-else discussion in the previous question, state the output for each of the following code segments when x is 9 and y is 11 and when x is 11 and y is 9. We eliminated the indentation from the following code to

make the problem more challenging. [*Hint: Apply the indentation conventions you've learned.]*

Part - a

```
1   if (x < 10)
2   if (y > 10)
3   System.out.println("*****");
4   else
5   System.out.println("#####");
6   System.out.println("$$$$$");
```

Part b

```
7   if (x < 10) {
8   if (y > 10)
9   System.out.println("*****");
10  }
11  else {
12  System.out.println("#####");
13  System.out.println("$$$$$");
14  }
```

For the following two questions (3 and 4) , read the problem statement, formulate the algorithm using pseudocode, write a Java Program, Test and run the Java Program and screenshot the output, Process three complete sets of data. Do NOT use iteration structure. Only use conditional structure. and take input from the user for the 3 test cases using scanner objects.

3. **(5 – Marks - Tax Calculator**) Develop a Java application that determines the total tax for each of three citizens. The tax rate is 15% for earnings up to 30,000 USD earned by each citizen and 20% for all earnings in excess of that ceiling. You are given a list with the citizens' names and their earnings in a given year. Your program should input this information for each citizen, then determine and display the citizen's total tax. Use class Scanner to input the data.
Hint: Assume three citizen input from the Terminal, Mosis Abhenry, earning 150,000 Euros, Marium Essa, earning 70,000 Euros, and Abrahim Rai, earning 30,000 Euros.
For this question, the process of top-down refinement of the pseudocode is given, you are only required to code it in Java. Do not forget that you must test **three different** customers in the Java Program. Then, learn it to answer question – 4.

HINT:

Simple Pseudocode

- Get input for the citizen's name and earnings.
- Calculate the tax based on earnings.
- Display the citizen's name and total tax.

Refined Pseudocode

Step 1: Get Input

- Prompt the user to input the citizen's name.
- Prompt the user to input the citizen's earnings.

Step 2: Calculate Tax

- If earnings are less than or equal to 30,000:
  - Tax is 15% of the earnings.
- If earnings exceed 30,000:
  - Tax is 15% on the first 30,000.
  - Tax is 20% on the earnings that exceed 30,000.

Step 3: Display Output

- Print the citizen's name.
- Print the total calculated tax.

Further Refined Detailed Pseudocode

I. **Get Input**
   a. Display message: "Enter citizen's name."
   b. Store input as name.
   c. Display message: "Enter citizen's earnings."
   d. Store input as earnings.

II. **Calculate Tax**
   a. If earnings <= 30,000:
      i. Set tax to earnings * 0.15.
   b. Else:
      i. Set tax to (30,000 * 0.15) + ((earnings - 30,000) * 0.20).

III. **Display Output**
   a. Display name and tax.

4. **(10 – Marks - Credit Limit Calculator)** Develop a Java application that determines whether any of several department-store customers has exceeded the credit limit on a charge account. For each customer the following facts are available: a) account number, b) balance at the beginning of the month, c) total of all items charges by the customers this month, d) total of all credits applied to the customer's account this month, e) allowed credit limit.

The program should input all these facts as integers, calculate the new balance (=beginning balance - charges – credits), display the new balance and determine whether the new balance exceeds the

customer's credit limit. For those customers whose credit limit is exceeded, the program should display the message "Credit limit exceeded."

Submit all the answers, along with the code and output as a pdf file.