EMAT10007 – Introduction to Computer Programming

Exercises – Week 2. Control Flow

Part 1 - Conditional Statements

Exercise 1 - Conditional Statements (Essential)

1. Create two variables, `a` and `b`, and assign a numerical value of your choice to each of the variables. Write a program that tests if `a - b` is positive, negative or zero and prints the outcome of the test to the Console in Spyder.
2. Create three variables. Each variable should be the name of a student and the value of the variable should be their score in an imaginary assignment e.g `valentina = 75`. The pass mark for the assignment is 40. Write a program that prints a message telling the user if all, some or none of the students passed the assignment.
3. Write a program to modify the initial value of the variable 'x' and print the new value, as shown in the flow diagram in Figure 1.
   Is there a different way to the one shown in the flow diagram to re-assign the value of x?
4. Write a program that:
   - asks the user to input a number
   - checks if a number is odd or even

   Hint: The modulo operator, `%`, gives the remainder of the division of the left operand by the right. e.g. `3 % 2 = 1`

   Are there any alternative ways to express the conditionals?

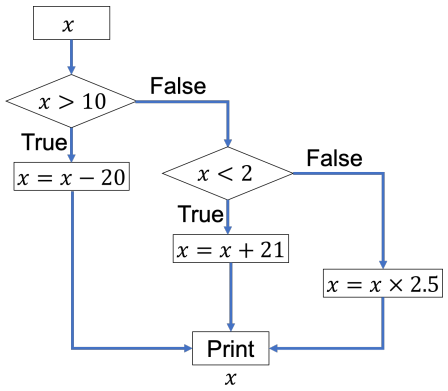

Figure 1: Flow diagram for use in Exercise 1.3

Exercise 2 - Modelling using Conditional Statements (Essential)

1. A currency trader uses the following equation to calculate the amount in US dollars (USD) for the amount the customer pays in pounds sterling (GBP):

$$USD = GBP \times M \times R$$

where $R = 1.38$ is the market rate and the multiplier, M is found using the table below, based on the amount paid.:

GBP	Multiplier
< 50	0.9
< 500 and ≥ 50	0.92
$< 5{,}000$ and ≥ 500	0.95
$< 50{,}000$ and ≥ 5000	0.97
$\geq 50,000$	0.98

Write a program that prints the amount in US dollars for a given amount in pounds sterling, and the effective exchange rate for the conversion= $\frac{\text{USD}}{\text{GBP}}$

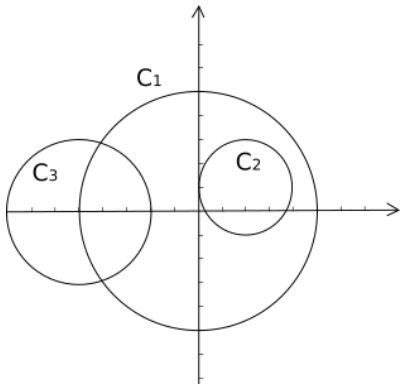

Figure 2: Overlapping circles C_1, C_2 and C_3.

Exercise 3 - More Conditional Statements (Advanced)

1. Suppose we have three circles in the xy-plane (Figure 2).
Circle C_1 is centred at $(0, 0)$ with radius of length 5.
Circle C_2 is centred at $(2, 1)$ and has radius of length 2.
Circle C_3 is centred at $(-5, 0)$ and has a radius of length 3.
Write a program which takes in the variables `x` and `y` and tells the user which circle(s) the point (x, y) is in.
How can you make your code as concise as possible?
Are there any conditions you do not have to test?

2.2 User input and nested conditionals

Exercise 4 - User Input (Essential)

1. Write program that asks the user for a number, tests if the number is positive, negative or zero and prints the outcome of the test to the Console in Spyder.
2. Write program that asks the user for their name and prints a message telling the user what letter their name ends with e.g. `Your name ends with the letter a`

Exercise 5 - Nested control statements (Essential)

1. Create a variable that asks the user for the name of an imaginary student, then asks the user for the student's score in an imaginary assignment. The pass mark for the assignment is 40. Write a program that prints a message telling the user if the student has passed or failed, and if they have passed, also prints their grade.

Score	Grade
≥ 70	A
< 70 and ≥ 60	B
< 60 and ≥ 50	C
< 50 and ≥ 40	D
< 40	Fail

2. Modify the program from Exercise 1.4 by using nested loops to also check:
   - if input even numbers are multiples of 4
   - if input odd numbers are multiples of 3

   Can this modification be achieved using:

   (A) only arithmetic and **comparison** operators?

   (B) only arithmetic and **logical** operators? (*Hint:* Remember **not** reverses the Boolean value of a variable or expression.)
3. Build a text based adventure game by writing a program to execute the flow diagram shown in Figure 3. Your program should ask the user questions and you should use conditionals and nested conditionals to determine the flow of the game.
4. Translate the flow diagram shown in Figure into a program. The program should accept two numbers, `m` and `n` given by the user using `input`.

Exercise 6 - More nested conditionals (Advanced)

1. Build your own text based adventure game in the style of the answer to Exercise 5.3. Your program should ask the user questions and you should use conditionals and nested conditionals to determine the flow of the game.

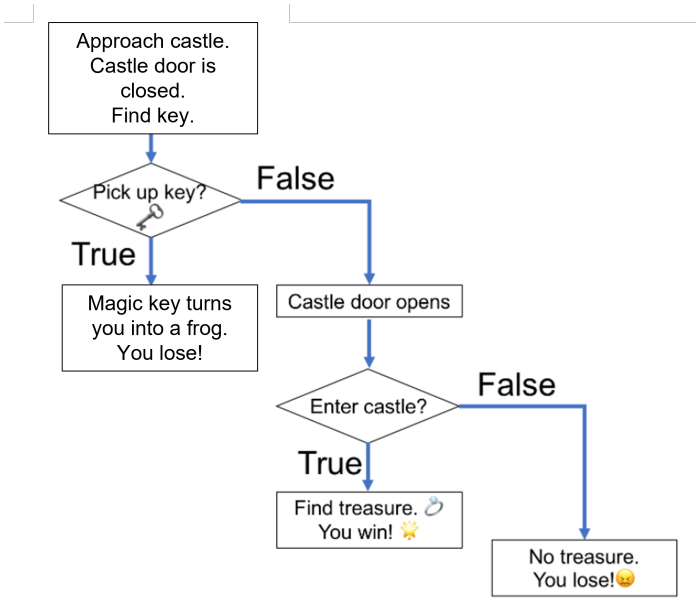

Figure 3: Flow diagram showing an example game

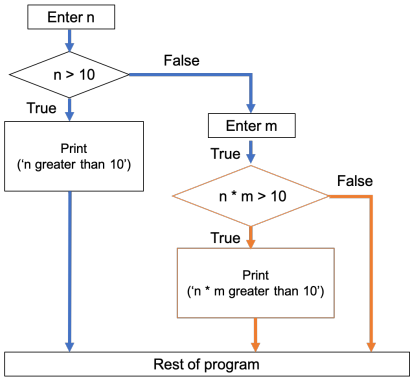

Figure 4: Flow diagram for use in Exercise 5.4

Checklist

- Check that you understand the basics: conditional statements (if, elif, else) as well as user input and nested condtiionals.
- Finish any incomplete Essential exercises for homework.
- Attend the drop-in session for one-to-one support from a Teaching Assistant if there was anything you didn't understand.