14BHD COMPUTER SCIENCE 2020/2021
Laboratory 5

Objective of the laboratory:

Review and consolidate:
- o The use of conditional constructs to make decisions within a program.
- o The use of cycles for the repeated execution of instructions.

Technical contents:
- Definition of variables, use of arithmetic expressions and string manipulation.
- Conditional structures and logical expressions.
- while and for loops.

To solve during the labs:

Exercise 1. Write a program that reads in three strings and sorts them lexicographically.
For instance:
Enter a string: **Charlie**
Enter a string: **Able**
Enter a string: **Baker**
Able
Baker
Charlie
[P3.16]

Exercise 2. When you use an automated teller machine (ATM) with your bank card, you need to use a personal identification number (PIN) to access your account. If a user fails more than three times when entering the PIN, the machine will block the card. Assume that the user's PIN is "1234" and write a program that asks the user for the PIN no more than three times, and does the following:
- If the user enters the right number, print a message saying, "Your PIN is correct", and end the program.
- If the user enters a wrong number, print a message saying, "Your PIN is incorrect" and, if you have asked for the PIN less than three times, ask for it again.
- If the user enters a wrong number three times, print a message saying "Your bank card is blocked" and end the program. [P3.39]

Exercise 3. *Factoring of integers*. Write a program that asks the user for an integer and then prints out all its factors. For example, when the user enters 150, the program should print:

2
3
5
5
[P4.16]

Exercise 4. A simple random generator is obtained by the formula:

$$r_{new} = (a \cdot r_{old} + b) \ \% \ m$$

and then setting r_{new} to r_{old}. Write a program that asks the user to enter an initial value for r_{old}. (Such a value is often called a seed). Then print the first 100 random integers generated by this formula, using $a = 32310901$, $b = 1729$ e $m = 2^{24}$. [P4.27]

Exercise 5. In a predator-prey simulation, you compute the populations of predators and prey, using the following equations:

$$prey_{n+1} = prey_n \times (1 + A - B \times pred_n)$$

$$pred_{n+1} = pred_n \times (1 - C + D \times prey_n)$$

Here, A is the rate at which prey birth exceeds natural death, B is the rate of predation, C is the rate at which predator deaths exceed births without foodm and D represents predator increase in the presence of food. Write a program that prompts users for these rates, the initial population sizes, and the number of periods. Then print the populations for the given number of periods. As inputs, try A = 0.1, B = C = 0.01, and D = 0.00002 with initial prey and predator populations of 1,000 and 20. [P4.36]

To be solved at home:

Exercise 6. French country names are feminine when they end with the letter "e", masculine otherwise, except for the following which are masculine even though they end with "e":

- le Belize
- le Cambodge

- le Mexique
- le Mozambique
- le Zaïre
- le Zimbabwe

Write a program that reads the French name of a country and adds the article: "le" for masculine or "la" for feminine, such as le Canada or la Belgique. However, if the country name starts with a vowel, use " l' "; for example, l'Afghanistan. For the following plural country names, use " les ":
- les Etats-Unis
- les Pays-Bas

[P3.30]

Exercise 7. Write an application to pre-sell a limited number of cinema tickets. Each buyer can buy as many as 4 tickets. No more than 100 tickets can be sold. Implement a program that prompts the user for the desired number of tickets and then displays the number of remaining tickets. Repeat until all tickets have been sold, and then display the total number of buyers. [P4.33]