IC250: Lab assignment 0

Note: The implementations have to be done in C. You can use a numerical programming environment like Scilab or Octave to verify the correctness of your program.

1. **Use of ADT.**
   Complex numbers have wide applications in many areas of science and engineering. For performing calculations with complex numbers, an abstract data type (ADT) for complex numbers is useful.

   Design and implement an ADT to perform arithmetic on complex numbers. Provide functions to perform operations like summation, multiplication, conversion from rectangular to polar form (and vice versa) and determine the complex conjugate.

   Use your ADT to verify de Moivre's formula:

   $$(r(\cos\theta + i\sin\theta))^n = r^n(\cos n\theta + i\sin n\theta)$$

   You can do this by repeated complex multiplication (n times) and by using the polar form.

   Your `main()` program should perform the calculations in the LHS and RHS using the functions from the ADT. You should define a `struct` called `complex` which represents a complex number.

2. **Numerical computation.**
   The Fibonacci sequence is defined by the following recurrance:

   $$f_0 = 0; f_1 = 1$$
   $$f_n = f_{n-1} + f_{n-2} \quad \text{for} \quad n \geq 2$$

   Show that f_n can be approximated by the formula

   $$f_n = \frac{1}{\sqrt{5}}[\phi^n - (-\phi)^{-n}]$$

   where $\phi = (1+\sqrt{5})/2$ is the *golden ratio.*

   Verify the above formula by iteratively (or recursively) computing f_n and by using the formula. You do not need to use an ADT for this.

3. **File I/O and the use of a library.**
   This problem must be done using GLib. Write a program which changes a specific word in an input file to uppercase. The output must be written out into a new file. Only the specific word has to be changed, the rest of the file contents must appear as it is. If the word dosent appear in the file, then the output file is same as the input file. The word and the input file have to be given as command line arguments. For example (see below),

```
 $ cat input.txt
This is a file about climate change
The climate is hot now!
$ changeWord climate input.txt output.txt
$ cat output.txt
This is a file about CLIMATE change
The CLIMATE is hot now!
```

   Read each line of the file into a `GString`. Use utility functions (like `g_string_ascii_up()`) to perform the conversion.

   Note. There are instructions on Moodle on how to install, compile and code using GLib.