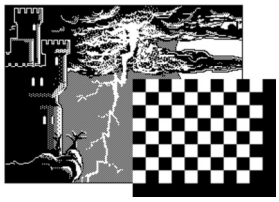
UNIVERSITY OF PARMA

Department of Engineering and Architecture
Degree course in Computer, Electronic and Communications Engineering
PRACTICAL TEST IN COMPUTER SCIENCE & PROGRAMMING LABORATORY
February 20th , 2025

Name: _____ Surname:_____ Matr:_____ Workstation: _____

Write a program using the C language (name the project with your student <**ID**>) that behaves as described below. The available time is 120 minutes. At the end of the time, the saved files on **U:** are going to be automatically collected. Additional documents, files… are available in **T:\Bertozzi**, it is recommended to use WordPad to read text files.



A digital image can be seen as a matrix of points. In black and white images, these points can be represented with a single byte that will take values from 0 (black) to 255 (white). There are different formats in which an image can be saved to a file.

In the case of the **Compuserve RLE format**, the "binary" files that contain an image have a 3-byte header with the values: 27 (ESC), 'G', and then 'M' for images with a resolution of 128×96 (width × height in points) or 'H' for images with a resolution of 256×192. The following bytes, **decremented by 32**, indicate **alternately** how many points are black and white, always starting with black. For example, if the first value after 'M'/'H' is 57, it means that in my image, starting from the top left, the first row will contain 57-32=25 consecutive black points. The file ends with 3 bytes with values 27, 'G', and 'N'.

In the case of the **PGM format**, the binary files that contain the image points start with an **ASCII header** that contains: in the first line "P5", in the second line the dimensions of the image (width and height in order) separated by a space, in the third line "255". These three lines end with a newline. Following this are all the bytes of the image matrix row by row. Develop a program that:

1. (2) asks the user for the name of an RLE file
2. (3-5) opens the specified file for reading, verifies that the header is correct for the RLE format (otherwise terminates the program), and calculates the resolution
3. (9-14) dynamically allocates an appropriate data structure to store the RLE image points and reads them from the file
4. (3-4) verifies that the RLE file ends correctly (otherwise terminates the program)
5. (2) asks the user for the name of a PGM file
6. (4-6) opens the file specified in the previous step for writing and saves the image read in step #3 in PGM format

The definition and use of functions for points 2, 3, 4, and 6 allows for additional points (the numbers in parentheses indicate the maximum score obtainable without and with the use of functions respectively).

Hints:
- I/O functions seen for ASCII files like fprintf() and others can also be used with binary files
- On lab PCs, to view image files you can use Open with → IrfanView

The code should be developed following the proposed order. The correction stops at the first incorrectly implemented step.