TP1
Image File Format

The objective of this practical work is to implement basic image manipulation tools, e.g. read, write and convert. To this aim, and without loss of generality, the simple image file formats PBM (Portable Map) will be considered.

1 "portable map" image file formats

The PBM file formats PBM, PGM and PPM are respectively: portable bitmap, portable grayscalemap and portable pixmap. They offer a simple and generic solution to help developing image manipulation tools. In these formats, an image is a matrix of pixels where values represent the illumination in each pixel: white and black (PBM), grayscale (PGM) or 3 values RGB (PPM).

Definition

The PBM file content is as follows:

1. A 'magic number' for identifying the file type. A pbm image's magic number is the two characters 'P4'.
2. Whitespace (blanks, TABs, CRs, LFs).
3. The width and height (separated with a whitespace) in pixels of the image, formatted as ASCII characters in decimal.
4. Only for PGM and PPM: The maximum intensity value between 0 and 255, again in ASCII decimal, followed by a whitespace.
5. Width $\times$ Height numbers. Those numbers are either decimal values coded in ASCII et separated by a whitespace for the formats P1, P2, P3, or directly binary values (usually 1 byte) in the case of P4, P5, P6. In the latter case, there is no whitespace between values.

Remarks:

- Lines beginning with "#" are ignored.
- No line should be longer than 70 characters.

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Examples

```
P1
# feep.pbm
24 7
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0
0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 1 0
0 1 1 1 0 0 0 1 1 1 0 0 0 1 1 1 0 0 0 1 1 1 1 0
0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0
0 1 0 0 0 0 0 1 1 1 1 1 0 0 1 1 1 1 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

PBM file of a 24×7 image for which values are coded in ASCII decimal

```
P2
# feep.pgm
24 7
15
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0  3  3  3  3  0  0  7  7  7  7  0  0 11 11 11 11  0  0 15 15 15 15  0
0  3  0  0  0  0  0  7  0  0  0  0  0 11  0  0  0  0  0 15  0  0 15  0
0  3  3  3  0  0  0  7  7  7  0  0  0 11 11 11  0  0  0 15 15 15 15  0
0  3  0  0  0  0  0  7  0  0  0  0  0 11  0  0  0  0  0 15  0  0  0  0
0  3  0  0  0  0  0  7  7  7  7  0  0 11 11 11 11  0  0 15  0  0  0  0
0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

PGM file of a 24×7 image . Intensity values are coded in ASCII decimal with 15 levels between black and white.

```
P3
# feep.ppm
4 4
15
0  0  0    0  0  0    0  0  0   15  0 15
0  0  0    0 15  7    0  0  0    0  0  0
0  0  0    0  0  0    0 15  7    0  0  0
15  0 15    0  0  0    0  0  0    0  0  0
```

PPM file of a 4×4 image. Intensity values are coded in ASCII decimal

2 Exercize 1

The archive contains skeletons of conversion programs between the PBM formats as well as an example: pxmtopxm.

1. Test pxmtopxm on test.pbm. What kind of conversion is performed ?
2. How is the image stored in the program ?
3. What is the purpose of the functions pm_getc and pm_getint in the file Util.c ?

4. What data types are involved when manipulating intensities ? in the case of ASCII decimals (P1, P2, P3) ? in the case of binary values (P4, P5, P6) ?

5. Which color is associated to the maximal value ?

3 Exercize 2

The objective is to complete the conversion program between the formats PGM, i.e. from P2 to P5 or from P5 to P2, pgmtopgm.c.

Note: Use the Makefile in the directory as well as the functions in Util.c in order to complete this program.

4 Exercize 3

The PPM format allows to store images in RGB format. Propose an algorithm to convert from PPM to PGM. Write the corresponding c program ppmtopgm.