Digital Image Processing HW1 - Image input/output

BMP Format

BMP is consist of **Bitmap File Header**, **Bitmap Info Header**, **Color Table (Palette)** and **Bitmap Array**.

Bitmap File Header

Bitmap file header is to store general information for bitmap file.

There are 14 bytes to store information below.

Shift	Name	Size(bytes)	Description
0000h	Identifier (ID)	2	In order to identify type of bitmap(*1)
0002h	File Size	4	Total size of file
0006h	Reserved	4	Reserved
000Ah	Bitmap Data Offset	4	The offset before bitmap array begin. (*2)

*1: There are many identifiers, i.e. ’*BM*', ’*BA*', ’*CI*'… , but the most common one is ’*BM*'.

*2: This term is used to find the start point of **bitmap array**.

Bitmap Info Header

Shift	Name	Size(bytes)	Description
000Eh	Bitmap Header Size	4	Length of bitmap info header(unit: byte)
0012h	Width	4	Width of bitmap array(unit: pixel)
0016h	Height	4	Height of bitmap array(unit: pixel)
001Ah	Planes	2	Planes of bitmap array
001Ch	Bits Per Pixel	2	Bits per pixel
001Eh	Compression	4	Way of compression(*3)
0022h	Bitmap Data Size	4	Size of bitmap array(unit: byte)
0026h	H-Resolution	4	Resolution on horizontal axis
002Ah	V-Resolution	4	Resolution on vertical axis
002Eh	Used Colors	4	The number of color in palette
0032h	Important Colors	4	Important color count

*3: (value : compression method) (0 : no compression), (1 : RLE 8-bit/pixel), (2 : RLE 4-bit/pixel), (3 : Bitfields)

Palette   **Bitmap Array**

Shift	Name	Size(bytes)	Description	Shift	Name	Size(bytes)	Description
0036h	Palette	N*4	Data of palette	-(*4)	Bitmap Data	-(*5)	Data of bitmap

*4: We can calculate **shift** by **bitmap data offset** in bitmap file header

*5: We can calculate **Size** by **width** * **height** * (**bits per pixel/4**) or **Bitmap Data Size** in Bitmap Info Header

PNG Format

PNG file starts with an "8-byte signature" and continues with several "**Chunks**".

PNG File Header (8-byte signature)

Values(hex)	Purpose
89	To reduce the chance that a text file is mistaken as a PNG, or vice versa.
50 4E 47	In ASCII, the letters PNG.
0D 0A	A DOS-style line ending (CRLF) to detect DOS-Unix line ending conversion of the data.
1A	A byte that stops display of the file under DOS when the end-of-file character appears.
0A	A Unix-style line ending (LF) to detect Unix-DOS line ending conversion.

"Chunks" Format

There are two types of chunks, **critical** chunks and **ancillary** chunks. A program must be able to identify **critical** chunks and if it does not understand ancillary chunks, it could ignore it. A chunk has the following format:

Length	Chunk Type(*6)	Chunk Data	CRC
4 bytes	4 bytes	**Length** bytes	4 bytes

*6: There are some rules for chunk type. The **first** letter is **uppercase** => **critical chunk**, and vice versa. The **second** letter is **uppercase** => **public (standard)**, and vice versa. The **third** letter must be **uppercase** to **confirm PNG spec**. The case of the **fourth letter** indicates whether the chunk is safe to **copy by editors that do not recognize it**.

Critical Chunks

IHDR(MUST be first chunk, size = 13 bytes): contain (in this order) the image's width(4bytes), height(4bytes), bit depth(1byte), color type(1byte), compression method(1byte), filter method(1byte), and interlace method(1byte).

PLTE: contain the palette (list of colors). Red (1byte), Green (1byte) and Blue (1byte).

IDAT: store actual image data, which could be split into multiple IDAT chunks.

IEND: marks the end of PNG file.

Reference

[1] 點陣圖（Bitmap）檔案格式-瘋小貓的華麗冒險
[2] BMP file format
[3] Portable Network Graphics
[4] PNG 格式