

# SDL\_bgi 3.0.2 Quick Reference

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March 27, 2024



## Contents

<b>1 Introduction to SDL_bgi</b>	<b>1</b>	<b>fillpoly()</b>	<b>16</b>
1.1 Sample Programs	1	floodfill()	16
1.2 The Graphics Environment	2	getactivepage()	16
1.3 Getting Help	3	getarccoords()	16
1.4 Definitions	3	getaspectratio()	16
1.5 Environment Variables	12	getbkcolor()	17
1.6 Colours	13	getcolor()	17
1.7 Fonts	13	getdefaultpalette()	17
1.8 Notes for SDL2 Programmers	13	getdrivername()	17
1.9 Notes for Python Programmers	14	getfillpattern()	17
<b>2 Standard BGI Graphics Functions</b>	<b>14</b>	getfillsettings()	17
arc()	14	getgraphmode()	17
bar()	14	getimage()	17
bar3d()	14	getlinesettings()	18
circle()	15	getmaxcolor()	18
cleardevice()	15	getmaxmode()	18
clearviewport()	15	getmaxx()	18
closegraph()	15	getmaxy()	18
detectgraph()	15	getmodename()	18
drawpoly()	15	getmoderange()	18
ellipse()	16	getpalette()	19
fillellipse()	16	getpalettesize()	19
		getpixel()	19
		gettextsettings()	19

<code>getviewsettings()</code> . . . . .	19	<code>setviewport()</code> . . . . .	25
<code>getvisualpage()</code> . . . . .	19	<code>setvisualpage()</code> . . . . .	25
<code>getx()</code> . . . . .	19	<code>setwritemode()</code> . . . . .	26
<code>gety()</code> . . . . .	20	<code>textheight()</code> . . . . .	26
<code>graphdefaults()</code> . . . . .	20	<code>textwidth()</code> . . . . .	26
<code>grapherrormsg()</code> . . . . .	20		
<code>graphresult()</code> . . . . .	20	<b>3 Non-Graphics Functions and</b>	
<code>imagesize()</code> . . . . .	20	<b>Macros</b>	<b>26</b>
<code>initgraph()</code> . . . . .	20	<code>getch()</code> . . . . .	26
<code>installuserdriver()</code> . . . . .	21	<code>kbhit()</code> . . . . .	26
<code>installuserfont()</code> . . . . .	21	<code>lastkey()</code> . . . . .	26
<code>line()</code> . . . . .	21	<code>random()</code> . . . . .	27
<code>linerel()</code> . . . . .	21	<b>4 SDL_bgi Additions</b>	<b>27</b>
<code>lineto()</code> . . . . .	21	<code>ALPHA_VALUE()</code> . . . . .	27
<code>moverel()</code> . . . . .	22	<code>BLUE_VALUE()</code> . . . . .	27
<code>moveto()</code> . . . . .	22	<code>closewindow()</code> . . . . .	27
<code>outtext()</code> . . . . .	22	<code>COLOR()</code> . . . . .	27
<code>outtextxy()</code> . . . . .	22	<code>COLOR32()</code> . . . . .	27
<code>pieslice()</code> . . . . .	22	<code>clearmousebutton()</code> . . . . .	28
<code>putimage()</code> . . . . .	22	<code>colorname()</code> . . . . .	28
<code>putpixel()</code> . . . . .	22	<code>colorRGB()</code> . . . . .	28
<code>rectangle()</code> . . . . .	22	<code>copysurface()</code> . . . . .	28
<code>registerbgidriver()</code> . . . . .	23	<code>doubleclick()</code> . . . . .	28
<code>registerbgifont()</code> . . . . .	23	<code>edelay()</code> . . . . .	28
<code>restorecrtmode()</code> . . . . .	23	<code>event()</code> . . . . .	28
<code>sector()</code> . . . . .	23	<code>eventtype()</code> . . . . .	29
<code>setactivepage()</code> . . . . .	23	<code>fputpixel()</code> . . . . .	29
<code>setallpalette()</code> . . . . .	23	<code>getbuffer()</code> . . . . .	29
<code>setaspectratio()</code> . . . . .	23	<code>getclick()</code> . . . . .	29
<code>setbkcolor()</code> . . . . .	24	<code>getcurrentwindow()</code> . . . . .	29
<code>setcolor()</code> . . . . .	24	<code>getevent()</code> . . . . .	29
<code>setfillpattern()</code> . . . . .	24	<code>getleftclick()</code> . . . . .	29
<code>setfillstyle()</code> . . . . .	24	<code>getlinebuffer()</code> . . . . .	30
<code>setgraphbufsize()</code> . . . . .	24	<code>getmaxheight()</code> . . . . .	30
<code>setgraphmode()</code> . . . . .	24	<code>getmaxwidth()</code> . . . . .	30
<code>setlinestyle()</code> . . . . .	24	<code>getmiddleclick()</code> . . . . .	30
<code>setpalette()</code> . . . . .	25	<code>getmouseclick()</code> . . . . .	30
<code>settextjustify()</code> . . . . .	25	<code>getrgbpalette()</code> . . . . .	30
<code>settextstyle()</code> . . . . .	25	<code>getrightclick()</code> . . . . .	30
<code>setusercharsize()</code> . . . . .	25	<code>getscreensize()</code> . . . . .	31

<code>getwindowheight()</code> . . . . .	31	<code>RGBPALETTE()</code> . . . . .	33
<code>getwindowwidth()</code> . . . . .	31	<code>sdlbgiauto()</code> . . . . .	34
<code>GREEN_VALUE()</code> . . . . .	31	<code>sdlbgifast()</code> . . . . .	34
<code>initpalette()</code> . . . . .	31	<code>sdlbgislow()</code> . . . . .	34
<code>initwindow()</code> . . . . .	31	<code>setallrgbpalette()</code> . . . . .	34
<code>IS_BGI_COLOR()</code> . . . . .	32	<code>setalpha()</code> . . . . .	34
<code>ismouseclick()</code> . . . . .	32	<code>setbkrgbcolor()</code> . . . . .	34
<code>IS_RGB_COLOR()</code> . . . . .	32	<code>setblendmode()</code> . . . . .	34
<code>kdelay()</code> . . . . .	32	<code>setcurrentwindow()</code> . . . . .	35
<code>mouseclick()</code> . . . . .	32	<code>setrgbcolor()</code> . . . . .	35
<code>mousex()</code> . . . . .	32	<code>setrgbpalette()</code> . . . . .	35
<code>mousey()</code> . . . . .	32	<code>setwinoptions()</code> . . . . .	35
<code>putbuffer()</code> . . . . .	32	<code>setwintitle()</code> . . . . .	35
<code>putlinebuffer()</code> . . . . .	33	<code>showerrorbox()</code> . . . . .	35
<code>readimagefile()</code> . . . . .	33	<code>showinfobox()</code> . . . . .	36
<code>RED_VALUE()</code> . . . . .	33	<code>swapbuffers()</code> . . . . .	36
<code>refresh()</code> . . . . .	33	<code>writeimagefile()</code> . . . . .	36
<code>resetwinoptions()</code> . . . . .	33	<code>xkbhit()</code> . . . . .	36
<code>resizepalette()</code> . . . . .	33		

## 1 Introduction to SDL\_bgi

`SDL_bgi` is a graphics library (`GRAPHICS.H`) for C, C++, WebAssembly, and Python.

In more detail: `SDL_bgi` is a multiplatform, fast, SDL2-based implementation of BGI written in C. BGI, the [Borland Graphics Interface](#) also known as `GRAPHICS.H`, was a graphics library provided by Borland Turbo C / Borland C++ compilers for MS-DOS (pre-Windows era!). BGI was very popular in the late eighties–early nineties of the last century, and it became the *de facto* standard for computer graphics. It is still widely used in colleges and universities in India.

`SDL_bgi` aims to provide a modern implementation of BGI and replace the old DOS-based compilers, that are tricky to run on modern operating systems. However, `SDL_bgi` is not just a BGI clone; it is a larger and more powerful superset. It provides many extensions for ARGB colours, multiple windows, bitmap and vector fonts, and mouse support. `SDL_bgi` implements nearly all extensions provided by another popular BGI implementation, [WinBGIm](#), and adds several more.

`SDL_bgi` is one of the easiest libraries to do graphics programming. It is much simpler to use than plain SDL2, OpenGL and the like; obviously, it’s also less complete. Teachers may find `SDL_bgi` a useful tool for introductory computer graphics courses.

This manual provides a quick reference to `SDL_bgi` functions. For more complete explanations and usage examples, please see the demo and test files in the source archive.

## 1.1 Sample Programs

This is a minimal program written in C that creates a window and draws 1000 random lines:

```
#include <graphics.h>

int main (int argc, char *argv[])
{
    int i, gd = DETECT, gm;
    initgraph (&gd, &gm, ""); // default: 800 x 600
    setbkcolor (BLACK);
    cleardevice ();
    outtextxy (0, 0, "Drawing 1000 lines...");
    for (i = 0; i < 1000; i++) {
        setcolor (1 + random (MAXCOLORS));
        line (random(getmaxx()), random(getmaxy()),
            random (getmaxx()), random(getmaxy()) );
    }
    getch ();
    closegraph ();
    return 0;
}
```

The program includes the header file `graphics.h`, which in turn includes `SDL_bgi.h` that contains all necessary definitions. `initgraph()` creates a window; from this point on, graphics functions can be called. `closegraph()` closes the window. The program can also be turned to WebAssembly and run in a web browser; please find compilation details in file `using.md`.

The above program can be easily rewritten in Python:

```
from sdl_bgi import *

gd, gm = DETECT, 0
initgraph (gd, gm, "") # default: 800 x 600
setbkcolor (BLACK)
cleardevice ()
outtextxy (0, 0, "Drawing 1000 lines...")

for i in range (1000):
    setcolor (1 + random (MAXCOLORS))
    line (random (getmaxx ()), random (getmaxy ()),
        random (getmaxx ()), random (getmaxy ()))

getch ()
closegraph ()
```

The program imports definitions from the `sdl_bgi.py` module. As you can see, the syntax of Python functions closely resembles that of corresponding C functions. Some syntax differences exist, though; they are explained in Section 1.9.

## 1.2 The Graphics Environment

- graphics must be initialised using `initgraph()` or `initwindow()`; one or more windows can be created. Only one of them is active, i.e. being drawn on, at any given moment.
- within a window, pixel coordinates range from the upper left corner at (0, 0) to the lower right corner at (`getmaxx()`, `getmaxy()`).
- some graphic functions set the coordinates of the last drawing position, defined as CP (Current Pointer): `cleardevice()`, `clearviewport()`, `graphdefaults()`, `linereel()`, `lineto()`, `moverel()`, `moveto()`.
- at any given moment, a foreground, background and fill colour, line style, line thickness, and fill pattern are defined. These parameters are used by functions like `line()` or `floodfill()`.
- line drawing functions can perform binary operations between plotted pixels and the background (XOR, OR, AND, NOT); please see `setwritemode()`.
- a viewport (subwindow) may also be defined, with or without clipping.
- in addition to the visualised window, hidden ones (“pages”) can be defined and drawn on; please see `setactivepage()` and `setvisualpage()`.
- BGI uses its own fonts; system fonts are not available.

## 1.3 Getting Help

The graphics man page is available for GNU/Linux, macOS, and MSYS2 platforms.

In Python, you can get help on any function using one of the following commands:

```
>>> from sdl_bgi import *
>>> help (initgraph)
Help on function initgraph in module sdl_bgi:

initgraph(graphdriver, graphmode, pathtodriver)
    Initializes the graphics system. Use initgraph (0, 0, "")
    for default settings.
>>> # or:
>>> print (initgraph.__doc__)

    Initializes the graphics system. Use initgraph (0, 0, "")
    for default settings.
>>>
```

## 1.4 Definitions

C programs must include definitions from header file `SDL_bgi.h`:

```

#ifndef _SDL_BGI_H
#define _SDL_BGI_H

#ifndef __GRAPHICS_H
#define __GRAPHICS_H

// SDL2 stuff
#include <SDL2/SDL.h>
#include <SDL2/SDL_keycode.h>
#include <SDL2/SDL_mouse.h>
#include <stdio.h> // for fprintf()
#include <stdlib.h> // for exit(), calloc()
#include <math.h> // for sin(), cos()
#include <string.h> // for strlen(), memcpy()

#ifdef __EMSCRIPTEN__
#include <emscripten.h>
#endif

#define SDL_BGI_VERSION 3.0.2

enum { NOPE, YEAH };
#define BGI_WINTITLE_LEN 512 // more than enough
// number of concurrent windows that can be created

#define NUM_BGI_WIN 16

// everything gets drawn here

extern SDL_Window *bgi_window;
extern SDL_Renderer *bgi_renderer;
extern SDL_Texture *bgi_texture;
extern Uint32 PALETTE_SIZE;

// available visual pages

#define VPAGES 4

// BGI fonts

enum {
    DEFAULT_FONT, // 8x8 bitmap
    TRIPLEX_FONT, // trip.h
    SMALL_FONT, // litt.h
    SANS_SERIF_FONT, // sans.h
    GOTHIC_FONT, // goth.h
    SCRIPT_FONT, // scri.h
    SIMPLEX_FONT, // simp.h
    TRIPLEX_SCR_FONT, // tscr.h
    COMPLEX_FONT, // lcom.h
    EUROPEAN_FONT, // euro.h
    BOLD_FONT, // bold.h
    LAST_SPEC_FONT
};

enum { HORIZ_DIR, VERT_DIR };

#define USER_CHAR_SIZE 0

enum {
    LEFT_TEXT, CENTER_TEXT, RIGHT_TEXT,
    BOTTOM_TEXT = 0, TOP_TEXT = 2
};

```

```

// BGI colours, including CGA and EGA palettes
enum {
    BLACK          = 0,
    BLUE           = 1,
    GREEN          = 2,
    CYAN           = 3,
    RED            = 4,
    MAGENTA        = 5,
    BROWN          = 6,
    LIGHTGRAY      = 7,
    DARKGRAY       = 8,
    LIGHTBLUE      = 9,
    LIGHTGREEN     = 10,
    LIGHTCYAN      = 11,
    LIGHTRED       = 12,
    LIGHTMAGENTA   = 13,
    YELLOW         = 14,
    WHITE          = 15,
    MAXCOLORS      = 15,
    EGA_BLACK      = 0,
    EGA_BLUE       = 1,
    EGA_GREEN      = 2,
    EGA_CYAN       = 3,
    EGA_RED        = 4,
    EGA_MAGENTA    = 5,
    EGA_BROWN      = 6,
    EGA_LIGHTGRAY  = 7,
    EGA_DARKGRAY   = 8,
    EGA_LIGHTBLUE  = 9,
    EGA_LIGHTGREEN = 10,
    EGA_LIGHTCYAN  = 11,
    EGA_LIGHTRED   = 12,
    EGA_LIGHTMAGENTA = 13,
    EGA_YELLOW     = 14,
    EGA_WHITE      = 15,
};

// ARGB colours, set by COLOR (), COLOR32 (), and RGBPALETTE ()
enum {
    ARGB_FG_COL    = 16,
    ARGB_BG_COL    = 17,
    ARGB_FILL_COL  = 18,
    ARGB_TMP_COL   = 19,
    TMP_COLORS     = 4
};

// line style, thickness, and drawing mode
enum { NORM_WIDTH = 1, THICK_WIDTH = 3 };
enum { SOLID_LINE, DOTTED_LINE, CENTER_LINE, DASHED_LINE,
      USERBIT_LINE };
enum { COPY_PUT, XOR_PUT, OR_PUT, AND_PUT, NOT_PUT };

// fill styles
enum {
    EMPTY_FILL,           // fills area in background color
    SOLID_FILL,           // fills area in solid fill color
    LINE_FILL,            // --- fill
    LTSLASH_FILL,         // /// fill
    SLASH_FILL,           // /// fill with thick lines
    BKSLASH_FILL,        // \\ \\ fill with thick lines
    LTBKSLASH_FILL,      // \\ \\ fill
    HATCH_FILL,           // light hatch fill
    XHATCH_FILL,         // heavy cross hatch fill
    INTERLEAVE_FILL,     // interleaving line fill
    WIDE_DOT_FILL,       // Widely spaced dot fill
    CLOSE_DOT_FILL,     // Closely spaced dot fill
    USER_FILL           // user defined fill
};

// mouse events - compatible with WinBGIm
#define WM_MOUSEMOVE      SDL_MOUSEMOTION
#define WM_LBUTTONDOWN    SDL_BUTTON_LEFT
#define WM_LBUTTONUP      SDL_MOUSEBUTTONDOWN + SDL_BUTTON_LEFT
#define WM_LBUTTONDOWNCLK SDL_MOUSEBUTTONDOWN + SDL_BUTTON_LEFT + 2
#define WM_MBUTTONDOWN    SDL_BUTTON_MIDDLE

```

```

#define WM_MBUTTONDOWN      SDL_MOUSEBUTTONDOWN + 10*SDL_BUTTON_MIDDLE
#define WM_MBUTTONDOWNCLK   SDL_MOUSEBUTTONDOWN + 10*SDL_BUTTON_MIDDLE+2

#define WM_RBUTTONDOWN      SDL_BUTTON_RIGHT
#define WM_RBUTTONDOWNUP    SDL_MOUSEBUTTONDOWN + 20*SDL_BUTTON_RIGHT
#define WM_RBUTTONDOWNCLK   SDL_MOUSEBUTTONDOWN + 20*SDL_BUTTON_RIGHT+2

#define WM_WHEEL            SDL_MOUSEWHEEL
#define WM_WHEELUP          SDL_BUTTON_RIGHT + 1
#define WM_WHEELDOWN        SDL_BUTTON_RIGHT + 2

// keys
#define KEY_HOME             SDLK_HOME
#define KEY_LEFT             SDLK_LEFT
#define KEY_UP               SDLK_UP
#define KEY_RIGHT            SDLK_RIGHT
#define KEY_DOWN             SDLK_DOWN
#define KEY_PGUP             SDLK_PAGEUP
#define KEY_PGDN             SDLK_PAGEDOWN
#define KEY_END              SDLK_END
#define KEY_INSERT           SDLK_INSERT
#define KEY_DELETE           SDLK_DELETE
#define KEY_F1               SDLK_F1
#define KEY_F2               SDLK_F2
#define KEY_F3               SDLK_F3
#define KEY_F4               SDLK_F4
#define KEY_F5               SDLK_F5
#define KEY_F6               SDLK_F6
#define KEY_F7               SDLK_F7
#define KEY_F8               SDLK_F8
#define KEY_F9               SDLK_F9
#define KEY_F10              SDLK_F10
#define KEY_F11              SDLK_F11
#define KEY_F12              SDLK_F12
#define KEY_CAPSLOCK         SDLK_CAPSLOCK
#define KEY_LEFT_CTRL        SDLK_LCTRL
#define KEY_RIGHT_CTRL       SDLK_RCTRL
#define KEY_LEFT_SHIFT       SDLK_LSHIFT
#define KEY_RIGHT_SHIFT      SDLK_RSHIFT
#define KEY_LEFT_ALT         SDLK_LALT
#define KEY_RIGHT_ALT        SDLK_RALT
#define KEY_ALT_GR           SDLK_MODE
#define KEY_LGUI             SDLK_LGUI
#define KEY_RGUI             SDLK_RGUI
#define KEY_MENU             SDLK_MENU
#define KEY_TAB              SDLK_TAB
#define KEY_BS               SDLK_BACKSPACE
#define KEY_RET              SDLK_RETURN
#define KEY_PAUSE            SDLK_PAUSE
#define KEY_SCR_LOCK         SDLK_SCROLLLOCK
#define KEY_ESC              SDLK_ESCAPE

#define QUIT                 SDL_QUIT

// graphics modes. Expanded from the original GRAPHICS.H
enum {
    DETECT = -1,
    SDL = 0,
    // all modes @ 320x200
    SDL_320x200 = 1, SDL_CGALO = 1, CGA = 1, CGACO = 1, CGAC1 = 1,
    CGAC2 = 1, CGAC3 = 1, MCGACO = 1, MCGAC1 = 1, MCGAC2 = 1,
    MCGAC3 = 1, ATT400CO = 1, ATT400C1 = 1, ATT400C2 = 1, ATT400C3 = 1,
    // all modes @ 640x200
    SDL_640x200 = 2, SDL_CGAHI = 2, CGAHI = 2, MCGAMED = 2,
    EGALO = 2, EGA64LO = 2,
    // all modes @ 640x350
    SDL_640x350 = 3, SDL_EGA = 3, EGA = 3, EGAHI = 3,
    EGA64HI = 3, EGAMONHI = 3,

```

```

// all modes @ 640x480
SDL_640x480 = 4, SDL_VGA = 4, VGA = 4, MCGAHI = 4, VGAHI = 4,
IBM8514LO = 4,
// all modes @ 720x348
SDL_720x348 = 5, SDL_HERC = 5,
// all modes @ 720x350
SDL_720x350 = 6, SDL_PC3270 = 6, HERCMONOHI = 6,
// all modes @ 800x600
SDL_800x600 = 7, SDL_SVGALO = 7, SVGA = 7,
// all modes @ 1024x768
SDL_1024x768 = 8, SDL_SVGAMED1 = 8,
// all modes @ 1152x900
SDL_1152x900 = 9, SDL_SVGAMED2 = 9,
// all modes @ 1280x1024
SDL_1280x1024 = 10, SDL_SVGAHI = 10,
// all modes @ 1366x768
SDL_1366x768 = 11, SDL_WXGA = 11,
// other
SDL_USER = 12, SDL_FULLSCREEN = 13
};

// error messages
enum graphics_errors {
    grOk = 0,
    grNoInitGraph = -1,
    grNotDetected = -2,
    grFileNotFound = -3,
    grInvalidDriver = -4,
    grNoLoadMem = -5,
    grNoScanMem = -6,
    grNoFloodMem = -7,
    grFontNotFound = -8,
    grNoFontMem = -9,
    grInvalidMode = -10,
    grError = -11,
    grIOerror = -12,
    grInvalidFont = -13,
    grInvalidFontNum = -14,
    grInvalidVersion = -18
};

// libXbgi compatibility
#define X11_CGALO      SDL_CGALO
#define X11_CGAHI     SDL_CGAHI
#define X11_EGA       SDL_EGA
#define X11           SDL
#define X11_VGA       SDL_VGA
#define X11_640x480   SDL_640x480
#define X11_HERC      SDL_HERC
#define X11_PC3270    SDL_PC3270
#define X11_SVGALO    SDL_SVGALO
#define X11_800x600   SDL_800x600
#define X11_SVGAMED1  SDL_SVGAMED1
#define X11_1024x768  SDL_1024x768
#define X11_SVGAMED2  SDL_SVGAMED2
#define X11_1152x900  SDL_1152x900
#define X11_SVGAHI    SDL_SVGAHI
#define X11_1280x1024 SDL_1280x1024
#define X11_WXGA      SDL_WXGA
#define X11_1366x768  SDL_1366x768
#define X11_USER      SDL_USER
#define X11_FULLSCREEN SDL_FULLSCREEN

// structs
struct arccoordstype {
    int x;
    int y;
};

```

```

    int xstart;
    int ystart;
    int xend;
    int yend;
};

struct date {
    int da_year;
    int da_day;
    int da_mon;
};

struct fillsettingstype {
    int pattern;
    int color;
};

struct linesettingstype {
    int linestyle;
    unsigned int upattern;
    int thickness;
};

struct palettetype {
    unsigned char size;
    Uint32 colors[MAXCOLORS + 1];
};

// SDL_bgi extension
struct rgbpalettetype {
    Uint32 size;
    Uint32 *colors;
};

struct textsettingstype {
    int font;
    int direction;
    int charsize;
    int horiz;
    int vert;
};

struct viewporttype {
    int left;
    int top;
    int right;
    int bottom;
    int clip;
};

```

Python bindings to `SDL_bgi` are implemented via [ctypes](#). Programs must import definitions from the `sdl_bgi.py` module:

```

from ctypes import *
from sysconfig import get_platform
from random import randint

# try to load the SDL_bgi library

if get_platform () == 'win-amd64':          # Windows, IDLE
    sdlbgilib = ".\SDL_bgi.dll"
elif get_platform () == 'mingw_x86_64':    # Windows, MSYS2/Mingw64
    sdlbgilib = '/msys64/mingw64/bin/SDL_bgi.dll'
else: # GNU/Linux, macOS
    sdlbgilib = 'libSDL_bgi.so'

```

```

try:
    sb = CDLL (sdlbgilib)
except:
    print ("The sdl_bgi.py module needs the SDL_bgi library binary;")
    print ("please get it from https://sdl-bgi.sourceforge.io")
    print ("Exiting.")
    quit ()

SDL_BGI_VERSION = "3.0.2"
NOPE = False
YEAH = True
BGI_WINTITLE_LEN = 512

# number of concurrent windows that can be created
NUM_BGI_WIN = 16

VPAGES = 4

# BGI fonts
DEFAULT_FONT      = 0    # 8x8 bitmap
TRIPLEX_FONT      = 1    # trip.h
SMALL_FONT        = 2    # litt.h
SANS_SERIF_FONT   = 3    # sans.h
GOTHIC_FONT       = 4    # goth.h
SCRIPT_FONT       = 5    # scri.h
SIMPLEX_FONT      = 6    # simp.h
TRIPLEX_SCR_FONT  = 7    # tscr.h
COMPLEX_FONT      = 8    # lcom.h
EUROPEAN_FONT     = 9    # euro.h
BOLD_FONT         = 10   # bold.h
LAST_SPEC_FONT    = 11

HORIZ_DIR = 0
VERT_DIR  = 1

USER_CHAR_SIZE = 0

LEFT_TEXT  = 0
CENTER_TEXT = 1
RIGHT_TEXT = 2
BOTTOM_TEXT = 0
TOP_TEXT   = 2

# BGI colours
BLACK      = 0
BLUE       = 1
GREEN      = 2
CYAN       = 3
RED        = 4
MAGENTA    = 5
BROWN      = 6
LIGHTGRAY  = 7
DARKGRAY   = 8
LIGHTBLUE  = 9
LIGHTGREEN = 10
LIGHTCYAN  = 11
LIGHTRED   = 12
LIGHTMAGENTA = 13
YELLOW     = 14
WHITE      = 15
MAXCOLORS  = 15

# ARGB colours set by COLOR () COLOR32 () and RGBPALETTE ()
ARGB_FG_COL = 16
ARGB_BG_COL = 17

```

```

ARGB_FILL_COL = 18
ARGB_TMP_COL  = 19
TMP_COLORS    = 4

# line style thickness and drawing mode

NORM_WIDTH    = 1
THICK_WIDTH   = 3

SOLID_LINE    = 0
DOTTED_LINE   = 1
CENTER_LINE   = 2
DASHED_LINE   = 3
USERBIT_LINE  = 4

COPY_PUT      = 0
XOR_PUT       = 1
OR_PUT        = 2
AND_PUT       = 3
NOT_PUT       = 4

# fill styles

EMPTY_FILL    = 0 # fills area in background color
SOLID_FILL    = 1 # fills area in solid fill color
LINE_FILL     = 2 # --- fill
LTSLASH_FILL  = 3 # /// fill
SLASH_FILL    = 4 # /// fill with thick lines
BKSLASH_FILL  = 5 # \\ \\ fill with thick lines
LTBKSLASH_FILL = 6 # \\ \\ fill
HATCH_FILL    = 7 # light hatch fill
XHATCH_FILL   = 8 # heavy cross hatch fill
INTERLEAVE_FILL = 9 # interleaving line fill
WIDE_DOT_FILL = 10 # Widely spaced dot fill
CLOSE_DOT_FILL = 11 # Closely spaced dot fill
USER_FILL     = 12 # user defined fill

# window properties
SDL_WINDOW_FULLSCREEN = 0x00000001
SDL_BLENDMODE_NONE    = 0x00000000
SDL_BLENDMODE_BLEND   = 0x00000001

# mouse events - compatible with WinBGIm

SDL_BUTTON_LEFT      = 1
SDL_BUTTON_MIDDLE    = 2
SDL_BUTTON_RIGHT     = 3
SDL_MOUSEMOTION      = 0x400 # from SDL_events.h
SDL_MOUSEBUTTONDOWN  = 0x401
SDL_MOUSEBUTTONUP    = 0x402
SDL_MOUSEWHEEL       = 0x403

WM_MOUSEMOVE         = SDL_MOUSEMOTION
WM_LBUTTONDOWN       = SDL_BUTTON_LEFT # from SDL_mouse.h
WM_LBUTTONUP         = SDL_MOUSEBUTTONUP + SDL_BUTTON_LEFT
WM_LBUTTONDOWNCLK    = SDL_MOUSEBUTTONDOWN + SDL_BUTTON_LEFT + 2

WM_MBUTTONDOWN       = SDL_BUTTON_MIDDLE
WM_MBUTTONUP         = SDL_MOUSEBUTTONUP + 10*SDL_BUTTON_MIDDLE
WM_MBUTTONDOWNCLK    = SDL_MOUSEBUTTONDOWN + 10*SDL_BUTTON_MIDDLE + 2

WM_RBUTTONDOWN       = SDL_BUTTON_RIGHT
WM_RBUTTONUP         = SDL_MOUSEBUTTONUP + 20*SDL_BUTTON_RIGHT
WM_RBUTTONDOWNCLK    = SDL_MOUSEBUTTONDOWN + 20*SDL_BUTTON_RIGHT + 2

WM_WHEEL             = SDL_MOUSEWHEEL
WM_WHEELUP           = SDL_BUTTON_RIGHT + 1
WM_WHEELDOWN         = SDL_BUTTON_RIGHT + 2

```

```

# keys

SDL_SCANCODE_TO_KEYCODE = lambda key: key | (1 << 30)
# 30 = SDLK_SCANCODE_MASK

KEY_HOME           = SDLK_SCANCODE_TO_KEYCODE (74) # from SDL_scancode.h
KEY_LEFT           = SDLK_SCANCODE_TO_KEYCODE (80)
KEY_UP             = SDLK_SCANCODE_TO_KEYCODE (82)
KEY_RIGHT          = SDLK_SCANCODE_TO_KEYCODE (79)
KEY_DOWN          = SDLK_SCANCODE_TO_KEYCODE (81)
KEY_PGUP           = SDLK_SCANCODE_TO_KEYCODE (75)
KEY_PGDN           = SDLK_SCANCODE_TO_KEYCODE (78)
KEY_END            = SDLK_SCANCODE_TO_KEYCODE (77)
KEY_INSERT         = SDLK_SCANCODE_TO_KEYCODE (73)
KEY_DELETE         = SDLK_SCANCODE_TO_KEYCODE (76)
KEY_F1             = SDLK_SCANCODE_TO_KEYCODE (58)
KEY_F2             = SDLK_SCANCODE_TO_KEYCODE (59)
KEY_F3             = SDLK_SCANCODE_TO_KEYCODE (60)
KEY_F4             = SDLK_SCANCODE_TO_KEYCODE (61)
KEY_F5             = SDLK_SCANCODE_TO_KEYCODE (62)
KEY_F6             = SDLK_SCANCODE_TO_KEYCODE (63)
KEY_F7             = SDLK_SCANCODE_TO_KEYCODE (64)
KEY_F8             = SDLK_SCANCODE_TO_KEYCODE (65)
KEY_F9             = SDLK_SCANCODE_TO_KEYCODE (66)
KEY_F10            = SDLK_SCANCODE_TO_KEYCODE (67)
KEY_F11            = SDLK_SCANCODE_TO_KEYCODE (68)
KEY_F12            = SDLK_SCANCODE_TO_KEYCODE (69)
KEY_CAPSLOCK       = SDLK_SCANCODE_TO_KEYCODE (57)
KEY_LEFT_CTRL      = SDLK_SCANCODE_TO_KEYCODE (224)
KEY_RIGHT_CTRL     = SDLK_SCANCODE_TO_KEYCODE (228)
KEY_LEFT_SHIFT     = SDLK_SCANCODE_TO_KEYCODE (225)
KEY_RIGHT_SHIFT    = SDLK_SCANCODE_TO_KEYCODE (229)
KEY_LEFT_ALT       = SDLK_SCANCODE_TO_KEYCODE (226)
KEY_RIGHT_ALT      = SDLK_SCANCODE_TO_KEYCODE (230)
KEY_ALT_GR         = SDLK_SCANCODE_TO_KEYCODE (230)
KEY_LGUI           = SDLK_SCANCODE_TO_KEYCODE (227)
KEY_RGUI           = SDLK_SCANCODE_TO_KEYCODE (231)
KEY_MENU           = SDLK_SCANCODE_TO_KEYCODE (118)
KEY_TAB            = SDLK_SCANCODE_TO_KEYCODE (43)
KEY_BS             = SDLK_SCANCODE_TO_KEYCODE (42)
KEY_RET            = SDLK_SCANCODE_TO_KEYCODE (40)
KEY_PAUSE          = SDLK_SCANCODE_TO_KEYCODE (72)
KEY_SCR_LOCK       = SDLK_SCANCODE_TO_KEYCODE (71)
KEY_ESC            = SDLK_SCANCODE_TO_KEYCODE (41)

SDL_KEYDOWN        = 0x300
SDL_QUIT           = 0x100
QUIT               = SDLK_QUIT

# graphics modes. Expanded from the original GRAPHICS.H

DETECT             = -1
SDL                = 0
SDL_320x200        = 1
CGA                = 1
SDL_640x200        = 2
SDL_640x350        = 3
SDL_EGA            = 3
EGA                = 3
SDL_640x480        = 4
SDL_VGA            = 4
VGA                = 4
SDL_720x348        = 5
SDL_720x350        = 6
SDL_800x600        = 7
SVGA               = 7
SDL_1024x768       = 8
SDL_1152x900       = 9
SDL_1280x1024     = 10

```

```

SDL_1366x768    = 11
SDL_USER        = 12
SDL_FULLSCREEN  = 13

# error messages

grOk            = 0
grNoInitGraph  = -1
grNotDetected   = -2
grFileNotFound = -3
grInvalidDriver = -4
grNoLoadMem     = -5
grNoScanMem    = -6
grNoFloodMem   = -7
grFontNotFound = -8
grNoFontMem    = -9
grInvalidMode  = -10
grError        = -11
grIOError      = -12
grInvalidFont  = -13
grInvalidFontNum = -14
grInvalidVersion = -18

# C structs, implemented as classes

class arccoordstype (Structure):
    _fields_ = [ ("x", c_int),
                 ("y", c_int),
                 ("xstart", c_int),
                 ("ystart", c_int),
                 ("xend", c_int),
                 ("yend", c_int) ]

class date (Structure):
    _fields_ = [ ("da_year", c_int),
                 ("da_day", c_int),
                 ("da_mon", c_int) ]

class fillsettingstype (Structure):
    _fields_ = [ ("pattern", c_int),
                 ("color", c_int) ]

class linesettingstype (Structure):
    _fields_ = [ ("linestyle", c_int),
                 ("upattern", c_uint),
                 ("thickness", c_uint) ]

class palettetype (Structure):
    _fields_ = [ ("size", c_ubyte),
                 ("colors", c_char * (MAXCOLORS + 1)) ]

# SDL_bgi extensions

class rgbpalettetype (Structure):
    _fields_ = [ ("size", c_uint),
                 ("colors", c_char_p) ]

class textsettingstype (Structure):
    _fields_ = [ ("font", c_int),
                 ("direction", c_int),
                 ("charsize", c_int),
                 ("horiz", c_int),
                 ("vert", c_int) ]

class viewporttype (Structure):
    _fields_ = [ ("left", c_int),
                 ("top", c_int),
                 ("right", c_int),
                 ("bottom", c_int),

```

```
("clip", c_int) ]
```

## 1.5 Environment Variables

These variables only apply to C and Python programs.

`SDL_BGI_RES`: when set to `VGA`, default resolution will be  $640 \times 480$  instead of default  $800 \times 600$ . Please see `initgraph()` (page 20) for details.

`SDL_BGI_RATE`: when set to `auto`, automatic screen refresh will be performed. Please see `initgraph()` (page 20) for details.

`SDL_BGI_PALETTE`: when set to `BGI`, the first 16 colours will use the same RGB values as Turbo C 2.01. Please see `initpalette()` (page 31) for details.

WebAssembly programs can use “environment files”, which are text files with the same name as the corresponding environment variable. These files contain a string containing the desired value. Please see examples in `test/assets/`.

## 1.6 Colours

`SDL_bgi` provides two palettes that can be used at the same time.

The default BGI palette includes 16 named colours (`BLACK... WHITE`); functions `getbkcolor()`, `getcolor()`, `putpixel()`, `setbkcolor()`, `setcolor()`, `setfillpattern()`, `setfillstyle()` and `setpalette()` use this palette by default.

An extended ARGB palette of `PALETTE_SIZE` additional colours can be created and accessed using functions `getrgbpalette()`, `setallpalette()`, `setbkgbcolor()`, `setrbgcolor()` and `setrbgpalette()`. These functions are functionally equivalent to their standard BGI counterparts. `PALETTE_SIZE` is 4096 by default; the palette can be resized using `resizepalette()`.

Standard BGI functions can also use ARGB colours using `COLOR()`, `COLOR32()`, and `RGBPALETTE()` as colour parameter; see sample programs in directory `test/`.

At any given moment, either the BGI or the ARGB palette is being used. Functions `IS_BGI_COLOR()` and `IS_RGB_COLOR()` return 1 if the corresponding palette is being used. Functions with `*rgb*` in their name trigger ARGB palette mode.

Constants `ARGB_FG_COL`, `ARGB_BG_COL`, `ARGB_FILL_COL`, and `ARGB_TMP_COL` denote the foreground, background, fill, and temporary ARGB colours that can be set with functions `COLOR()`, `COLOR32()`, and `RGBPALETTE()`.

## 1.7 Fonts

`SDL_bgi` provides an  $8 \times 8$  bitmap font and vector fonts decoded from original `CHR` files; loading `CHR` fonts from disk is also possible. Please see `settextstyle()` for details.

`CHR` font support was added by Marco Diego Aurélio Mesquita.

## 1.8 Notes for SDL2 Programmers

The following variables are declared in `SDL_bgi.h`, and are accessible to the programmer (C/C++ only):

```
SDL_Window    *bgi_window;
SDL_Renderer  *bgi_renderer;
SDL_Texture   *bgi_texture;
Uint32        PALETTE_SIZE;
```

so they can be used by native SDL2 functions. In fact, you can use BGI and native SDL2 functions together, as in the following code snippet:

```
SDL_Surface *bitmap;
SDL_Texture *texture;
...
bitmap = SDL_LoadBMP ("picture.bmp");
texture = SDL_CreateTextureFromSurface (bgi_renderer, bitmap);
SDL_RenderCopy (bgi_renderer, texture, NULL, NULL);
SDL_RenderPresent (bgi_renderer);
...
```

Please see `test/loadimage.c` for a complete example.

## 1.9 Notes for Python Programmers

Even though the syntax of C and Python versions of `SDL_bgi` is quite similar, `ctypes` introduces a few minor differences in some cases. Please consult `howto_Python.md` for further explanations.

## 2 Standard BGI Graphics Functions

The following are standard BGI functions, as implemented for example in Turbo C. They are all prototyped in `SDL_bgi.h`, and implemented in `sdl_bgi.py`.

Unless otherwise specified, graphics routines draw shapes using the current drawing colour, i.e. as specified by `setcolor()`.

In most cases, Python functions use the same syntax and data types as their C counterparts. When syntax differs, a Python template is provided. Variables passed by reference are implemented using the `byref()` function, provided by `ctypes`.

```
C void arc (int x, int y, int stangle, int endangle, int radius);
Python arc (x, y, stangle, endangle, radius)
```

Draws a circular arc centered at  $(x, y)$ , with a radius given by *radius*, traveling from *stangle* to *endangle*. The angle for `arc()` is measured counterclockwise, with 0 degrees at 3 o' clock, 90 degrees at 12 o' clock, etc.

**Note:** The *linestyle* parameter does not affect arcs, circles, ellipses, or pieslices. Only the *thickness* parameter is used.

```
C void bar (int left, int top, int right, int bottom);
Python bar (left, top, right, bottom)
```

Draws a filled-in rectangle (bar), using the current fill colour and fill pattern. The bar is not outlined; to draw an outlined two-dimensional bar, use `bar3d()` with *depth* equal to 0.

```
C void bar3d (int left, int top, int right, int bottom, int depth,
int topflag);
Python bar3d (left, top, right, bottom, depth, topflag)
```

Draws a three-dimensional, filled-in rectangle (bar), using the current fill colour and fill pattern. The three-dimensional outline of the bar is drawn in the current line style and colour. The bar's depth, in pixels, is given by *depth*. If *topflag* is nonzero, a top is put on.

```
C void circle (int x, int y, int radius);
Python circle (x, y, radius)
```

Draws a circle of the given *radius* at (*x*, *y*).

**Note:** The *linestyle* parameter does not affect arcs, circles, ellipses, or pieslices. Only the *thickness* parameter is used.

```
C void cleardevice (void);
Python cleardevice ()
```

Clears the graphics screen, filling it with the current background colour. The CP is moved to (0, 0).

```
C void clearviewport (void);
Python clearviewport ()
```

Clears the viewport, filling it with the current background colour. The CP is moved to (0, 0), relative to the viewport.

```
C void closegraph (void);
Python closegraph ()
```

Closes the graphics system. In Emscripten, it closes the browser tab or window.

```
C void detectgraph (int *graphdriver, int *graphmode);
Python graphdriver, graphmode = c_int (), c_int ()
Python detectgraph (byref (graphdriver), byref (graphmode))
```

Detects the graphics driver and default graphics mode to use; `SDL` and `SDL_FULLSCREEN`, respectively.

```
C void drawpoly (int numpoints, int *polypoints);
Python drawpoly (numpoints, polypoints);
```

Draws a polygon of *numpoints* vertices. In C, *polypoints* is a pointer to a sequence of ( $2 * \textit{numpoints}$ ) integers; each pair gives the *x* and *y* coordinate of each vertex. The polygon is not closed automatically.

In Python, *polypoints* is a list.

```
C void ellipse (int x, int y, int stangle, int endangle, int xradius,
int yradius);
Python ellipse (x, y, stangle, endangle, xradius, yradius)
```

Draws an elliptical arc centered at (*x*, *y*), with axes given by *xradius* and *yradius*, traveling from *stangle* to *endangle*.

```
C void fillellipse (int x, int y, int xradius, int yradius);
Python fillellipse (x, y, xradius, yradius)
```

Draws an ellipse centered at (*x*, *y*), with axes given by *xradius* and *yradius*, and fills it using the current fill colour and fill pattern.

```
C void fillpoly (int numpoints, int *polypoints);
Python fillpoly (numpoints, polypoints)
```

Draws a polygon of *numpoints* vertices and fills it using the current fill colour.

```
C void floodfill (int x, int y, int border);
Python floodfill (x, y, border)
```

Fills an enclosed area, starting from point (*x*, *y*) bounded by the *border* colour. The area is filled using the current fill colour.

```
C int getactivepage (void);
Python getactivepage ()
```

Returns the active page number.

```
C void getarccoords (struct arccoordstype *arccoords);
Python arccoords = arccoordstype ()
Python getarccoords (byref (arccoords))
```

Gets the coordinates of the last call to `arc()`, filling the `arccoords` struct/class.

```
C void getaspectratio (int *xasp, int *yasp);
Python xasp, yasp = c_int (), c_int ()
Python getaspectratio (byref (xasp), byref (yasp))
```

Retrieves the current graphics mode's aspect ratio. `xasp` and `yasp` are always 10000 (i.e. pixels are square).

```
C int getbkcolor (void);
Python getbkcolor ()
```

Returns the current background colour.

```
C int getcolor (void);
Python getcolor ()
```

Returns the current drawing (foreground) colour in the default palette. If the foreground colour was set by `COLOR()`, `getcolor()` returns -1.

```
C struct palettetype *getdefaultpalette (void);
Python palette = palettetype ()
Python getdefaultpalette (byref (palette))
```

Returns the palette definition struct/class.

```
C char *getdrivename (void);
Python getdrivename ()
```

Returns a (pointer to a) string containing the name of the current graphics driver.

```
C void getfillpattern (char *pattern);
Python getfillpattern (pattern)
```

Copies the user-defined fill pattern, as set by `setfillpattern()`, into the 8-byte area pointed to by `pattern`. In Python, `pattern` is an 8-byte string.

```
C void getfillsettings (struct fillsettingstype *fillinfo);
Python fillinfo = fillsettingstype ()
Python getfillsettings (byref (fillinfo))
```

Fills the `fillsettingstype` struct/class pointed to by `fillinfo` with information about the current fill pattern and fill colour.

```
C int getgraphmode (void);
Python getgraphmode ()
```

Returns the current graphics mode.

```
C void getimage (int left, int top, int right, int bottom, void
*bitmap);
Python getimage (left, top, right, bottom, *bitmap)
```

Copies a bit image of the specified region into the memory pointed by *bitmap*, previously allocated with `malloc (imagesize ())` (C) or `create_string_buffer (imagesize ())` (Python).

```
C void getlinesettings (struct linesettingstype *lineinfo);
Python lineinfo = linesettingstype ()
Python getlinesettings (byref (lineinfo))
```

Fills the `linesettingstype` struct/class pointed by *lineinfo* with information about the current line style, pattern, and thickness.

```
C int getmaxcolor (void);
Python getmaxcolor ()
```

Returns the maximum colour value available. If the default BGI palette is being used, it returns `MAXCOLORS`; otherwise (ARGB palette), it returns `PALETTE_SIZE`.

```
C int getmaxmode (void);
Python getmaxmode ()
```

Returns the maximum mode number for the current driver. In `SDL.bgi`, the default is `SDL_FULLSCREEN`.

```
C int getmaxx (void);
Python getmaxx ()
```

Returns the maximum *x* screen coordinate.

```
C int getmaxy (void);
Python getmaxy ()
```

Returns the maximum *y* screen coordinate.

```
C char* getmodename (int mode_number);
Python getmodename (mode_number)
```

Returns a (pointer to a) string containing the name of the specified graphics mode.

```
C void getmoderange (int graphdriver, int *lomode, int *himode);
Python lomode, himode = c_int (), c_int ()
Python getmoderange (0, byref (lomode), byref (himode))
```

Returns the range of valid graphics modes. The *graphdriver* parameter is ignored.

```
C void getpalette (struct palettetype *palette);
Python palette = palettetype ()
Python getpalette (palette)
```

Fills the palettetype struct/class pointed by *palette* with information about the current palette's size and colours.

```
C int getpalettesize (void);
Python getpalettesize ()
```

Returns the size of the palette (MAXCOLORS + 1 in BGI mode, or MAXRGBCOLORS + 1 in ARGB mode).

```
C int getpixel (int x, int y);
Python getpixel (x, y)
```

Returns the colour of the pixel located at (*x*, *y*).

```
C void gettextsettings (struct textsettingstype *texttypeinfo);
Python texttypeinfo = textsettingstype ()
Python gettextsettings (texttypeinfo)
```

Fills the textsettingstype struct/class pointed to by *texttypeinfo* with information about the current text font, direction, size, and justification.

```
C void getviewsettings (struct viewporttype *viewport);
Python viewport = viewporttype ()
Python getviewsettings (viewport)
```

Fills the viewporttype struct/class pointed to by *viewport* with information about the current viewport.

```
C int getvisualpage (void);  
 getvisualpage ()
```

Returns the visual page number.

```
C int getx (void);  
 getx ()
```

Returns the current CP  $x$  coordinate, relative to the viewport.

```
C int gety (void);  
 gety ()
```

Returns the current CP  $y$  coordinate, relative to the viewport.

```
C void graphdefaults (void);  
 graphdefaults ()
```

Resets all graphics settings to their default values: sets the viewport to the entire screen, moves the CP to (0, 0), sets the default palette colours, the default drawing and background colour, the default fill style and pattern, the default text font and justification.

```
C char* grapherrormsg (int errorcode);  
 grapherrormsg (errorcode)
```

Returns the (pointer to the) error message string associated with *errorcode*, returned by `graphresult()`.

```
C int graphresult (void);  
 graphresult ()
```

Returns the error code for the last unsuccessful graphics operation and resets the error level to `grOk`.

```
C unsigned imagesize (int left, int top, int right, int bottom);  
 imagesize (left, top, right, bottom)
```

Returns the size in bytes of the memory area required to store a bit image. This value must be allocated in a buffer before copying the image with `getimage()`.

```

C void initgraph (int *graphdriver, int *graphmode, char *pathtodriver);
Python initgraph (graphdriver, graphmode, pathtodriver);

```

Initializes the graphics system. In `SDL_bgi`, you can use `SDL` as *graphdriver*, then choose a suitable graphics mode (listed in `graphics.h`) as *graphmode*. The *pathtodriver* argument is ignored. Typically, *graphdriver* is set to `DETECT`, and *graphmode* is not set; these values will set the default resolution ( $800 \times 600$ ) as `SVGA`. If the environment variable `SDL_BGI_RES` equals `VGA` or `vga`, then `VGA` resolution ( $640 \times 480$ ) will be forced.

You can also use `NULL` for *graphdriver* and *graphmode* to get the default resolution ( $800 \times 600$ ), or use `detectgraph()` (see above) to get fullscreen.

Unless a fullscreen window is already present, multiple windows can be created.

Using `initgraph()`, the default 16-colour palette uses the same ARGB values as the original palette in Turbo C. Using `initwindow()`, the default 16-colour palette uses different (possibly, better-looking) ARGB values.

After `initgraph()`, all graphics commands are immediately displayed, as in the original BGI. This could make drawing very slow; you may want to use `initwindow()` instead.

Alternatively, automatic screen refresh can be performed according to the value of the `SDL_BGI_RATE` environment variable. If the variable is set to `auto`, screen refresh is automatically performed every *msec* milliseconds; this value is the current screen refresh rate, as given by `SDL_GetDisplayMode()`. If the variable is set to an integer value *msec*, automatic screen refresh will be performed every *msec* milliseconds.

Automatic screen refresh is much faster than the default behaviour; however, this feature may not work on some graphic cards.

```

C int installuserdriver (char *name, int (*detect)(void));
Python installuserdriver ()

```

Unimplemented; not used by `SDL_bgi`.

```

C int installuserfont (char *name);
Python installuserfont (name)

```

Loads and installs a `CHR` font from disk. The function returns an integer to be used as first argument in `settextstyle()`.

```

C void line (int x1, int y1, int x2, int y2);
Python line (x1, y1, x2, y2)

```

Draws a line between two specified points; the `CP` is not updated.

```
C void linerel (int dx, int dy);
Python linerel (dx, dy)
```

Draws a line from the CP to a point that is  $(dx, dy)$  pixels from the CP. The CP is then advanced by  $(dx, dy)$ .

```
C void lineto (int x, int y);
Python lineto (x, y)
```

Draws a line from the CP to  $(x, y)$ , then moves the CP to  $(dx, dy)$ .

```
C void moverel (int dx, int dy);
Python moverel (dx, dy)
```

Moves the CP by  $(dx, dy)$  pixels.

```
C void moveto (int x, int y);
Python moveto (x, x)
```

Moves the CP to the position  $(x, y)$ , relative to the viewport.

```
C void outtext (char *textstring);
Python outtext (textstr)
```

Outputs *textstring* at the CP.

```
C void outtextxy (int x, int y, char *textstring);
Python outtextxy (x, y, textstring)
```

Outputs *textstring* at  $(x, y)$ .

```
C void pieslice (int x, int y, int stangle, int endangle, int radius);
Python pieslice (x, y, stangle, endangle, radius)
```

Draws and fills a pie slice centered at  $(x, y)$ , with a radius given by *radius*, traveling from *stangle* to *endangle*. The pie slice is filled using the current fill colour.

```
C void putimage (int left, int top, void *bitmap, int op);
Python putimage (left, top, bitmap, op)
```

Puts the bit image pointed to by *bitmap* onto the screen, with the upper left corner of the image placed at  $(left, top)$ . *op* specifies the drawing mode (COPY\_PUT, etc).

```
C void putpixel (int x, int y, int color);
Python putpixel (x, y, color)
```

Plots a pixel at (*x*, *y*) in the colour defined by *color*.

```
C void rectangle (int left, int top, int right, int bottom);
Python rectangle (left, top, right, bottom)
```

Draws a rectangle delimited by (*left*, *top*) and (*right*, *bottom*).

```
C int registerbgidriver (void (*driver)(void));
Python registerbgidriver ()
```

Unimplemented; not used by SDL\_bgi.

```
C int registerbgifont (void (*font)(void));
Python registerbgifont ()
```

Unimplemented; not used by SDL\_bgi.

```
C void restorecrtmode (void);
Python restorecrtmode ()
```

Hides the graphics window and turns on text mode.

```
C void sector (int x, int y, int stangle, int endangle, int xradius,
int yradius);
Python sector (x, y, stangle, endangle, xradius, yradius)
```

Draws and fills an elliptical pie slice centered at (*x*, *y*), horizontal and vertical radii given by *xradius* and *yradius*, traveling from *stangle* to *endangle*.

```
C void setactivepage (int page);
Python setactivepage (page)
```

Makes *page* the active page for all subsequent graphics output. In multi-window mode, setactivepage() only works for the first window.

```
C void setallpalette (struct palettetype *palette);
Python palette = palettetype ()
Python setallpalette (palette)
```

Sets the current palette to the values stored in *palette*.

```
C void setaspectratio (int xasp, int yasp);
Python xasp, yasp = c_int (), c_int ()
Python setaspectratio (xasp, yasp)
```

Changes the default aspect ratio of the graphics. In `SDL_bgi`, this function is not necessary since the pixels are square on modern hardware.

```
void setbkcolor (int color);
```

Sets the current background colour in the default BGI palette. If ARGB colours are not being used and  $color > MAXCOLORS$ , then sets  $color \% MAXCOLORS$ .

```
C void setcolor (int color);
Python setcolor (color)
```

Sets the current drawing colour in the default BGI palette. If ARGB colours are not being used and  $color > MAXCOLORS$ , then sets  $color \% MAXCOLORS$ .

```
C void setfillpattern (char *upattern, int color);
Python setfillpattern (upattern, color)
```

Sets a user-defined fill pattern. *upattern* is a pointer to an 8-byte area; in Python, *upattern* is an 8-byte string. Each bit set to 1 in each byte is plotted as a pixel.

```
C void setfillstyle (int upattern, int color);
Python setfillstyle (upattern, color)
```

Sets the fill pattern and fill colour. *upattern* is a pointer to an 8-byte area; in Python, *upattern* is an 8-byte string. Each bit set to 1 in each byte is plotted as a pixel.

```
C unsigned setgraphbufsize (unsigned bufsize);
Python setgraphbufsize (bufsize)
```

Unimplemented; not used by `SDL_bgi`.

```
C void setgraphmode (int mode);
Python setgraphmode (mode)
```

Shows the window that was hidden by `restorecrtmode()`. The *mode* parameter is ignored,

```
C void setlinestyle (int linestyle, unsigned upattern,
int thickness);
```

```
 setlinestyle (linestyle, upattern, thickness)
```

Sets the line width and style for all lines drawn by `line()`, `lineto()`, `rectangle()`, `drawpoly()`, etc. The line style can be `SOLID_LINE`, `DOTTED_LINE`, `CENTER_LINE`, `DASHED_LINE`, or `USERBIT_LINE`; in the latter case, the user provides a 16-bit number (*upattern*) whose bits set to 1 will be plotted as pixels.

The line thickness can be set with `NORM_WIDTH` or `THICK_WIDTH`.

Arcs, circles, ellipses, and pieslices are not affected by *linestyle*, but are affected by *thickness*.

```
C void setpalette (int colornum, int color);
```

```
 setpalette (colornum, color)
```

Changes the standard palette *colornum* to *color*, which can also be specified using the `COLOR()` function; it also changes the colour of currently drawn pixels.

```
C void setttextjustify (int horiz, int vert);
```

```
 setttextjustify (horiz, vert)
```

Sets text justification. Text output will be justified around the CP horizontally and vertically; settings are `LEFT_TEXT`, `CENTER_TEXT`, `RIGHT_TEXT`, `BOTTOM_TEXT`, and `TOP_TEXT`.

```
C void setttextstyle (int font, int direction, int charsize);
```

```
 setttextstyle (font, direction, charsize)
```

Sets the text font (8×8 bitmap font `DEFAULT_FONT` and vector fonts `TRIPLEX_FONT`, `SMALL_FONT`, `SANS_SERIF_FONT`, `GOTHIC_FONT`, `SCRIPT_FONT`, `SIMPLEX_FONT`, `TRIPL-EX_SCR_FONT`), the text direction (`HORIZ_DIR`, `VERT_DIR`), and the size of the characters. *charsize* is a scaling factor for the text (max. 10). If *charsize* is 0, the text will either use the default size, or it will be scaled by the values set with `setusercharsize()`.

Experimental feature: if a CHR font is available in the same directory as the running program, it will be loaded and used instead of its internal equivalent.

```
C void setusercharsize (int multx, int divx, int multy, int divy);
```

```
 setusercharsize (multx, divx, multy, divy)
```

Lets the user change the character width and height. If a previous call to `setttextstyle()` set *charsize* to 0, the default width is scaled by *multx/divx*, and the default height is scaled by *multy/divy*.

```
C void setviewport (int left, int top, int right, int bottom,
int clip);
```

```
 setviewport (left, top, right, bottom, clip)
```

Sets the current viewport for graphics output. If *clip* is nonzero, all drawings will be clipped (truncated) to the current viewport.

```
C void setvisualpage (int page);
```

```
 setvisualpage (page)
```

Sets the visual graphics page number to *page*. In “fast mode”, the screen is not cleared.

```
C void setwritemode (int mode);
```

```
 setwritemode (mode)
```

Sets the writing mode for line drawing. *mode* can be COPY\_PUT, XOR\_PUT, OR\_PUT, AND\_PUT, and NOT\_PUT.

```
C int textheight (char *textstring);
```

```
 textheight (textstring)
```

Returns the height in pixels of *textstring*.

```
C int textwidth (char *textstring);
```

```
 textwidth (textstring)
```

Returns the width in pixels of *textstring*.

### 3 Non-Graphics Functions and Macros

```
C void delay (int millisec);
```

```
 delay (millisec)
```

Waits for *millisec* milliseconds. In “slow mode”, a screen refresh is performed.

*Note:* in Turbo C, this function was provided by DOS.H.

```
C int getch (void);
```

```
 getch ()
```

Waits for a key and returns its ASCII or key code (i.e. KEY\_\*). In “slow mode”, a screen refresh is performed. If an SDL\_QUIT event occurs, QUIT is returned.

*Note:* in Turbo C, this function was provided by CONIO.H.

```
C int kbhit (void);
Python kbhit ()
```

Returns 1 when a key is pressed, excluding special keys (Ctrl, Shift, etc.); in “slow mode”, a screen refresh is performed. If an SDL\_QUIT event occurs, QUIT is returned.

*Note:* in Turbo C, this function was provided by CONIO.H.

```
C int lastkey (void);
Python lastkey ()
```

Returns the last key that was detected by kbhit().

```
C int random (int range) (macro)
Python random (range)
```

Returns an integer random number between 0 and  $range - 1$ .

*Note:* in Turbo C, this function was provided by STDLIB.H.

## 4 *SDL\_bgi Additions*

The following *SDL\_bgi* extensions are mostly compatible with those made available by WinBGIm.

```
C int ALPHA_VALUE (int color);
Python ALPHA_VALUE (color)
```

Returns the alpha (transparency) component of an ARGB colour in the ARGB palette.

```
C int BLUE_VALUE (int color);
Python BLUE_VALUE (color)
```

Returns the blue component of an ARGB colour in the ARGB palette.

```
C void closewindow (int id);
Python closewindow (id)
```

Closes the window identified by *id*. If *id* is ALL\_WINDOWS, closegraph() is called.

```
C int COLOR (int r, int g, int b);
Python COLOR (r, g, b)
```

Can be used as colour argument for `getbkcolor()`, `getcolor()`, `putpixel()`, `setbkcolor()`, `setbkcolor()`, `setcolor()`, `setfillpattern()`, `setfillstyle()`, and `setpalette()` to set a colour specifying its ARGB components. The colour index is `ARGB_TMP_COL`.

Functions `ALPHA_VALUE()`, `BLUE_VALUE()`, `GREEN_VALUE()`, and `RED_VALUE()` do not work on temporary colours.

```
C int COLOR32 (Uint32 color);
Python COLOR32 (color)
```

Can be used as colour argument for `getbkcolor()`, `getcolor()`, `putpixel()`, `setbkcolor()`, `setcolor()`, `setfillpattern()`, `setfillstyle()`, and `setpalette()` to set a colour as ARGB integer. The colour index is `ARGB_TMP_COL`.

Functions `ALPHA_VALUE()`, `BLUE_VALUE()`, `GREEN_VALUE()`, and `RED_VALUE()` do not work on temporary colours.

```
C void clearmousebutton (int kind);
Python clearmousebutton (kind)
```

Clears mouse events; subsequent calls to `ismouseclick()` will return 0.

```
C char* colorname (int color);
Python colorname (color)
```

Returns a string containing the colour name ("BLACK", "BLUE", etc.)

```
C int colorRGB (int r, int g, int b) (macro)
Python colorRGB (r, g, b)
```

Can be used to compose a 32 bit colour with *r g b* components; the alpha value is set to `0xff`. This macro/function is typically used to set values in memory buffers.

```
C void copysurface (SDL_Surface surface, int x1, int y1, int x2,
int y2);
Python copysurface (surface, x1, y1, x2, y2)
```

Copies *surface* to the rectangle defined by *x1*, *y1*, *x2*, *y2* and displays it immediately. If *x2* or *y2* equals 0, then the original surface size will be used.

```
C int doubleclick (void);
Python doubleclick ()
```

Returns 1 if the last mouse click was a double click.

```
C int edelay (int msec);
Python edelay (msec)
```

Waits for *msec* milliseconds. In “slow mode”, a screen refresh is performed. If an event occurs during the delay, this function returns 1, otherwise 0. Use `eventtype()` to get the last event.

```
C int event (void);
Python event ()
```

Returns 1 if one of the following events has occurred: `SDL_KEYDOWN`, `SDL_MOUSEBUTTONDOWN`, `SDL_MOUSEWHEEL`, or `SDL_QUIT`; 0 otherwise.

```
C int eventtype (void);
Python eventtype ()
```

Returns the type of the last event. Reported events are `SDL_KEYDOWN`, `SDL_MOUSEMOTION`, `SDL_MOUSEBUTTONDOWN`, `SDL_MOUSEBUTTONUP`, `SDL_MOUSEWHEEL`, and `SDL_QUIT`.

```
C void fputpixel (int x, int y);
Python fputpixel (x, int y)
```

Plots a point at (*x*, *y*) using the current drawing colour. This function is usually faster than `putpixel()`.

```
C void getbuffer (Uint32 *buffer);
Python getbuffer (buffer)
```

Copies the contents of the active window to *buffer*, which must be a `(getmaxy() + 1) × (getmaxx() + 1)` array of *Uint32* (C) or a string buffer (Python). Copied elements are in ARGB format.

```
C int getclick (void);
Python getclick ()
```

Waits for a mouse click and returns the button that was clicked.

```
C int getcurrentwindow (void);
Python getcurrentwindow ()
```

Returns the *id* of the current window.

```
C int getevent (void);
Python getevent ()
```

Waits for one of the following events: `SDL_KEYDOWN`, `SDL_MOUSEBUTTONDOWN`, `SDL_MOUSEWHEEL`, and `SDL_QUIT`. It returns the code of the key, or the mouse button, either `WM_WHEELUP` or `WM_WHEELDOWN`, or `SDL_QUIT`.

x

```
C void getleftclick (void);
Python getleftclick ()
```

Waits for the left mouse button to be clicked and released.

```
C void getlinebuffer (int y, Uint32 *linebuffer);
Python getlinebuffer (y, linebuffer)
```

Copies the *y*-th screen line to *linebuffer*, which must be a `getmaxx()+1` array of `Uint32` in ARGB format (C), or a string buffer allocated with `create_string_buffer (imagesize ())` (Python).

```
C int getmaxheight (void);
Python getmaxheight ()
```

Returns the maximum possible height for a new window (actual screen height in pixels). This function may be called before graphics initialisation.

```
C int getmaxwidth (void);
Python getmaxwidth ()
```

Returns the maximum possible width for a new window (actual screen width in pixels). This function may be called before graphics initialisation.

```
C void getmiddleclick (void);
Python getmiddleclick ()
```

Waits for the middle mouse button to be clicked and released.

```
C void getmouseclick (int kind, int *x, int *y);
Python x, y = c_int (), c_int ()
Python getmouseclick (kind, byref (x), byref (y))
```

Sets the *x*, *y* coordinates of the last *kind* button click expected by `ismouseclick()`.

```

C void getrgbpalette (struct rgbpalettetype *palette int size);
Python palette = rgbpalettetype ()
Python getrgbpalette (palette, size)

```

Fills the `rgbpalettetype` struct/class pointed by `palette` with information about the current ARGB palette's size and colours.

```

C void getrightclick (void);
Python getrightclick ()

```

Waits for the right mouse button to be clicked and released.

```

C void getscreensize (int *width, int *height);
Python x, y = c_int (), c_int ()
Python getscreensize (byref (x), byref (y))

```

Reports the screen width and height in `width` and `height`, regardless of current window dimensions. This function may be called before graphics initialisation.

(macro)

```

C void getwindowheight (void);
Python getwindowheight ()

```

Equivalent to `getmaxy()` (WinBGI compatibility).

(macro)

```

C void getwindowwidth (void);
Python getwindowwidth ()

```

Equivalent to `getmaxx()` (WinBGI compatibility).

```

C int GREEN_VALUE (int color);
Python GREEN_VALUE (color)

```

Returns the green component of an ARGB colour in the ARGB palette.

```

C void initpalette (void);
Python initpalette ()

```

Initialises the BGI palette to the standard 16 colours. If the environment variable `SDL_BGI_PALETTE` equals `BGI`, the first 16 colours will use the same RGB values as Turbo C 2.01; otherwise, a brighter palette will be used.

```
C void initwindow (int width, int height);
Python initwindow (width, height)
```

Initializes the graphics system, opening a  $width \times height$  window. If either *width* or *height* is 0, then `SDL_FULLSCREEN` will be used. Unless a fullscreen window is already present, multiple windows can be created.

The user must update the screen as needed using `refresh()`, or use `sdlbgiauto()`.

This function is also overloaded as `initwindow(int width, int height, char *title)` to specify the window title without using `setwinoptions()`.

```
C int IS_BGI_COLOR (int color);
Python IS_BGI_COLOR (color)
```

Returns 1 if the *current* drawing colour is a standard BGI colour (that is, not ARGB). The *color* argument is actually redundant (WinBGIm compatibility).

```
C int ismouseclick (int kind);
Python ismouseclick (kind)
```

Returns 1 if the *kind* mouse button was clicked.

```
C int IS_RGB_COLOR (int color);
Python IS_RGB_COLOR (color)
```

Returns 1 if the *current* drawing colour is ARGB. The *color* argument is actually redundant (WinBGIm compatibility).

```
C int kdelay (int msec);
Python edelay (msec)
```

Waits for *msec* milliseconds. In “slow mode”, a screen refresh is performed. If a key is pressed during the delay, this function returns 1, otherwise 0.

```
C int mouseclick (void);
Python mouseclick ()
```

Returns the code of the mouse button that is being clicked, or `SDL_MOUSEMOTION` if the mouse is being moved, or 0 if no mouse event is occurring.

```
C int mousex (void);
Python mousex ()
```

Returns the X coordinate of the last mouse click.

```
C int mousey (void);
Python mousey ()
```

Returns the Y coordinate of the last mouse click.

```
C void putbuffer (Uint32 *buffer);
Python putbuffer (buffer)
```

Copies *buffer* to the current window. *buffer* must be a  $(\text{getmaxy}() + 1) \times (\text{getmaxx}() + 1)$  array of *Uint32* in ARGB format. This function is faster than direct pixel manipulation.

```
C void putlinebuffer (int y, Uint32 *linebuffer);
Python putlinebuffer (y, linebuffer)
```

Copies *linebuffer* to the *y* coordinate in the current window. *linebuffer* must be a  $\text{getmaxx}() + 1$  array of *Uint32* in ARGB format. This function is faster than direct pixel manipulation.

```
C void readimagefile (char *filename, int x1, int y1, int x2, int y2);
Python readimagefile (filename, x1, y1, x2, y2)
```

Reads a .bmp file and displays it immediately at  $(x1, y1)$ . If  $(x2, y2)$  are not 0, the bitmap is stretched to fit the rectangle  $x1, y1 - x2, y2$ ; otherwise, the bitmap is clipped as necessary.

```
C int RED_VALUE (int color);
Python RED_VALUE (color)
```

Returns the red component of an ARGB colour in the ARGB palette.

```
C void refresh (void);
Python refresh ()
```

Updates the screen contents, i.e. displays all graphics.

```
C void resetwinoptions (int id, char *title, int x, int y);
Python resetwinoptions (id, title, x, y)
```

Resets the window title *title* and position to  $(x, y)$  of an existing window identified by *id*. *x* and *y* can be set to `SDL_WINDOWPOS_CENTERED` or `SDL_WINDOWPOS_UNDEFINED`. If either *x* or *y* is -1, position parameters are ignored.

```
C int resizepalette (Uint32 newsiz);
Python resizepalette (newsiz)
```

Resizes the ARGB palette to *newsiz*; returns 0 if successful, 1 otherwise. The initial size of the ARGB palette is 4096.

```
C int RGBPALETTE (int color);
Python RGBPALETTE (color)
```

Can be used as a colour argument for `getbkcolor()`, `getcolor()`, `putpixel()`, `setbkcolor()`, `setbkcolor()`, `setcolor()`, `setfillpattern()`, `setfillstyle()`, and `setpalette()` to set the colour from the ARGB palette *color* entry. The colour index is `ARGB_TMP_COL`.

Functions `ALPHA_VALUE()`, `BLUE_VALUE()`, `GREEN_VALUE()`, and `RED_VALUE()` do not work on temporary colours.

```
C void sdlbgiauto (void);
Python sdlbgiauto ()
```

Triggers “auto mode”, i.e. `refresh()` is performed automatically. Caveat: it may not work on some graphics cards.

```
C void sdlbgifast (void);
Python sdlbgifast ()
```

Triggers “fast mode”, i.e. `refresh()` is needed to display graphics.

```
C void sdlbgislow (void);
Python sdlbgislow ()
```

Triggers “slow mode”, i.e. `refresh()` is not needed to display graphics.

```
C void setallrgbpalette (struct rgbpalettetype *palette);
Python palette = rgbpalettetype ()
Python setallrgbpalette (byref (palette))
```

Sets the current ARGB palette to the values stored in *palette*.

```
C void setalpha (int col, Uint8 alpha);
Python setalpha (col, alpha)
```

Sets alpha transparency for colour *col* to *alpha* (0–255); 0 means full transparency, 255 full opacity. `setalpha()` works with colours in both palettes.

```
C void setbkrgbcolor (int n);
Python setbkrgbcolor (n)
```

Sets the current background colour using the *n*-th colour entry in the ARGB palette.

```
C void setblendmode (int blendmode);
Python setblendmode (blendmode)
```

Sets the blend mode to be used with screen refresh. *blendmode* can be `SDL_BLENDMODE_NONE` (default in “slow mode”) or `SDL_BLENDMODE_BLEND`. The latter enables alpha blending.

```
C void setcurrentwindow (int id);
Python setcurrentwindow (id)
```

Sets the current active window to *id*.

```
C void setrgbcolor (int n);
Python setrgbcolor (n)
```

Sets the current drawing colour using the *n*-th colour entry in the ARGB palette.

```
C void setrgbpalette (int n, int r, int g, int b);
Python setrgbpalette (n, r, g, b)
```

Sets the *n*-th entry in the ARGB palette specifying the *r*, *g*, and *b* components. Using `setrgbpalette()` and `setrgbcolor()` is faster than setting colours with `setcolor()` with a `COLOR()` argument. It does not change the colour of currently drawn pixels.

```
C void setwinoptions (char *title, int x, int y, Uint32 flags);
Python setwinoptions (title, x, y, flags)
```

Sets the window title *title*, the initial position to (*x*, *y*), and SDL2 flags OR’ed together. *x* and *y* can be set to `SDL_WINDOWPOS_CENTERED` or `SDL_WINDOWPOS_UNDEFINED`.

If *title* is an empty string, the window title is set to the default value `SDL_bgi`.

If either *x* or *y* is -1, the position parameters are ignored.

If *flags* is -1, the parameter is ignored; otherwise, only the values `SDL_WINDOW_FULLSCREEN`, `SDL_WINDOW_FULLSCREEN_DESKTOP`, `SDL_WINDOW_SHOWN`, `SDL_WINDOW_HIDDEN`, `SDL_WINDOW_BORDERLESS`, and `SDL_WINDOW_MINIMIZED` can be applied.

```
C void setwintitle (intid, char *title);  
 setwintitle (id, title)
```

Sets the title of the window identified by *id*.

```
C void showerrorbox (const char *message);  
 showerrorbox (message)
```

Opens an error message box with the specified message. The message box waits for the user to click on the OK button.

```
C void showinfobox (const char *message);  
 showinfobox (message)
```

Opens an information message box with the specified message. The message box waits for the user to click on the OK button.

```
C int swapbuffers (void);  
 swapbuffers ()
```

Swaps the current active and the current visual graphics pages.

```
C void writeimagefile (char *filename, int left, int top, int right,  
int bottom);  
 writeimagefile (filename, left, top, right, bottom)
```

Writes a .bmp file from the screen rectangle defined by *left*, *top*–*right*, *bottom*.

```
C int xkbhit (void);  
 xkbhit ()
```

Returns 1 when any key is pressed, including special keys (Ctrl, Shift, etc.); in “slow mode”, a screen refresh is performed. If an SDL\_QUIT event occurs, QUIT is returned.

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Brought to you by Guido Gonzato, PhD =8-)