Střední škola informatiky, poštovnictví a finančnictví Brno, příspěvková organizace

Ročníková práce

Brno 2016

Marian Dolinský

Střední škola informatiky, poštovnictví a finančnictví Brno, příspěvková organizace

Hra Snake

Ročníková práce

Vedoucí práce:	Vypracoval: Marian Dolinský
Mgr. František Skalka	Studijní obor: IT
	Číslo oboru: 18-20-M/01
	Třída: IT2

Brno 2016

Prohlašuji, že jsem ročníkovou práci vypracoval samostatně s přispěním vedoucího práce a použil jsem jen literaturu a informační zdroje uvedené v kapitole literatura.

Děkuji Mgr. Františku Skalkovi za odborné vedení a cenné rady, které mi poskytl při zpracování této ročníkové práce.

Souhlasím s půjčováním a zpřístupněním ročníkové práce.

V Brně 30. května 2016 ....

Obsah

1 Úvod

Pro letošní ročníkovou práci jsem si vybral téma „Hra“. Původně však na mne toto téma nezbylo, a mým tématem tak byly „Tabulky“. Tehdy jsem měl již rozpracovanou hru Snake, ale i přesto jsem začal pracovat na hře Hledání min, která téma „Tabulky“ – 2d pole – splňovala. Danou hru jsem však nikdy úplně nedokončil, protože jsme si se spolužákem svá témata vyměnili, ale právě vývoj hry Hledání min mě donutil k vytvoření hlavičkového souboru „unigfcs.h“, který se dá jednoduše použít pro vytváření her a dodnes tvoří základ hry Snake. Až ke konci mě napadlo vytvořit Project Superior, ze kterého jsem však stihl udělat jen malou část, ale i tak tato hra využívá některé jeho funkce.

2 O programu

Mojí ročníkovou prací je jednoduchá hra Snake ve Windows konzoli. Hra obsahuje jednoduché a přehledné menu, kde si může uživatel vybrat typ hry – hra pro jednoho hráče, nebo hru dvou hráčů, nabídku About, která zobrazí informace o programu a stránku zobrazující ovládání hry. Při začínání hry je možno nastavit obtížnost, která mění rychlost hada/ů, lze vybírat ze tří předdefinovaných rychlostí, nebo si vybrat vlastní. Hra obsahuje dva módy – Normal a Borderless. Borderless umožňuje projíždět skrz okraje okna. Dále může uživatel nastavit vzhled svého hada, jak barvu, tak znak reprezentující tělo hada. Program je plně responzivní, pokud však neprobíhá hra, kdy je změna velikosti nemožná. Ve hře jsou dva cheaty – fisa a hamster, které je možno aktivovat všude mimo probíhající hru.

3 Zdrojový kód

3.1 Snake.cpp

```
/*
	Name: Snake v1.7 'A better way'
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 30/05/16 05:33
	Description: Simple Snake game for console in Windows.

	TODO:
		hotseat arrows bug - sometimes rewrite
		obstacles
		responsive gameboard
		slowdown, poison
		increase speed with time in snake
		settings - controls etc
		save high scores
		save stats
			- berries eated
			- win/loose rate
			- specials eated
			- time played
			- bend counts :D
			- specials eated
			- games played
			- difficulties played
					.
					.
					.

	!!! The game is fully responsive but when playing, board size cannot be changed and is resetted to size on game start original.
	!!! Responsivity works better on Windows 10 than on older Windowses because console in W10 is resizable and can be maximized as another window apps.
	!!! Don't use Dev-C++ project, it will not recompile outside-project files (unigfcs.h) each project compilation (some files must be manually deleted to recompile them).
*/

//#define DEBUG
#define DISABLE_BUFFERASWINDOW

const char CHEATS[][10] =
{
	{ "fisa" },
	{ "hamster" }
};

#define CHANGELOG_COLUMNS 45
const char CHANGELOG_GAME[][CHANGELOG_COLUMNS] =
{
	{ "1.7 'A better way':	(05/29/2016)" },
	{ "- Rewrited game engine" },
	{ "- Showing score in title" },
	{ "- Added new cheats" },
	{ "- Added specials" },
	{ "- Fixed bug with right bottom corner" },
	{ "- Fully removed screen flashing" },
	{ "- Some bugs were fixed" },
	{ "1.6 'FISA is your hero':	(12/18/2015)" },
	{ "- Added a little secret" },
	{ "- Changed controls" },
	{ "- Fixed screen flashing" },
	{ "- Improved game performance" },
		{ "- Some bugs were fixed" },
		{ "1.5 'Make a way!':		(11/29/2015)" },
		{ "- Added borderless mode" },
		{ "- Better game performance" },
		{ "1.4 'It grows':		(11/24/2015)" },
		{ "- Game is now responsive designed" },
		{ "- Code were optimized" },
		{ "1.3 'Let me continue':	(11/22/2015)" },
		{ "- Hotseat continues if one player dies" },
		{ "- Added changelog" },
		{ "- Some bugs were fixed" },
		{ "1.2 'Do it twice':		(11/17/2015)" },
		{ "- Added multiplayer" },
		{ "- Code is more effective" },
		{ "- Some bugs were fixed" },
		{ "1.1 'When meowside flies':	(11/13/2015)" },
		{ "- Added menus" },
		{ "- Some bugs were fixed" },
		{ "1.0 'First release':	(11/12/2015)" },
		{ "- Only singleplayer" },
		{ "- Without menus" }
};

#include "unigfcs.h"

const char BERRY_CHAR			= 249;
const char NEUTRAL					= -5;
const int CHEATS_HAMSTER		= 3;
//const int NAME_LENGTH_MAX	= 16;

const int SLEEP_EASY		= 200;
const int SLEEP_MEDIUM	= 50;
const int SLEEP_HARD		= 30;

const int SNAKE_LENGTH_START = 3;
const int SNAKE_LENGTH_MAX		= SNAKE_LENGTH_START + 100;

#define SPECIAL_SPAWN rand() % 1000000 == 53
const int SPECIAL_BONUS = 3;
const int LENGTH_PRECISION = (int)floor(log10(SNAKE_LENGTH_MAX)) + 1;
const char CONTROLS[2][4] =
{
		{ 'W', 'A', 'S', 'D'},
		{ Up, Left, Down, Right }
};

typedef enum
{
		Fisa,
		Hamster
} CHEAT;

typedef enum
{
		Bonus,
		Mine/*,
		Slowdown,
		Poison*/
} SPECIAL;

typedef struct
{
		char Direction;
		COORD Position;
} VECTOR;

typedef struct
{
		COORD Position;
		VISUAL Visual;
} BERRY;

typedef struct
{
		bool Collision;
		int Active;
		int Shown;
		VECTOR Head;
		VECTOR Tail;

		struct BEND
		{
				int Active;
				int ToAssign;
				VECTOR Vector[SNAKE_LENGTH_MAX];
		} Bend;

		VISUAL Visual;/*
		char PlayerName[NAME_LENGTH_MAX];
		bool Poison;
		int PoisonTimer;*/
} SNAKE;

typedef enum
{
		WASD,
		Arrows
} CONTROLTYPE;

typedef enum
{
		KUp,
		KLeft,
		KDown,
		KRight
} CONTROL;

char liveTitle[35] = {0};
BERRY specials[] =
{
		// Bonus
		{
				{ }, { '+', Green }
		},

		// Mine
		{
				{ }, { 148, Red }
		}/*,

		// Slowdown
		{
				{ }, { 233, Yellow }
		},

		// Poison
		{
				{ }, { 233, DarkYellow }
		}*/
};

int main();
//void controls(); - already declared in unigfcs.h
//bool game(DIFFICULTY difficulty, bool hotseat); - already declared in unigfcs.h
int customdifficultyselection();
//bool strrem(char *str, int index);
```

```
bool playername(int sleep, bool hotseat, bool borders);
bool snakecreator(int sleep, bool hotseat, bool borders, const char *playersNames[2]);
// In-game functions
void livetitle(int score);
void livetitle(const char *playerName1, int score1, const char *playerName2, int score2);
void setrandomcolors();
void recreateboard(bool *gameBoard, VISUAL snake, BERRY berry, bool isSpecialShown, SPECIAL shownSpecial);
void recreateboard(bool *gameBoard, SNAKE snakes[2], BERRY berries[2], bool isSpecialShown, SPECIAL shownSpecial);
void newberry(BERRY *berry, bool *gameBoard);
void playsnake(int sleep, bool borders, VISUAL visual, const char *playerName);
void playhotseat(int sleep, bool borders, VISUAL visuals[2], const char *playersNames[2]);

int main()
{
	initialize("Snake", "v1.7 'A better way'", "beta 4", 79, 24);
	mainmenu(Green);

	// Program should not get there
	cls();
	vcenter(3);
	hcenter("SOMETHING WENT WRONG :-(\n");
	hcenter("Press any key to close the game . . .");

	getch();

	exit(EXIT_FAILURE);
}

void controls()
{
	const int CENTERING = 35;

	bool render = true;
	char key;

	while (true)
	{
		if (consoleSizeChanged || render)
		{

			cls();

#ifdef DEBUG
			vcenter(9);
#else
			vcenter(8);
#endif

			hcenter("CONTROLS");
			fputs("\n\n", stdout);

			hcenter(CENTERING, "Player 1:	Arrow keys\n");
			hcenter(CENTERING, "Player 2:	WASD\n");

#ifdef DEBUG
			hcenter(CENTERING, "Freeze game:	SPACE\n");
#endif

			hcenter(CENTERING, "Pause game:	ESC\n");
			hcenter(CENTERING, "Menus navigation:  Arrow keys, ENTER, ESC");
			fputs("\n\n", stdout);

			hcenter("> Back  ");

			consoleSizeChanged = false;
			render = false;
		}
```

```
#ifdef DEBUG
			movecursor(COORD_ORIGIN);
			DEBUG_CHEATS;
#endif

			if (kbhit())
			{
				key = getch();

				if (key == Enter || key == Esc)
				{
					return;
				}
			}

			Sleep(MENU_SLEEP);
		}
}

bool game(DIFFICULTY difficulty, bool hotseat)
{
		const int CENTERING = 6;

		bool renderMain = true, renderSelection = true;
		char key;
		int outDifficulty, selection = 0;
		COORD cursorPosition;

		if (difficulty == Custom)
		{
			outDifficulty = customdifficultyselection();

			if (outDifficulty == 0)
			{
				return false;
			}
		}
		else
		{
			outDifficulty = (difficulty == Easy ? SLEEP_EASY : (difficulty == Medium ? SLEEP_MEDIUM :
SLEEP_HARD));
		}

		while (true)
		{
			if (consoleSizeChanged || renderMain)
			{
				cls();

				vcenter(5);
				hcenter("CHOOSE GAME MODE");
				fputs("\n\n", stdout);

				cursorPosition = hcenter(CENTERING, "Normal\n");
				cursorPosition.X -= 2;

				hcenter(CENTERING, "Borderless\n");
				putchar('\n');
				hcenter(CENTERING, "Back");

				consoleSizeChanged = false;
				renderMain = false;
				renderSelection = true;
			}

#ifdef DEBUG
			DEBUG_MAIN;
#endif
```

```
        if (renderSelection)
        {
            for (int i = (selection == 2 ? -2 : -1); i <= (selection == 1 ? 2 : 1); i++)
            {
                movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection == 2 ? 1 : 0) +
i);

                putchar(' ');
            }

            movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection == 2 ? 1 : 0));
            putchar('>');

            renderSelection = false;
        }

        if (kbhit())
        {
            key = getkey(getcheat(getch()));

            if ((key == Enter && selection == 2) || key == Esc)
            {
                return false;
            }
            else if (key == Enter)
            {
                if (playername(outDifficulty, hotseat, (selection == 0 ? true : false)))
                {
                    return true;
                }

                renderMain = true;
            }
            else if (key == Up && selection != 0)
            {
                selection--;
                renderSelection = true;
            }
            else if (key == Down && selection != 2)
            {
                selection++;
                renderSelection = true;
            }
        }

        Sleep(MENU_SLEEP);
    }
}

int customdifficultyselection()
{
    const int CENTERING = 7;
    const int MIN = 10;
    const int MAX = 300;
    const int STEP = 5;

    bool renderMain = true, renderSelection = true;
    char key;
    int selection = 0, wheelSelection = MIN;
    COORD cursorPosition, wheelCursorPosition;

    while (true)
    {
        if (consoleSizeChanged || renderMain)
        {
            cls();

            vcenter(7);
				hcenter("CHOOSE CUSTOM DELAY");
				fputs("\n\n", stdout);

				wheelCursorPosition = getcursorposition();

				printf("\n\n\n");

				cursorPosition = hcenter(CENTERING, "Confirm\n");
				cursorPosition.X -= 2;

				hcenter(CENTERING, "Back");

				consoleSizeChanged = false;
				renderMain = false;
				renderSelection = true;
			}

#ifdef DEBUG
			DEBUG_MAIN;
			printf("\nwheelSelection: %3d | ", wheelSelection);
			printf("wheelCursorPosition: %*d %*d", consoleSizeXPrecision, wheelCursorPosition.X, consoleSizeX-
Precision, wheelCursorPosition.Y);
#endif

			if (renderSelection)
			{
				wheelselection(wheelCursorPosition, wheelSelection, MIN, MAX, STEP);

				movecursor(cursorPosition.X, cursorPosition.Y + (selection == 0 ? 1 : 0));
				putchar(' ');

				movecursor(cursorPosition.X, cursorPosition.Y + selection);
				putchar('>');

				renderSelection = false;
			}

			if (kbhit())
			{
				key = getkey(getcheat(getch()));

				if ((key == Enter && selection == 1) || key == Esc)
				{
					return 0;
				}
				else if (key == Enter)
				{
					return wheelSelection;
				}
				else if (key == Up && selection != 0)
				{
					selection--;
					renderSelection = true;
				}
				else if (key == Down && selection != 1)
				{
					selection++;
					renderSelection = true;
				}
				else if (key == Left)
				{
					wheelSelection -= STEP;

					if (wheelSelection == MIN - STEP)
					{
						wheelSelection = MAX;
					}
```

```
                    renderSelection = true;
                }
                else if (key == Right)
                {
                    wheelSelection += STEP;

                    if (wheelSelection == MAX + STEP)
                    {
                        wheelSelection = MIN;
                    }

                    renderSelection = true;
                }
            }

            Sleep(MENU_SLEEP);
        }
}

bool playername(int sleep, bool hotseat, bool borders)
{
        char playersNames[2][1] = {0};

        if (snakecreator(sleep, hotseat, borders, (const char **)playersNames))
        {
            return true;
        }

        return false;

        // Here should be TextBox for selecting names
}

bool snakecreator(int sleep, bool hotseat, bool borders, const char *playersNames[2])
{
        const char BODIES[] = {'O', 'X', 176, 177, 219, '\0'};
        const int CENTERING = 7;
        const int COLOR_CHAR = 254;
        const int COLOR_MIN = Blue;
        const int COLOR_MAX = White;

        bool changing, resetVisual = true, renderMain = true, renderMainSelection = true, renderSnakeSelection = true;
        char key;
        int actualSnake, bodySelection, colorSelection, selection;
        COORD bodyCursorPosition, colorCursorPosition, snakeCursorPosition, cursorPosition;
        VISUAL snakeVisual[2];

        changing = false;
        actualSnake = 0;

        while (true)
        {
            if (consoleSizeChanged || renderMain)
            {
                if (resetVisual)
                {
                    bodySelection = 0;
                    colorSelection = White;
                    selection = 0;

                    snakeVisual[actualSnake].Char = BODIES[bodySelection];
                    snakeVisual[actualSnake].Color = (COLOR)colorSelection;

                    resetVisual = false;
                }

                cls();
                vcenter(15);
```

```
				if (!hotseat)
				{
					hcenter("CREATE YOUR OWN SNAKE");
				}
				else
				{
					hcenter(strlen("PLAYER X - CREATE YOUR OWN SNAKE"));
					printf("PLAYER %d - CREATE YOUR OWN SNAKE", actualSnake + 1);
				}

				fputs("\n\n", stdout);

				// Go to absolute center on X axis
				colorCursorPosition = snakeCursorPosition = hcenter(0);

				// Set coordinates for snake preview
				snakeCursorPosition.X--;
				snakeCursorPosition.Y += 2;

				// Get coordinates for body selection
				movecursor(0, colorCursorPosition.Y + 8);
				bodyCursorPosition = hcenter(9);

				// Print color selection
				colorCursorPosition.X += 10;

				for (int i = COLOR_MAX; i >= COLOR_MIN; i--)
				{
					setforeground((COLOR)i);

					movecursor(colorCursorPosition.X, colorCursorPosition.Y + (COLOR_MAX - i));
					putchar(COLOR_CHAR);
				}

				colorCursorPosition.X += 2;

				putchar('\n');
				// Get coordinates for main selection
				cursorPosition = hcenter(CENTERING);
				cursorPosition.X -= 2;
				cursorPosition.Y += 3;

				consoleSizeChanged = false;
				renderMain = false;
				renderMainSelection = true;
				renderSnakeSelection = true;
			}

#ifdef DEBUG
			setforeground(White);
			DEBUG_MAIN;
			printf("\nbodyCursor: %*d %*d | ", consoleSizeXPrecision, bodyCursorPosition.X, consoleSizeXPreci-
sion, bodyCursorPosition.Y);
			printf("colorCursor: %*d %*d | ", consoleSizeXPrecision, colorCursorPosition.X, consoleSizeXPrecision,
colorCursorPosition.Y);
			printf("snakeCursor: %*d %*d", consoleSizeXPrecision, snakeCursorPosition.X, consoleSizeXPrecision,
snakeCursorPosition.Y);
			printf("\nbodySelection: %2d | ", bodySelection);
			printf("colorSelection: %2d | ", colorSelection);
			printf("changing: %d | ", changing);
			printf("snakeVisual[%d].Char: %c | ", actualSnake, snakeVisual[actualSnake].Char);
			printf("snakeVisual[%d].Color: %2d", actualSnake, snakeVisual[actualSnake].Color);
#endif

			if (renderSnakeSelection)
			{
				// Print snake preview
				setforeground((COLOR)colorSelection);

				for (int i = 0; i < 3; i++)
				{
					movecursor(snakeCursorPosition.X, snakeCursorPosition.Y + i);
					putchar(BODIES[bodySelection]);
				}

				// Print body selection
				movecursor(bodyCursorPosition);

				setforeground(DarkGray);
				printf("%c ", (bodySelection == 1 ? BODIES[strlen(BODIES) - 1] : (bodySelection == 0 ? BO-
DIES[strlen(BODIES) - 2] : BODIES[bodySelection - 2])));

				setforeground(Gray);
				printf("%c ", (bodySelection == 0 ? BODIES[strlen(BODIES) - 1] : BODIES[bodySelection - 1]));

				setforeground(White);
				printf("%c ", BODIES[bodySelection]);

				setforeground(Gray);
				printf("%c ", (bodySelection == strlen(BODIES) - 1 ? BODIES[0] : BODIES[bodySelection + 1]));

				setforeground(DarkGray);
				printf("%c", (bodySelection == strlen(BODIES) - 2 ? BODIES[0] : (bodySelection == str-
len(BODIES) - 1 ? BODIES[1] : BODIES[bodySelection + 2])));

				setforeground(White);
			}

			if (renderSnakeSelection)
			{
				for (int i = 0; i < COLOR_MAX; i++)
				{
					movecursor(colorCursorPosition.X, colorCursorPosition.Y + i);
					putchar(' ');
				}

				if (changing)
				{
					movecursor(colorCursorPosition.X, colorCursorPosition.Y + (COLOR_MAX -
colorSelection));

					putchar('<');

					setforeground(DarkGray);
				}

				renderSnakeSelection = false;
			}

			if (renderMainSelection)
			{
				movecursor(0, cursorPosition.Y);
				hcenter(CENTERING, "Confirm\n");
				hcenter(CENTERING, "Change\n");
				hcenter(CENTERING, "Back");

				for (int i = -1; i <= 1; i += 2)
				{
					movecursor(cursorPosition.X, cursorPosition.Y + selection + i);
					putchar(' ');
				}

				movecursor(cursorPosition.X, cursorPosition.Y + selection);
				putchar('>');

				renderMainSelection = false;
```

```
}

if (kbhit())
{
        key = getkey(getcheat(getch()));

        if (changing)
        {
                if (key == Enter)
                {
                        changing = false;
                        renderMainSelection = true;
                        renderSnakeSelection = true;

                        // Assign snakeVisual from selection
                        snakeVisual[actualSnake].Char = BODIES[bodySelection];
                        snakeVisual[actualSnake].Color = (COLOR)colorSelection;
                }
                else if (key == Esc)
                {
                        changing = false;
                        resetVisual = true;
                        renderMainSelection = true;
                        renderSnakeSelection = true;

                        // Assign selection from snakeVisual
                        colorSelection = (int)snakeVisual[actualSnake].Color;

                        for (int i = 0; i < strlen(BODIES); i++)
                        {
                                if (BODIES[i] == snakeVisual[actualSnake].Char)
                                {
                                        bodySelection = i;
                                        break;
                                }
                        }
                }
                else if (key == Up && colorSelection != COLOR_MAX)
                {
                        colorSelection++;
                        renderSnakeSelection = true;
                }
                else if (key == Down && colorSelection != COLOR_MIN)
                {
                        colorSelection--;
                        renderSnakeSelection = true;
                }
                else if (key == Left)
                {
                        if (bodySelection == 0)
                        {
                                bodySelection = strlen(BODIES) - 1;
                        }
                        else
                        {
                                bodySelection--;
                        }

                        renderSnakeSelection = true;
                }
                else if (key == Right)
                {
                        if (bodySelection == strlen(BODIES) - 1)
                        {
                                bodySelection = 0;
                        }
                        else
                        {
```

```
                                        bodySelection++;
                                }

                                renderSnakeSelection = true;
                        }
                }
                else //if (!changing)
                {
                        if ((key == Enter && selection == 2) || key == Esc)
                        {
                                if (actualSnake == 0)
                                {
                                        return false;
                                }
                                else
                                {
                                        actualSnake = 0;
                                        renderMain = true;

                                        // Assign selection from snakeVisual
                                        colorSelection = (int)snakeVisual[actualSnake].Color;

                                        for (int i = 0; i < strlen(BODIES); i++)
                                        {
                                                if (BODIES[i] == snakeVisual[actualSnake].Char)
                                                {
                                                        bodySelection = i;
                                                        break;
                                                }
                                        }
                                }
                        }
                        else if (key == Enter)
                        {
                                if (selection == 1)
                                {
                                        changing = true;
                                        renderMainSelection = true;
                                        renderSnakeSelection = true;
                                }
                                else //if (selection == 0)
                                {
                                        if (!hotseat)
                                        {
                                                playsnake(sleep, borders, snakeVisual[actualSnake],
playersNames[0]);
                                                return true;
                                        }
                                        else
                                        {
                                                if (actualSnake == 0)
                                                {
                                                        actualSnake = 1;
                                                        resetVisual = true;
                                                        renderMain = true;
                                                }
                                                else
                                                {
                                                        playhotseat(sleep, borders, snakeVisual,
playersNames);
                                                        return true;
                                                }
                                        }

                                }
                        }
                        else if (key == Up && selection != 0)
                        {
```

```
                    selection--;
                    renderMainSelection = true;
                }
                else if (key == Down && selection != 2)
                {
                    selection++;
                    renderMainSelection = true;
                }
            }
        }

        Sleep(MENU_SLEEP);
    }
}

void livetitle(int score)
{
    sprintf(liveTitle, "%s - score: %d", gameName, score - SNAKE_LENGTH_START);
    SetConsoleTitle(liveTitle);
}

void livetitle(const char *playerName1, int score1, const char *playerName2, int score2)
{
    sprintf(liveTitle, "%s - %s: %d, %s: %d", gameName, playerName1, score1 - SNAKE_LENGTH_START, player-
Name2, score2 - SNAKE_LENGTH_START);
    SetConsoleTitle(liveTitle);
}

void setrandomcolors()
{
    DWORD written;

    do
    {
        setforeground((COLOR)(rand() % 16));
        setbackground((COLOR)(rand() % 16));
    } while (foregroundColor == backgroundColor);

    FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), foregroundColor + (backgroundColor <<
4), (forcedConsoleSize.X + 1) * (forcedConsoleSize.Y + 1), COORD_ORIGIN, &written);
}

void recreateboard(bool *gameBoard, VISUAL snake, BERRY berry, bool isSpecialShown, SPECIAL shownSpecial)
{
    cls();

    if (cheats[Fisa])
    {
        setrandomcolors();
    }

    // Print snake
    for (int y = 0; y < forcedConsoleSize.Y + 1; y++)
    {
        for (int x = 0; x < forcedConsoleSize.X + 1; x++)
        {
            if (*(gameBoard + (y * (forcedConsoleSize.X + 1)) + x))
            {
                movecursor(x, y);

                if (!cheats[Fisa])
                {
                    draw(snake);
                }
                else
                {
                    putchar(BLOCK_NORMAL);
                }
				}
			}
		}

		// Print berry
		movecursor(berry.Position);

		if (!cheats[Fisa])
		{
			draw(berry.Visual);
		}
		else
		{
			putchar(berry.Visual.Char);
		}

		// Print special
		if (isSpecialShown)
		{
			movecursor(specials[shownSpecial].Position);

			if (!cheats[Fisa])
			{
				draw(specials[shownSpecial].Visual);
			}
			else
			{
				putchar(specials[shownSpecial].Visual.Char);
			}
		}
}

void recreateboard(bool *gameBoard, SNAKE snakes[2], BERRY berries[2], bool isSpecialShown, SPECIAL shownSpecial)
{
		// TODO: everything here
}

void newberry(BERRY *berry, bool *gameBoard)
{
		bool collision;

		do
		{
			collision = false;

			berry->Position.X = rand() % (forcedConsoleSize.X + 1);
			berry->Position.Y = rand() % (forcedConsoleSize.Y + 1);

			// Collision - new berry with snake
			for (int y = -1; y <= 1; y++)
			{
				// Skip this cycle step when variables points out of GAMEBOARD range
				if ((berry->Position.Y == 0 && y == -1) || (berry->Position.Y == forcedConsoleSize.Y && y
== 1))
				{
					continue;
				}

				for (int x = -1; x <= 1; x++)
				{
					// Skip this cycle step when variables points out of GAMEBOARD range
					if ((berry->Position.X == 0 && x == -1) || (berry->Position.X == forcedConsoleSi-
ze.X && x == 1))
					{
						continue;
					}
```

```
                                        if (*(gameBoard + ((berry->Position.Y + y) * (forcedConsoleSize.X + 1)) + (berry-
>Position.X + x)))
                                        {
                                                collision = true;
                                                break;
                                        }
                                }

                                if (collision)
                                {
                                        break;
                                }
                        }
        } while (collision);

        berry->Visual.Color = (COLOR)(rand() % 8 + 8);

        // Print berry
        movecursor(berry->Position);
        draw(berry->Visual);
}

void playsnake(int sleep, bool borders, VISUAL visual, const char *playerName)
{
#ifndef DEBUG
        timer(true);
#endif

        forcedConsoleSize = consoleSize;
        SuspendThread(sizecheckthreadHandle);
        SuspendThread(cheatpromptthreadHandle);
        cls();

        bool isSpecialShown, lastFisaState;
        bool gameBoard[forcedConsoleSize.Y + 1][forcedConsoleSize.X + 1];
        char key;
        SPECIAL shownSpecial;
        BERRY berry;
        SNAKE snake;

        // Assign variables
        isSpecialShown = false;
        lastFisaState  = cheats[Fisa];
        memset(gameBoard, false, (forcedConsoleSize.X + 1) * (forcedConsoleSize.Y + 1));
        shownSpecial = (SPECIAL)0;

        berry.Visual.Char = BERRY_CHAR;

        snake.Collision                         = false;
        snake.Active                            = SNAKE_LENGTH_START;
        snake.Shown                                     = 0;
        snake.Bend.Active               = 0;
        snake.Bend.ToAssign                     = 0;
        snake.Head.Position.X           = (forcedConsoleSize.X + 1) / 2;
        snake.Head.Position.Y           = (forcedConsoleSize.Y + 1) / 2;
        snake.Tail.Position             = snake.Head.Position;
        snake.Head.Direction            = CONTROLS[Arrows][KUp];
        snake.Tail.Direction            = snake.Head.Direction;
        snake.Visual                            = visual;
        //strcpy(snake.PlayerName, playerName);

        gameBoard[snake.Head.Position.Y][snake.Head.Position.X] = true;

        for (int i = 0; i < SNAKE_LENGTH_MAX; i++)
        {
                snake.Bend.Vector[i].Position.X = NEUTRAL;
                snake.Bend.Vector[i].Position.Y = NEUTRAL;
                snake.Bend.Vector[i].Direction  = NEUTRAL;
```

```
}

// Create berry
newberry(&berry, gameBoard[0]);
livetitle(snake.Active);

// Main game cycle
while (true)
{
	forceconsolesize();

	if (consoleSizeChanged)
	{
		movecursor(berry.Position);
		draw(berry.Visual);

		consoleSizeChanged = false;
	}

	if (cheats[Fisa])
	{
		setrandomcolors();
	}

	// Print snake
	gameBoard[snake.Head.Position.Y][snake.Head.Position.X] = true;
	movecursor(snake.Head.Position);

	if (!cheats[Fisa])
	{
		draw(snake.Visual);
	}
	else
	{
		putchar(BLOCK_NORMAL);
	}

	if (snake.Shown < snake.Active)
	{
		snake.Shown++;
	}
	else
	{
		// Remove tail
		gameBoard[snake.Tail.Position.Y][snake.Tail.Position.X] = false;
		movecursor(snake.Tail.Position);

		if (!cheats[Fisa])
		{
			setforeground(Black);
			putchar(snake.Visual.Char);
			setforeground(White);
		}
		else
		{
			putchar(' ');
		}

		// Change tail direction
		if (snake.Tail.Position == snake.Bend.Vector[snake.Bend.Active].Position)
		{
			snake.Tail.Direction = snake.Bend.Vector[snake.Bend.Active++].Direction;

			if (snake.Bend.Active == SNAKE_LENGTH_MAX)
			{
				snake.Bend.Active = 0;
			}
		}
```

```
				// Change tail position
				if (snake.Tail.Direction == CONTROLS[Arrows][KUp])
				{
					snake.Tail.Position.Y--;
				}
				else if (snake.Tail.Direction == CONTROLS[Arrows][KDown])
				{
					snake.Tail.Position.Y++;
				}
				else if (snake.Tail.Direction == CONTROLS[Arrows][KLeft])
				{
					snake.Tail.Position.X--;
				}
				else if (snake.Tail.Direction == CONTROLS[Arrows][KRight])
				{
					snake.Tail.Position.X++;
				}

				// Move tail to opposite console edges
				if (!borders)
				{
					if (snake.Tail.Position.X < 0)
					{
						snake.Tail.Position.X = forcedConsoleSize.X;
					}
					else if (snake.Tail.Position.X > forcedConsoleSize.X)
					{
						snake.Tail.Position.X = 0;
					}
					else if (snake.Tail.Position.Y < 0)
					{
						snake.Tail.Position.Y = forcedConsoleSize.Y;
					}
					else if (snake.Tail.Position.Y > forcedConsoleSize.Y)
					{
						snake.Tail.Position.Y = 0;
					}
				}
			}

			movecursor(COORD_ORIGIN);

#ifdef DEBUG
			printf("head: %*d %*d %c | ", consoleSizeXPrecision, snake.Head.Position.X, consoleSizeXPrecision,
snake.Head.Position.Y, printarrow(snake.Head.Direction));
			printf("bend[%*d]:% *d% *d %c | ", LENGTH_PRECISION, snake.Bend.Active, consoleSizeXPrecision +
1, snake.Bend.Vector[snake.Bend.Active].Position.X, consoleSizeXPrecision + 1, sna-
ke.Bend.Vector[snake.Bend.Active].Position.Y,
				printarrow(snake.Bend.Vector[snake.Bend.Active].Direction));
			printf("active: %*d | ", LENGTH_PRECISION, snake.Active);
			printf("berry: %*d %*d | ", consoleSizeXPrecision, berry.Position.X, consoleSizeXPrecision, ber-
ry.Position.Y);
			printf("color: %c%c", (foregroundColor < 10 ? foregroundColor + '0' : foregroundColor - 10 + 'A'), (ba-
ckgroundColor < 10 ? backgroundColor + '0' : backgroundColor - 10 + 'A'));

			printf("\ntail: %*d %*d %c | ", consoleSizeXPrecision, snake.Tail.Position.X, consoleSizeXPrecision,
snake.Tail.Position.Y, printarrow(snake.Tail.Direction));

			if (snake.Bend.ToAssign > 0)
			{
				printf("bend[%*d]: %*d %*d %c | ",
						LENGTH_PRECISION, snake.Bend.ToAssign,
						consoleSizeXPrecision, snake.Bend.Vector[snake.Bend.ToAssign -
1].Position.X,
						consoleSizeXPrecision, snake.Bend.Vector[snake.Bend.ToAssign -
1].Position.Y,
						printarrow(snake.Bend.Vector[snake.Bend.ToAssign - 1].Direction)
```

```
                                        );
                }

                else
                {
                        printf("bend[%*d]: %s %s - | ", LENGTH_PRECISION, snake.Bend.ToAssign, createline('-', 
consoleSizeXPrecision),  createline('-', consoleSizeXPrecision));
                }

                printf("shown:  %*d | ", LENGTH_PRECISION, snake.Shown);
                printf("sleep: %3d", sleep);
                printf("\nisSpecialShown: %d | ", isSpecialShown);
                printf("specials[%d]: %*d %*d", shownSpecial, consoleSizeXPrecision, spe-
cials[shownSpecial].Position.X, consoleSizeXPrecision, specials[shownSpecial].Position.Y);
                DEBUG_CHEATS;
#endif

                Sleep(sleep);

                if (kbhit())
                {
                        key = getch();

                        if (key == -32 || key == 224)
                        {
                                // Get new direction for head
                                key = getch();

                                if (IF_ARROW(key) && key != snake.Head.Direction && key != (sna-
ke.Head.Direction == Up ? Down : (snake.Head.Direction == Down ? Up : (snake.Head.Direction == Left ? Right : Left))))
                                {
                                        // Assign new bend
                                        snake.Head.Direction = sna-
ke.Bend.Vector[snake.Bend.ToAssign].Direction = key;
                                        snake.Bend.Vector[snake.Bend.ToAssign++].Position = sna-
ke.Head.Position;

                                        if (snake.Bend.ToAssign == SNAKE_LENGTH_MAX)
                                        {
                                                snake.Bend.ToAssign = 0;
                                        }
                                }
                        }
                        else if (key == Esc)
                        {
                                ResumeThread(sizecheckthreadHandle);
                                ResumeThread(cheatpromptthreadHandle);
                                SetConsoleTitle(gameName);

                                setforeground(White);
                                setbackground(Black);

                                if (pausemenu(false))
                                {
                                        return;
                                }

                                SuspendThread(sizecheckthreadHandle);
                                SuspendThread(cheatpromptthreadHandle);
                                livetitle(snake.Active);

                                if (cheats[Fisa] != lastFisaState)
                                {
                                        recreateboard(gameBoard[0], snake.Visual, berry, isSpecialShown, 
shownSpecial);
                                        lastFisaState = cheats[Fisa];
                                }
                        }
```

```
#ifdef DEBUG
            else if (key == Space)
            {
                while (getch() != Space);
            }
#endif
        }

        // Change snake position
        if (snake.Head.Direction == CONTROLS[Arrows][KUp])
        {
            snake.Head.Position.Y--;
        }
        else if (snake.Head.Direction == CONTROLS[Arrows][KDown])
        {
            snake.Head.Position.Y++;
        }
        else if (snake.Head.Direction == CONTROLS[Arrows][KLeft])
        {
            snake.Head.Position.X--;
        }
        else if (snake.Head.Direction == CONTROLS[Arrows][KRight])
        {
            snake.Head.Position.X++;
        }

        if (!borders)
        {
            // Move head to opposite console edge
            if (snake.Head.Position.X < 0)
            {
                snake.Head.Position.X = forcedConsoleSize.X;
            }
            else if (snake.Head.Position.X > forcedConsoleSize.X)
            {
                snake.Head.Position.X = 0;
            }
            else if (snake.Head.Position.Y < 0)
            {
                snake.Head.Position.Y = forcedConsoleSize.Y;
            }
            else if (snake.Head.Position.Y > forcedConsoleSize.Y)
            {
                snake.Head.Position.Y = 0;
            }
        }

        // Eat berry
        if (snake.Head.Position == berry.Position)
        {
            snake.Active += (cheats[Hamster] ? CHEATS_HAMSTER : 1);
            livetitle(snake.Active);

            newberry(&berry, gameBoard[0]);
        }

        // Specials
        if (!isSpecialShown && SPECIAL_SPAWN)
        {
            // Create new special berry
            shownSpecial = (SPECIAL)(rand() % (sizeof(specials) / sizeof(specials[0])));
            newberry(&specials[shownSpecial], gameBoard[0]);

            isSpecialShown = true;
        }
        else if (isSpecialShown)
        {
            if (snake.Head.Position == specials[shownSpecial].Position)
```

```
				{
					// Eat special berry
					switch (shownSpecial)
					{
						case Bonus:
							snake.Active += SPECIAL_BONUS;
							livetitle(snake.Active);
							break;

						case Mine:
							snake.Collision = true;
							break;
						/*
						case Slowdown:
							// TODO: slowdown
							break;

						case Poison:
							// TODO: poison
							break;*/
					}

					isSpecialShown = false;
				}
				else if (SPECIAL_SPAWN)
				{
					// Remove special berry
					movecursor(specials[shownSpecial].Position);
					putchar(' ');

					isSpecialShown = false;
				}
			}

			// Collision
			if (!snake.Collision)
			{
				snake.Collision = borders && !(snake.Head.Position >= COORD_ORIGIN && sna-
ke.Head.Position <= forcedConsoleSize) || gameBoard[snake.Head.Position.Y][snake.Head.Position.X];
			}

			// Game end
			if (snake.Collision || snake.Active == SNAKE_LENGTH_MAX)
			{
				SetConsoleTitle(gameName);
				ResumeThread(sizecheckthreadHandle);
				ResumeThread(cheatpromptthreadHandle);

				setforeground(White);
				setbackground(Black);

				showscore(snake.Active == SNAKE_LENGTH_MAX, snake.Active - SNA-
KE_LENGTH_START, sleep == SLEEP_EASY ? Easy : (sleep == SLEEP_MEDIUM ? Medium : (sleep == SLEEP_HARD ?
Hard : Custom)), borders ? "Normal" : "Borderless");
				return;
			}
		}
}

void playhotseat(int sleep, bool borders, VISUAL visuals[2], const char *playersNames[2])
{
#ifndef DEBUG
	timer(true);
#endif

	forcedConsoleSize = consoleSize;
	SuspendThread(sizecheckthreadHandle);
	SuspendThread(cheatpromptthreadHandle);
```

```
cls();

bool isSpecialShown, lastFisaState;
bool gotNewDirection[2];
bool gameBoard[forcedConsoleSize.Y + 1][forcedConsoleSize.X + 1];
char key;
// Represents actual snake index from snakes array
int s;
// Represents actual berry index from berries array
int b;
SPECIAL shownSpecial;
BERRY berries[2];
SNAKE snakes[2];

// Assign variables
isSpecialShown = false;
lastFisaState  = cheats[Fisa];
memset(gameBoard, false, (forcedConsoleSize.X + 1) * (forcedConsoleSize.Y + 1));
shownSpecial = (SPECIAL)0;

for (s = 0; s <= 1; s++)
{
        berries[s].Visual.Char = BERRY_CHAR;

        snakes[s].Collision                     = false;
        snakes[s].Active                        = SNAKE_LENGTH_START;
        snakes[s].Shown                                 = 0;
        snakes[s].Bend.Active                   = 0;
        snakes[s].Bend.ToAssign                 = 0;
        snakes[s].Head.Position.X       = (forcedConsoleSize.X + 1) * (1 + (2 * s)) / 4;
        snakes[s].Head.Position.Y       = (forcedConsoleSize.Y + 1) / 2;
        snakes[s].Tail.Position                 = snakes[s].Head.Position;
        snakes[s].Head.Direction        = CONTROLS[s][KUp];
        snakes[s].Tail.Direction        = snakes[s].Head.Direction;
        snakes[s].Visual                        = visuals[s];
        //strcpy(snakes[s].PlayerName, playersNames[s]);

        gameBoard[snakes[s].Head.Position.Y][snakes[s].Head.Position.X] = true;

        for (int i = 0; i < SNAKE_LENGTH_MAX; i++)
        {
                snakes[s].Bend.Vector[i].Position.X = NEUTRAL;
                snakes[s].Bend.Vector[i].Position.Y = NEUTRAL;
                snakes[s].Bend.Vector[i].Direction  = NEUTRAL;
        }
}

// Create berries
newberry(&berries[0], gameBoard[0]);

do
{
        newberry(&berries[1], gameBoard[0]);
} while (berries[0].Position == berries[1].Position);

livetitle("Player 1", snakes[0].Active, "Player 2", snakes[1].Active);

// Main game cycle
while (true)
{
        forceconsolesize();

        if (consoleSizeChanged)
        {
                movecursor(berries[0].Position);
                draw(berries[0].Visual);

                movecursor(berries[1].Position);
```

```
            draw(berries[1].Visual);

            consoleSizeChanged = false;
        }
        /*
        if (cheats[Fisa])
        {
            setrandomcolors();
        }
        */
        for (s = 0; s <= 1; s++)
        {
            if (!snakes[s].Collision)
            {
                // Print snake
                gameBoard[snakes[s].Head.Position.Y][snakes[s].Head.Position.X] = true;
                movecursor(snakes[s].Head.Position);
                /*
                if (!cheats[Fisa])
                {*/
                    draw(snakes[s].Visual);
                /*}
                else
                {
                    putchar(BLOCK_NORMAL);
                }*/

                if (snakes[s].Shown < snakes[s].Active)
                {
                    snakes[s].Shown++;
                }
                else
                {
                    // Remove tail
                    gameBoard[snakes[s].Tail.Position.Y][snakes[s].Tail.Position.X] = false;
                    movecursor(snakes[s].Tail.Position);
                    /*
                    if (!cheats[Fisa])
                    {*/
                        setforeground(Black);
                        putchar(snakes[s].Visual.Char);
                        setforeground(White);
                    /*}
                    else
                    {
                        putchar(' ');
                    }*/

                    // Change tail direction
                    if (snakes[s].Tail.Position == sna-
kes[s].Bend.Vector[snakes[s].Bend.Active].Position)
                    {
                        snakes[s].Tail.Direction = sna-
kes[s].Bend.Vector[snakes[s].Bend.Active++].Direction;

                        if (snakes[s].Bend.Active == SNAKE_LENGTH_MAX)
                        {
                            snakes[s].Bend.Active = 0;
                        }
                    }

                    // Change tail position
                    if (snakes[s].Tail.Direction == CONTROLS[s][KUp])
                    {
                        snakes[s].Tail.Position.Y--;
                    }
                    else if (snakes[s].Tail.Direction == CONTROLS[s][KDown])
                    {
                        snakes[s].Tail.Position.Y++;
                    }
                    else if (snakes[s].Tail.Direction == CONTROLS[s][KLeft])
                    {
                        snakes[s].Tail.Position.X--;
                    }
                    else if (snakes[s].Tail.Direction == CONTROLS[s][KRight])
                    {
                        snakes[s].Tail.Position.X++;
                    }

                    // Move tail to opposite console edges
                    if (!borders)
                    {
                        if (snakes[s].Tail.Position.X < 0)
                        {
                            snakes[s].Tail.Position.X = forcedConsoleSize.X;
                        }
                        else if (snakes[s].Tail.Position.X > forcedConsoleSize.X)
                        {
                            snakes[s].Tail.Position.X = 0;
                        }
                        else if (snakes[s].Tail.Position.Y < 0)
                        {
                            snakes[s].Tail.Position.Y = forcedConsoleSize.Y;
                        }
                        else if (snakes[s].Tail.Position.Y > forcedConsoleSize.Y)
                        {
                            snakes[s].Tail.Position.Y = 0;
                        }
                    }
                }

                movecursor(COORD_ORIGIN);
            }
        }

        Sleep(sleep);

        // Get new directions for heads
        // Not really efficient, should be rewrited
        gotNewDirection[0] = false;
        gotNewDirection[1] = false;

        if (kbhit())
        {
            key = toupper(getch());

            if (!snakes[0].Collision && IF_WASD(key) && key != (snakes[0].Head.Direction == 'W' ? 'S' :
(snakes[0].Head.Direction == 'S' ? 'W' : (snakes[0].Head.Direction == 'A' ? 'D' : 'A'))))
            {
                // Assign new bend
                snakes[0].Head.Direction = sna-
kes[0].Bend.Vector[snakes[0].Bend.ToAssign].Direction = key;
                snakes[0].Bend.Vector[snakes[0].Bend.ToAssign++].Position = sna-
kes[0].Head.Position;

                if (snakes[0].Bend.ToAssign == SNAKE_LENGTH_MAX)
                {
                    snakes[0].Bend.ToAssign = 0;
                }

                gotNewDirection[0] = true;
            }
            else if (key == -32 || key == 224)
            {
                key = getch();
```

```
					if (!snakes[1].Collision && IF_ARROW(key) && key != (snakes[1].Head.Direction
== Up ? Down : (snakes[1].Head.Direction == Down ? Up : (snakes[1].Head.Direction == Left ? Right : Left))))
					{
						// Assign new bend
						snakes[1].Head.Direction = sna-
kes[1].Bend.Vector[snakes[1].Bend.ToAssign].Direction = key;
						snakes[1].Bend.Vector[snakes[1].Bend.ToAssign++].Position = sna-
kes[1].Head.Position;

						if (snakes[1].Bend.ToAssign == SNAKE_LENGTH_MAX)
						{
							snakes[1].Bend.ToAssign = 0;
						}

						gotNewDirection[1] = true;
					}
				}
				else if (key == Esc)
				{
					ResumeThread(sizecheckthreadHandle);
					ResumeThread(cheatpromptthreadHandle);
					SetConsoleTitle(gameName);

					setforeground(White);
					setbackground(Black);

					if (pausemenu(true))
					{
						return;
					}

					SuspendThread(sizecheckthreadHandle);
					SuspendThread(cheatpromptthreadHandle);
					livetitle("Player 1", snakes[0].Active, "Player 2", snakes[1].Active);

					/*
					if (cheats[Fisa] != lastFisaState)
					{
						recreateboard(gameBoard[0], snake.Visual, berry, isSpecialShown,
shownSpecial);
						lastFisaState = cheats[Fisa];
					}*/
				}
#ifdef DEBUG
				else if (key == Space)
				{
					while (getch() != Space);
				}
#endif
			}

			if (!snakes[0].Collision && !snakes[1].Collision && kbhit())
			{
				key = toupper(getch());

				if (!gotNewDirection[0] && IF_WASD(key) && key != (snakes[0].Head.Direction == 'W' ? 'S' :
(snakes[0].Head.Direction == 'S' ? 'W' : (snakes[0].Head.Direction == 'A' ? 'D' : 'A'))))
				{
					// Assign new bend
					snakes[0].Head.Direction = sna-
kes[0].Bend.Vector[snakes[0].Bend.ToAssign].Direction = key;
					snakes[0].Bend.Vector[snakes[0].Bend.ToAssign++].Position = sna-
kes[0].Head.Position;

					if (snakes[0].Bend.ToAssign == SNAKE_LENGTH_MAX)
					{
						snakes[0].Bend.ToAssign = 0;
					}
```

```
                gotNewDirection[0] = true;
            }
            else if (key == -32 || key == 224)
            {
                key = getch();

                if (!snakes[1].Collision && IF_ARROW(key) && key != (snakes[1].Head.Direction
== Up ? Down : (snakes[1].Head.Direction == Down ? Up : (snakes[1].Head.Direction == Left ? Right : Left))))
                {
                    // Assign new bend
                    snakes[1].Head.Direction = sna-
kes[1].Bend.Vector[snakes[1].Bend.ToAssign].Direction = key;
                    snakes[1].Bend.Vector[snakes[1].Bend.ToAssign++].Position = sna-
kes[1].Head.Position;

                    if (snakes[1].Bend.ToAssign == SNAKE_LENGTH_MAX)
                    {
                        snakes[1].Bend.ToAssign = 0;
                    }

                    gotNewDirection[1] = true;
                }
            }
            else if (key == Esc)
            {
                ResumeThread(sizecheckthreadHandle);
                ResumeThread(cheatpromptthreadHandle);
                SetConsoleTitle(gameName);

                setforeground(White);
                setbackground(Black);

                if (pausemenu(true))
                {
                    return;
                }

                SuspendThread(sizecheckthreadHandle);
                SuspendThread(cheatpromptthreadHandle);
                livetitle("Player 1", snakes[0].Active, "Player 2", snakes[1].Active);
                /*
                if (cheats[Fisa] != lastFisaState)
                {
                    recreateboard(gameBoard[0], snake.Visual, berry, isSpecialShown,
shownSpecial);
                    lastFisaState = cheats[Fisa];
                }*/
            }
#ifdef DEBUG
            else if (key == Space)
            {
                while (getch() != Space);
            }
#endif
        }

        for (s = 0; s <= 1; s++)
        {
            if (!snakes[s].Collision)
            {
                // Change snake position
                if (snakes[s].Head.Direction == CONTROLS[s][KUp])
                {
                    snakes[s].Head.Position.Y--;
                }
                else if (snakes[s].Head.Direction ==  CONTROLS[s][KDown])
                {
                    snakes[s].Head.Position.Y++;
                }
                else if (snakes[s].Head.Direction ==  CONTROLS[s][KLeft])
                {
                    snakes[s].Head.Position.X--;
                }
                else if (snakes[s].Head.Direction ==  CONTROLS[s][KRight])
                {
                    snakes[s].Head.Position.X++;
                }

                if (!borders)
                {
                    // Move head to opposite console edge
                    if (snakes[s].Head.Position.X < 0)
                    {
                        snakes[s].Head.Position.X = forcedConsoleSize.X;
                    }
                    else if (snakes[s].Head.Position.X > forcedConsoleSize.X)
                    {
                        snakes[s].Head.Position.X = 0;
                    }
                    else if (snakes[s].Head.Position.Y < 0)
                    {
                        snakes[s].Head.Position.Y = forcedConsoleSize.Y;
                    }
                    else if (snakes[s].Head.Position.Y > forcedConsoleSize.Y)
                    {
                        snakes[s].Head.Position.Y = 0;
                    }
                }

                // Eat berry
                for (b = 0; b <= 1; b++)
                {
                    if (snakes[s].Head.Position == berries[b].Position)
                    {
                        snakes[s].Active += (cheats[Hamster] ? CHEATS_HAMSTER :
1);
                        livetitle("Player 1", snakes[0].Active, "Player 2", sna-
kes[1].Active);


                        do
                        {
                            newberry(&berries[b], gameBoard[0]);
                        } while (berries[b].Position == berries[1 - b].Position);
                    }
                }

                // Specials
                if (!isSpecialShown && SPECIAL_SPAWN)
                {
                    // Create new special berry
                    shownSpecial = (SPECIAL)(rand() % (sizeof(specials) / size-
of(specials[0])));


                    newberry(&specials[shownSpecial], gameBoard[0]);
                    isSpecialShown = true;
                }
                else if (isSpecialShown)
                {
                    if (snakes[s].Head.Position == specials[shownSpecial].Position)
                    {
                        // Eat special berry
                        switch (shownSpecial)
                        {
                            case Bonus:
                                snakes[s].Active += SPECIAL_BONUS;
```

```
								livetitle("Player 1", snakes[0].Active, "Player 
2", snakes[1].Active);
								break;

							case Mine:
								snakes[s].Collision = true;
								break;
							/*
							case Slowdown:
								// TODO: slowdown
								break;

							case Poison:
								// TODO: poison
								break;*/
						}

						isSpecialShown = false;
					}
					else if (SPECIAL_SPAWN)
					{
						// Remove special berry
						movecursor(specials[shownSpecial].Position);
						putchar(' ');

						isSpecialShown = false;
					}
				}

				// Collision
				if (!snakes[s].Collision)
				{
					snakes[s].Collision = borders && !(snakes[s].Head.Position >= 
COORD_ORIGIN && snakes[s].Head.Position <= forcedConsoleSize) || gameBo-
ard[snakes[s].Head.Position.Y][snakes[s].Head.Position.X];
				}
			}
		}

		// Game end
		if ((snakes[0].Collision || snakes[0].Active == SNAKE_LENGTH_MAX) && (snakes[1].Collision || 
snakes[1].Active == SNAKE_LENGTH_MAX))
		{
			bool won[2] = { snakes[0].Active == SNAKE_LENGTH_MAX, snakes[1].Active == SNA-
KE_LENGTH_MAX };
			int scores[2] = { snakes[0].Active - SNAKE_LENGTH_START, snakes[1].Active - SNA-
KE_LENGTH_START};

			SetConsoleTitle(gameName);
			ResumeThread(sizecheckthreadHandle);
			ResumeThread(cheatpromptthreadHandle);

			setforeground(White);
			setbackground(Black);

			showscore(won, scores, sleep == SLEEP_EASY ? Easy : (sleep == SLEEP_MEDIUM ? Medium 
: (sleep == SLEEP_HARD ? Hard : Custom)), borders ? "Normal" : "Borderless");
			return;
		}
	}
}
```

3.2 unigfcs.h

```
/*
	Name: unigfcs.h (Universal game functions) v1.4
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 30/05/16 05:45
	Description: Lots of useful functions for creating games in Windows console.

	DEBUG						- enables DEBUG mode
	DISABLE_HOTSEAT					- disables hotseat from mainmenu
	DISABLE_DIFFICULTY				- disables difficulty menu
	DISABLE_CUSTOMDIFFICULTY		- disables custom difficulty option
	DISABLE_CHANGELOG				- disables changelogs
	DISABLE_CHEATS					- disables all cheats and functions used with cheats
	DISABLE_BUFFERASWINDOW			- buffer height will be only by 1 greater than window height
*/

#ifndef UNIGFCS_H
#define UNIGFCS_H

#include "Project Superior CFC\superior.hpp"
#include <time.h>
#include <math.h>

#if !defined DISABLE_CHANGELOG && !defined CHANGELOG_COLUMNS
	#error CHANGELOG_COLUMNS not defined
#endif

#ifdef DEBUG
	#warning DEBUG enabled
#endif

#define IF_ARROW(KEY) (KEY == Up || KEY == Down || KEY == Left || KEY == Right)
#define IF_WASD(KEY) (KEY == 'W' || KEY == 'S' || KEY == 'A' || KEY == 'D')

// Using macros so don't have to pass so much arguments
#ifdef DEBUG
	#define DEBUG_CHEATS \
		printf("\n"); \
		for (int i = 0; i < sizeof(cheats) / sizeof(cheats[0]) - 1; i++) \
		{ \
			printf("cheats[%d]: %d | ", i, cheats[i]); \
		} \
		printf("cheats[%d]: %d", sizeof(cheats) / sizeof(cheats[0]) - 1, cheats[sizeof(cheats) / sizeof(cheats[0]) -
1])

	#define DEBUG_KEY(KEY) \
		printf("key: %c", printarrow(KEY))

	// Cannot use #ifdef etc in MACROs
	#ifndef DISABLE_CHEATS
		#define DEBUG_MAIN \
			movecursor(COORD_ORIGIN); \
			printf("selection: %d | ", selection); \
			printf("cursorPosition: %*d %*d | ", consoleSizeXPrecision, cursorPosition.X, consoleSizeX-
Precision, cursorPosition.Y); \
			printf("consoleSizeChanged: %d | ", consoleSizeChanged); \
			DEBUG_KEY(key); \
			DEBUG_CHEATS
	#else
		#define DEBUG_MAIN \
			movecursor(COORD_ORIGIN); \
			printf("selection: %d | ", selection); \
			printf("cursorPosition: %*d %*d | ", consoleSizeXPrecision, cursorPosition.X, consoleSizeX-
Precision, cursorPosition.Y); \
			printf("consoleSizeChanged: %d | ", consoleSizeChanged); \
			DEBUG_KEY(key)
	#endif
#endif

typedef enum
{
		Easy,
		Medium,
		Hard,
		Custom,
		NoDifficulty
} DIFFICULTY;

typedef enum
{
		Restart,
		Menu,
		Quit
} QUITACTION;

const char *gameName, *gameVersion, *gameBranch;
#ifndef DISABLE_CHANGELOG
const char CHANGELOG_UNIGFCS[][CHANGELOG_COLUMNS] =
{
		{ "1.4:			(5/30/2016)" },
		{ "- Using Project Superior CFC v1.0 beta 1" },
		{ "1.3:			(5/29/2016)" },
		{ "- Real time responsivity" },
		{ "- Added custom difficulty" },
		{ "- Added timer" },
		{ "- Added cheats support" },
		{ "- Added ability to move cursor" },
		{ "- Added custom console title" },
		{ "- Fully removed screen flashing" },
		{ "- Lots of improvements" },
		{ "- Lots of code optimalizations" },
		{ "- Lots of new features" },
		{ "- Some bugs were fixed" },
		{ "1.2:			(12/18/2015)" },
		{ "- Added macros for ENTER, ESC and SPACE" },
		{ "- Added unigfcs.h changelog" },
		{ "- Improved responsive design" },
		{ "- Some bugs were fixed" },
		{ "1.1:" },
		{ "- Code were optimized" },
		{ "- Some bugs were fixed" },
		{ "1.0:			(11/24/2015)" },
		{ "- First release" },
		{ "- Universal game menus" },
		{ "- Custom font" }
};
#endif
#ifndef DISABLE_BUFFERASWINDOW
const int BUFFER_ADDITION = 1;
#else
const int BUFFER_ADDITION = 2;
#endif
const int MENU_SLEEP = 15;
const UINT CP_OEM = 437;

#ifndef DISABLE_CHEATS
bool cheatActivated, showCheatPrompt, consoleSizeChangedCheatPrompt;
#endif
bool consoleSizeChanged;
bool cheats[sizeof(CHEATS) / sizeof(CHEATS[0])];
#ifdef DEBUG
int consoleSizeXPrecision;
#endif
// Console sizes are decreased by 1 so it can be compared with COORDs
COORD consoleSize, minimalConsoleSize, forcedConsoleSize;
HANDLE sizecheckthreadHandle = NULL;
#ifndef DISABLE_CHEATS
HANDLE cheatpromptthreadHandle = NULL;
#endif
```

```
// Applicable for bool-returning functions: returns true to make caller return too
void initialize(const char *name, const char *version, const char *branch, int minimalConsoleWidth, int minimalConsole-
Height);
DWORD WINAPI consolesizecheckthread(LPVOID lpvoid);
#ifndef DISABLE_CHEATS
DWORD WINAPI cheatpromptthread(LPVOID lpvoid);
#endif
void setconsolesize(COORD size);
// Returns true if consoleSize was changed
bool assignconsolesize();
void forceconsolesize();
void copybuffer(const HANDLE *dest, const HANDLE *source);
void setforeground(COLOR foreground);
void setbackground(COLOR background);
char getcheat(char key);
#ifdef DEBUG
char printarrow(char arrow);
#endif
void mainmenu(COLOR titleColor);
bool difficultyselection(bool hotseat);
void wheelselection(COORD position, int selected, int min, int max, int step);
void about();
#ifndef DISABLE_CHANGELOG
void changelog(const char CHANGELOG[][CHANGELOG_COLUMNS], int size);
#endif
bool pausemenu(bool hotseat);
bool quitdialog(QUITACTION action, bool playing, bool hotseat);
void showscore(bool won, int score, DIFFICULTY difficulty, const char *gameMode);
void showscore(bool won[2], int score[2], DIFFICULTY difficulty, const char *gameMode);
void timer(bool isColored);
// WARNING!!! Prints only alphabet, numbers and space
void bigtext(const char *text);
// These must be in each game
void controls();
bool game(DIFFICULTY difficulty, bool hotseat);
//void customdifficultyselection(); - returned data type depends on game

void initialize(const char *name, const char *version, const char *branch, int minimalConsoleWidth, int minimalConsole-
Height)
{
	gameName = strdup(name);
	gameVersion = strdup(version);
	gameBranch = strdup(branch);

	minimalConsoleSize.X = minimalConsoleWidth;
	minimalConsoleSize.Y = minimalConsoleHeight;

#ifndef DEBUG
	setcursor(false);
	srand(time(NULL));
#else
	setcursor(true);
#endif

	// Assign variables
#ifndef DISABLE_CHEATS
	consoleSizeChangedCheatPrompt = true;
#endif
	consoleSizeChanged = true;
	memset(cheats, false, sizeof(cheats));

	assignconsolesize();
	sizecheckthreadHandle = CreateThread(NULL, 0, consolesizecheckthread, NULL, 0, NULL);

	// Set Lucida Console font
	CONSOLE_FONT_INFOEX font;
```

```
   font.cbSize = sizeof(font);
   font.nFont = 7;
   font.dwFontSize.X = 12;
   font.dwFontSize.Y = 16;
   font.FontFamily = FF_DONTCARE;
   font.FontWeight = FW_NORMAL;
   wcscpy(font.FaceName, L"Lucida Console");

   SetCurrentConsoleFontEx(GetStdHandle(STD_OUTPUT_HANDLE), false, &font);

        // Use OEM Code Page
        SetConsoleOutputCP(CP_OEM);
        SetConsoleTitle(name);

        setforeground(White);
        setbackground(Black);
}

DWORD WINAPI consolesizecheckthread(LPVOID lpvoid)
{
        while (true)
        {
                if (!consoleSizeChanged)
                {
                        consoleSizeChanged = assignconsolesize();
                        consoleSizeChangedCheatPrompt = consoleSizeChanged;

                        if (consoleSizeChanged)
                        {
                                if (consoleSize < minimalConsoleSize)
                           {
                                consoleSize = minimalConsoleSize;
                                        setconsolesize(consoleSize);
                                }
                                else if (consoleSize.X < minimalConsoleSize.X)
                                {
                                        consoleSize.X = minimalConsoleSize.X;
                                        setconsolesize(consoleSize);
                                }
                                else if (consoleSize.Y < minimalConsoleSize.Y)
                                {
                                        consoleSize.Y = minimalConsoleSize.Y;
                                        setconsolesize(consoleSize);
                                }
                        }
                }

                Sleep(50);
        }

        return EXIT_FAILURE;
}

#ifndef DISABLE_CHEATS
DWORD WINAPI cheatpromptthread(LPVOID lpvoid)
{
        char *message = NULL;
        int timer, length = 0;
        DWORD attribsWritten, charsWritten;
        COLOR foregroundBackup, backgroundBackup;

        while (true)
        {
                if (showCheatPrompt || consoleSizeChangedCheatPrompt)
                {
                        showCheatPrompt = false;
                        consoleSizeChangedCheatPrompt = false;
                        timer = 0;
```

```
				FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), backgroundColor +
(backgroundColor << 4), length, COORD_ORIGIN, &attribsWritten);
				message = strdup(cheatActivated ? " Cheat activated " : " Cheat deactivated ");
				length = strlen(message);

				// Print message
				foregroundBackup = foregroundColor;
				backgroundBackup = backgroundColor;

				setforeground(Black);
				setbackground(Gray);

				movecursor(COORD_ORIGIN);
				fputs(message, stdout);

				setforeground(foregroundBackup);
				setbackground(backgroundBackup);

				//	char *strdup(const char *src)
				//	{
				//		char *output = (char *)malloc(strlen(src) + 1);
				//
				//		if (output == NULL)
				//		{
				//			return NULL;
				//		}
				//
				//		strcpy(output, src);
				//		return output;
				//	}
				//
				// ^ this is how strdup works
				// So the string returned from strdup is dynamically allocated and should be freed
				// If not it'll be allocated 'till program closes and another apps couldn't use it
				free(message);
			}

			Sleep(200);
			timer += 200;

			if (timer == 2000)
			{
				FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), backgroundColor +
(backgroundColor << 4), length, COORD_ORIGIN, &attribsWritten);
				SuspendThread(cheatpromptthreadHandle);
			}
		}

		return EXIT_FAILURE;
}
#endif

void setconsolesize(COORD size)
{
		SMALL_RECT windowSize = { 0 };

		// Cannot set greater size than (buffer - 1) and buffer size cannot be less than window size
		if (consoleSize.X < size.X || consoleSize.Y < size.Y)
		{
			windowSize.Right = consoleSize.X < size.X ? consoleSize.X : size.X;
			windowSize.Bottom = consoleSize.Y < size.Y ? consoleSize.Y : size.Y;

			SetConsoleWindowInfo(GetStdHandle(STD_OUTPUT_HANDLE), true, &windowSize);
		}

		COORD bufferSize = { size.X + 1, size.Y + BUFFER_ADDITION };
		SetConsoleScreenBufferSize(GetStdHandle(STD_OUTPUT_HANDLE), bufferSize);
		windowSize.Right = size.X;
		windowSize.Bottom = size.Y;
		SetConsoleWindowInfo(GetStdHandle(STD_OUTPUT_HANDLE), true, &windowSize);

		assignconsolesize();
		consoleSizeChanged = true;
}

bool assignconsolesize()
{
		COORD temp;
		CONSOLE_SCREEN_BUFFER_INFO stdOutInfo;

		// Get console sizes and assign consoleSize
    GetConsoleScreenBufferInfo(GetStdHandle(STD_OUTPUT_HANDLE), &stdOutInfo);

    temp.X = stdOutInfo.srWindow.Right - stdOutInfo.srWindow.Left + 1;
		temp.Y = stdOutInfo.srWindow.Bottom - stdOutInfo.srWindow.Top + BUFFER_ADDITION;

		// Do not write in consoleSize if console window size does not really changed
		if (temp.X - 1 != consoleSize.X || temp.Y - BUFFER_ADDITION != consoleSize.Y)
		{
				SetConsoleScreenBufferSize(GetStdHandle(STD_OUTPUT_HANDLE), temp);

				consoleSize.X = temp.X - 1;
				consoleSize.Y = temp.Y - BUFFER_ADDITION;

#ifdef DEBUG
				consoleSizeXPrecision = (int)floor(log10(consoleSize.X)) + 1;
#endif

				return true;
		}

		return false;
}

void forceconsolesize()
{
		assignconsolesize();

		if (consoleSize != forcedConsoleSize)
		{
				setconsolesize(forcedConsoleSize);
		}
}

void copybuffer(const HANDLE *dest, const HANDLE *source)
{
		COORD bufferSize = { consoleSize.X + 1, consoleSize.Y + 1 };
		CHAR_INFO charInfo[bufferSize.Y][bufferSize.X];
		SMALL_RECT region = { 0, 0, consoleSize.X, consoleSize.Y };

		ReadConsoleOutput(*source, charInfo[0], bufferSize, COORD_ORIGIN, &region);
		WriteConsoleOutput(*dest, charInfo[0], bufferSize, COORD_ORIGIN, &region);
}

char getcheat(char key)
{
#ifndef DISABLE_CHEATS
		if (key == -32 || key == 224)
		{
				return key;
		}

		for (int i = 0; i < sizeof(CHEATS) / sizeof(CHEATS[0]); i++)
		{
			// Compare key with first letter on every line
			if (key == CHEATS[i][0] || key == toupper(CHEATS[i][0]))
			{
				// If key equals first letter continue reading keys for cheat
				for (int j = 1; j < strlen(CHEATS[i]); j++)
				{
					key = getch();

					if (key != CHEATS[i][j] && key != toupper(CHEATS[i][j]))
					{
						return key;
					}
				}

				cheats[i] = !cheats[i];

#ifndef DEBUG
				showCheatPrompt = true;
				cheatActivated = cheats[i];

				if (cheatpromptthreadHandle == NULL)
				{
					cheatpromptthreadHandle = CreateThread(NULL, 0, cheatpromptthread, NULL, 0, 
NULL);
				}
				else
				{
					ResumeThread(cheatpromptthreadHandle);
				}
#endif

				return key;
			}
		}
#endif //DISABLE_CHEATS

		return key;
}

#ifdef DEBUG
char printarrow(char arrow)
{
		switch(arrow)
		{
			case Up:	return 'U';
			case Down:		return 'D';
			case Left: return 'L';
			case Right:		return 'R';
			default:	return 'N';
		}
}
#endif

void mainmenu(COLOR titleColor)
{
#ifndef DISABLE_HOTSEAT
		const int SELECTION_MAX = 4;
#else
		const int SELECTION_MAX = 3;
#endif

		const int CENTERING = 10;

		bool renderMain = true, renderSelection = true;
		char key;
		int selection = 0;
		COORD cursorPosition;
```

```
	while (true)
	{
		if (consoleSizeChanged || renderMain)
		{
			cls();

			vcenter(13);

			setforeground(titleColor);
			bigtext(gameName);
			setforeground(White);

#ifdef DEBUG
			putchar('\n');
			hcenter(-20, "DEBUG MODE\n");
			putchar('\n');
#else
			printf("\n\n\n");
#endif

			cursorPosition = hcenter(CENTERING, "Start game\n");
			cursorPosition.X -= 2;

#ifndef DISABLE_HOTSEAT
			hcenter(CENTERING, "Hotseat\n");
#endif

			hcenter(CENTERING, "Controls\n");
			hcenter(CENTERING, "About\n");
			putchar('\n');
			hcenter(CENTERING, "Quit game");

			consoleSizeChanged = false;
			renderMain = false;
			renderSelection = true;
		}

#ifdef DEBUG
		DEBUG_MAIN;
#endif

		if (renderSelection)
		{
			for (int i = (selection == SELECTION_MAX ? -2 : -1); i <= (selection == SELECTION_MAX - 1
? 2 : 1); i++)
			{
				movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection == SE-
LECTION_MAX ? 1 : 0) + i);
				putchar(' ');
			}

			movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection == SELECTION_MAX
? 1 : 0));
			putchar('>');

			renderSelection = false;
		}

		if (kbhit())
		{
			key = getkey(getcheat(getch()));

			if ((key == Enter && selection == SELECTION_MAX) || key == Esc)
			{
				quitdialog(Quit, false, false);
				renderMain = true;
			}
			else if (key == Enter)
```

```
            {
                if (selection == 0)
                {
                    difficultyselection(false);
                }
#ifndef DISABLE_HOTSEAT
                else if (selection == 1)
                {
                    difficultyselection(true);
                }
#endif

                else if (selection == SELECTION_MAX - 2)
                {
                    controls();
                }
                else //if (selection == SELECTION_MAX - 1)
                {
                    about();
                }

                renderMain = true;
            }
            else if (key == Up && selection != 0)
            {
                selection--;
                renderSelection = true;
            }
            else if (key == Down && selection != SELECTION_MAX)
            {
                selection++;
                renderSelection = true;
            }
        }

        Sleep(MENU_SLEEP);
    }
}

bool difficultyselection(bool hotseat)
{
#ifdef DISABLE_DIFFICULTY
    game(NoDifficulty, hotseat);
#else

#ifndef DISABLE_CUSTOMDIFFICULTY
    const int SELECTION_MAX = 4;
#else
    const int SELECTION_MAX = 3;
#endif

    const int CENTERING = 6;

    bool renderMain = true, renderSelection = true;
    char key;
    int selection = 1;
    COORD cursorPosition;

    while (true)
    {
        if (consoleSizeChanged || renderMain)
        {
            cls();

            vcenter(7);
            hcenter("CHOOSE DIFFICULTY");
            fputs("\n\n", stdout);
				cursorPosition = hcenter(CENTERING, "Easy\n");
				cursorPosition.X -= 2;

				hcenter(CENTERING, "Medium\n");
				hcenter(CENTERING, "Hard\n");
				putchar('\n');

#ifndef DISABLE_CUSTOMDIFFICULTY
				hcenter(CENTERING, "Custom\n");
#endif

				hcenter(CENTERING, "Back");

				consoleSizeChanged = false;
				renderMain = false;
				renderSelection = true;
			}

#ifdef DEBUG
			DEBUG_MAIN;
#endif

			if (renderSelection)
			{
				for (int i = (selection == 3 ? -2 : -1); i <= (selection == 2 ? 2 : 1); i++)
				{
					movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection >= 3 ? 1 : 0) +
i);
					putchar(' ');
				}

				movecursor(cursorPosition.X, cursorPosition.Y + selection + (selection >= 3 ? 1 : 0));
				putchar('>');

				renderSelection = false;
			}

			if (kbhit())
			{
				key = getkey(getcheat(getch()));

				if ((key == Enter && selection == SELECTION_MAX) || key == Esc)
				{
					return false;
				}
				else if (key == Enter)
				{
					if (game((DIFFICULTY)selection, hotseat))
					{
						return true;
					}

					renderMain = true;
				}
				else if (key == Up && selection != 0)
				{
					selection--;
					renderSelection = true;
				}
				else if (key == Down && selection != SELECTION_MAX)
				{
					selection++;
					renderSelection = true;
				}
			}

			Sleep(MENU_SLEEP);
		}
```

```
#endif
}

void wheelselection(COORD position, int selected, int min, int max, int step)
{
	int temp;
	COLOR foregroundBackup = foregroundColor;

	movecursor(position);
	hcenter(19);

	for (int i = -2; i <= 2; i++)
	{
		setforeground(i == 0 ? White : (i == -1 || i == 1 ? Gray : DarkGray));

		temp = selected + (i * step);
		printf("%3d ", (temp >= min && temp <= max ? temp : (temp < min ? max - (min - temp) + step : min +
(temp - max) - step)));
	}

	setforeground(foregroundBackup);
}

void about()
{
	const int CENTERING = 24;

	bool renderMain = true, renderSelection = true;
	bool printGameBranch = gameBranch != NULL && strcmp(gameBranch, "");
	char key;
	int selection = 2;
	COORD cursorPosition;

	while (true)
	{
		if (consoleSizeChanged || renderMain)
		{
			cls();

#ifndef DISABLE_CHANGELOG
			vcenter(10 + (printGameBranch ? 1 : 0));
#else
			vcenter(7 + (printGameBranch ? 1 : 0));
#endif

			hcenter("ABOUT");
			fputs("\n\n", stdout);

			hcenter(CENTERING, "%s %s\n", gameName, gameVersion);

#ifndef DEBUG
			if (printGameBranch)
			{
#endif
				hcenter(CENTERING, "Current branch: %s", gameBranch);
#ifndef DEBUG
			}
#endif

#ifdef DEBUG
			printf("%s(DEBUG)", (printGameBranch ? " " : ""));
#endif

			putchar('\n');
			hcenter(CENTERING, "Using unigfcs.h v1.4\n");
			hcenter(CENTERING, "Using Project Superior CFC v1.0 beta 1\n");
			hcenter(CENTERING, "Current console size: %dx%d\n\n", consoleSize.X + 1, consoleSize.Y +
1);
```

```
			SetConsoleOutputCP(1250);
			hcenter(CENTERING, "(c) 2016 Marian Dolinský\n\n");
			SetConsoleOutputCP(CP_OEM);

#ifndef DISABLE_CHANGELOG
			cursorPosition = hcenter(9, "Changelog\n");
			cursorPosition.X -= 2;

			hcenter(9, "Changelog (unigfcs.h)\n");
			hcenter(9, "Back");
#else
			hcenter("> Back");
#endif

			consoleSizeChanged = false;
			renderMain = false;
			renderSelection = true;
		}

#ifdef DEBUG
		DEBUG_MAIN;
#endif

#ifndef DISABLE_CHANGELOG
		if (renderSelection)
		{
			for (int i = -1; i <= 1; i += 2)
			{
				movecursor(cursorPosition.X, cursorPosition.Y + selection + i);
				putchar(' ');
			}

			movecursor(cursorPosition.X, cursorPosition.Y + selection);
			putchar('>');

			renderSelection = false;
		}

		if (kbhit())
		{
			key = getkey(getcheat(getch()));

			if ((key == Enter && selection == 2) || key == Esc)
			{
				return;
			}
			else if (key == Enter)
			{
				if (selection == 0)
				{
					changelog(CHANGELOG_GAME, sizeof(CHANGELOG_GAME));
				}
				else //if (selection == 1)
				{
					changelog(CHANGELOG_UNIGFCS, sizeof(CHANGELOG_UNIGFCS));
				}

				selection = 2;
				renderMain = true;
			}
			else if (key == Up && selection != 0)
			{
				selection--;
				renderSelection = true;
			}
			else if (key == Down && selection != 2)
			{
				selection++;
				renderSelection = true;
			}
		}

		Sleep(MENU_SLEEP);
#else
		if (kbhit())
		{
			key = getch();

			if (key == Enter || key == Esc)
			{
				return;
			}
		}

		Sleep(MENU_SLEEP);
#endif
	}
}

#ifndef DISABLE_CHANGELOG
void changelog(const char CHANGELOG[][CHANGELOG_COLUMNS], int size)
{
	const int CENTERING = 37;
	const int ROWS_MAX = 15;

	bool renderMain = true, renderChangelog = true;
	char key;
	int row = 0;
	COORD changelogPosition;

	while (true)
	{
		if (consoleSizeChanged || renderMain)
		{
			cls();

			vcenter(ROWS_MAX + 4);
			hcenter(CHANGELOG == CHANGELOG_GAME ? "CHANGELOG" : "CHANGELOG
(UNIGFCS.H)");
			fputs("\n\n", stdout);

			changelogPosition = getcursorposition();

			movecursor(0, changelogPosition.Y + ROWS_MAX + 1);
			hcenter("> Back  ");

			consoleSizeChanged = false;
			renderMain = false;
			renderChangelog = true;
		}

		if (renderChangelog)
		{
			movecursor(changelogPosition);

			for (int i = 0; i < ROWS_MAX; i++)
			{
				hcenter(CENTERING, "%s%-*s \n", (CHANGELOG[row + i][0] == '-' ? "  " : ""),
CHANGELOG_COLUMNS, CHANGELOG[row + i]);
			}

			renderChangelog = false;
		}

#ifdef DEBUG
		movecursor(COORD_ORIGIN);
```

```
			printf("row: %2d | ", row);
			printf("size: %d | ", size);
			DEBUG_KEY(key);
			DEBUG_CHEATS;
#endif

			if (kbhit())
			{
				key = getkey(getcheat(getch()));

				if (key == Enter | | key == Esc)
				{
					return;
				}
				else if (key == Up && row != 0)
				{
					row--;
					renderChangelog = true;
				}
				else if (key == Down && row != (size / CHANGELOG_COLUMNS) - ROWS_MAX)
				{
					row++;
					renderChangelog = true;
				}
			}

			Sleep(MENU_SLEEP);
		}
}
#endif

bool pausemenu(bool hotseat)
{
		const int CENTERING = 8;

		bool renderMain = true, renderSelection = true;
		char key;
		int selection = 0;
		COORD cursorPosition;
		HANDLE gameBoardBuffer = CreateConsoleScreenBuffer(GENERIC_READ | GENERIC_WRITE, 0, NULL,
CONSOLE_TEXTMODE_BUFFER, NULL);
		HANDLE stdOut = GetStdHandle(STD_OUTPUT_HANDLE);

		copybuffer(&gameBoardBuffer, &stdOut);

		while (true)
		{
			if (consoleSizeChanged | | renderMain)
			{
				cls();

				vcenter(7);
				hcenter("PAUSE MENU");
				fputs("\n\n", stdout);

				cursorPosition = hcenter(CENTERING, "Resume\n");
				cursorPosition.X -= 2;

				hcenter(CENTERING, "Restart\n");
				hcenter(CENTERING, "Controls\n");
				hcenter(CENTERING, "Go to main menu\n");
				hcenter(CENTERING, "Quit game");

				consoleSizeChanged = false;
				renderMain = false;
				renderSelection = true;
			}
```

```
#ifdef DEBUG
                DEBUG_MAIN;
#endif

                if (renderSelection)
                {
                        for (int i = -1; i <= 1; i += 2)
                        {
                                movecursor(cursorPosition.X, cursorPosition.Y + selection + i);
                                putchar(' ');
                        }

                        movecursor(cursorPosition.X, cursorPosition.Y + selection);
                        putchar('>');

                        renderSelection = false;
                }

                if (kbhit())
                {
                        key = getkey(getcheat(getch()));

                        if ((key == Enter && selection == 0) | | key == Esc)
                        {
                                forceconsolesize();
                                copybuffer(&stdOut, &gameBoardBuffer);

                                return false;
                        }
                        else if (key == Enter)
                        {
                                if (selection == 2)
                                {
                                        controls();
                                }
                                else
                                {
                                        if (quitdialog(selection == 1 ? Restart : (selection == 3 ? Menu : Quit), true,
hotseat))
                                        {
                                                return true;
                                        }
                                }

                                renderMain = true;
                        }
                        else if (key == Up && selection != 0)
                        {
                                selection--;
                                renderSelection = true;
                        }
                        else if (key == Down && selection != 4)
                        {
                                selection++;
                                renderSelection = true;
                        }
                }

                Sleep(MENU_SLEEP);
        }
}

bool quitdialog(QUITACTION action, bool playing, bool hotseat)
{
        bool renderMain = true, renderSelection = true;
        char key;
        int selection = 1;
        COORD cursorPosition;
```

```
	while (true)
	{
		if (consoleSizeChanged || renderMain)
		{
			cls();

			vcenter(playing ? 4 : 3);
			hcenter(action == Restart ? "Are you sure you want to restart the game?" : (action == Menu ?
"Are you sure you want to go to main menu?" : "Are you sure you want to quit the game?"));

			if (playing)
			{
				putchar('\n');
				hcenter("Your game progress will be lost!");
			}

			fputs("\n\n", stdout);

			cursorPosition = hcenter(18, "Yes");
			cursorPosition.X += 14;

			movecursor(cursorPosition.X + 2, cursorPosition.Y);
			fputs("No", stdout);

			consoleSizeChanged = false;
			renderMain = false;
			renderSelection = true;
		}

#ifdef DEBUG
		DEBUG_MAIN;
#endif

		if (renderSelection)
		{
			movecursor(cursorPosition.X - (selection == 1 ? 16 : 0), cursorPosition.Y);
			putchar(' ');

			movecursor(cursorPosition.X - (selection == 0 ? 16 : 0), cursorPosition.Y);
			putchar('>');

			renderSelection = false;
		}

		if (kbhit())
		{
			key = getkey(getcheat(getch()));

			if ((key == Enter && selection == 1) || key == Esc)
			{
				return false;
			}
			else if (key == Enter)
			{
				if (action == Restart)
				{
					return difficultyselection(hotseat);
				}
				else if (action == Menu)
				{
					return true;
				}
				else //if (action == Quit)
				{
					cls();
					exit(EXIT_SUCCESS);
				}
```

```
                renderMain = true;
            }
            else if (key == Left && selection != 0)
            {
                selection--;
                renderSelection = true;
            }
            else if (key == Right && selection != 1)
            {
                selection++;
                renderSelection = true;
            }
        }

        Sleep(MENU_SLEEP);
    }
}

void showscore(bool won, int score, DIFFICULTY difficulty, const char *gameMode)
{
    const int CENTERING = 7;

    bool renderMain = true, renderSelection = true;
    char key;
    int selection = 1;
    COORD cursorPosition;

    while (true)
    {
        if (consoleSizeChanged || renderMain)
        {
            cls();
            vcenter(14);

            if (won)
            {
                setforeground(Green);
                bigtext("YOU WON");
            }
            else
            {
                setforeground(Red);
                bigtext("GAME OVER");
            }

            setforeground(White);
            printf("\n\n\n");

            hcenter(14, "Your score: %d\n\n", score);
            hcenter(18, "Difficulty: %s\n", difficulty == Easy ? "Easy" : (difficulty == Medium ? "Medium"
: (difficulty == Hard ? "Hard" : "Custom")));
            hcenter(18, "Game mode: %s\n\n", gameMode);

            cursorPosition = hcenter(CENTERING, "Restart\n");
            cursorPosition.X -= 2;

            hcenter(CENTERING, "Back");

            consoleSizeChanged = false;
            renderMain = false;
            renderSelection = true;
        }

#ifdef DEBUG
        DEBUG_MAIN;
#endif
```

```
		if (renderSelection)
		{
			movecursor(cursorPosition.X, cursorPosition.Y + (selection == 0 ? 1 : 0));
			putchar(' ');

			movecursor(cursorPosition.X, cursorPosition.Y + selection);
			putchar('>');

			renderSelection = false;
		}

		if (kbhit())
		{
			key = getkey(getcheat(getch()));

			if ((key == Enter && selection == 1) || key == Esc)
			{
				return;
			}
			else if (key == Enter)
			{
				difficultyselection(false);
				return;
			}
			else if (key == Up && selection != 0)
			{
				selection--;
				renderSelection = true;
			}
			else if (key == Down && selection != 1)
			{
				selection++;
				renderSelection = true;
			}
		}

		Sleep(MENU_SLEEP);
	}
}

void showscore(bool won[2], int score[2], DIFFICULTY difficulty, const char *gameMode)
{
	const int CENTERING = 7;

	bool renderMain = true, renderSelection = true;
	char key;
	int selection = 1;
	COORD cursorPosition;

	while (true)
	{
		if (consoleSizeChanged || renderMain)
		{
			cls();
			vcenter(15);

			if (won[0] || won[1])
			{
				setforeground(Green);
				bigtext("YOU WON");
			}
			else
			{
				setforeground(Red);
				bigtext("GAME OVER");
			}

			setforeground(White);
```

```
					printf("\n\n\n");

					hcenter(27, won[0] ? "Player 1 won with score %d\n" : "Player 1 died with score %d\n", sco-
re[0]);
					hcenter(27, won[1] ? "Player 2 won with score %d\n" : "Player 2 died with score %d\n\n",
score[1]);
					hcenter(18, "Difficulty: %s\n", difficulty == Easy ? "Easy" : (difficulty == Medium ? "Medium"
: (difficulty == Hard ? "Hard" : "Custom")));
					hcenter(18, "Game mode: %s\n\n", gameMode);

					cursorPosition = hcenter(CENTERING, "Restart\n");
					cursorPosition.X -= 2;

					hcenter(CENTERING, "Back");

					consoleSizeChanged = false;
					renderMain = false;
					renderSelection = true;
				}

#ifdef DEBUG
				DEBUG_MAIN;
#endif

				if (renderSelection)
				{
					movecursor(cursorPosition.X, cursorPosition.Y + (selection == 0 ? 1 : 0));
					putchar(' ');

					movecursor(cursorPosition.X, cursorPosition.Y + selection);
					putchar('>');

					renderSelection = false;
				}

				if (kbhit())
				{
					key = getkey(getcheat(getch()));

					if ((key == Enter && selection == 1) | | key == Esc)
					{
						return;
					}
					else if (key == Enter)
					{
						difficultyselection(true);
						return;
					}
					else if (key == Up && selection != 0)
					{
						selection--;
						renderSelection = true;
					}
					else if (key == Down && selection != 1)
					{
						selection++;
						renderSelection = true;
					}
				}

				Sleep(MENU_SLEEP);
		}
}

void timer(bool isColored)
{
		const int SLEEP = 1100;
		cls();
```

```
        if (isColored)
        {
                setforeground(Red);
        }

        vcenter(5);
        bigtext("3");
        Sleep(SLEEP);
        cls();

        if (isColored)
        {
                setforeground(Yellow);
        }

        vcenter(5);
        bigtext("2");
        Sleep(SLEEP);
        cls();

        if (isColored)
        {
                setforeground(Green);
        }

        vcenter(5);
        bigtext("1");
        Sleep(SLEEP);
        cls();

        vcenter(5);
        bigtext("GO!");
        Sleep(SLEEP);

        setforeground(White);
}

void bigtext(const char *text)
{
        // centering is assigned to 4 because of four spaces on left and on right side
        // strlen(text) - 1 = count of spaces between each letters
        // int centering = 4 + strlen(text) - 1;
        int centering = 3 + strlen(text);
        char str[strlen(text)];

        strcpy(str, text);

        // Rewrite str as uppercase and set centering
        for (int i = 0; i < strlen(str); i++)
        {
                str[i] = toupper(str[i]);

                if (str[i] == 'M' || str[i] == 'N' || str[i] == 'Q' || str[i] == 'T' || str[i] == 'W' || str[i] == 'X' || str[i] ==
'Y')
                {
                        centering += 8;
                }
                else if (str[i] == 'V' || str[i] == '0' || (str[i] >= '2' && str[i] <= '9'))
                {
                        centering += 6;
                }
                else if (str[i] == '1')
                {
                        centering += 4;
                }
                else if (str[i] == 'I' || str[i] == ' ')
                {
```

```
                centering += 2;
        }
        else if (str[i] == '!')
        {
                centering++;
        }
        else
        {
                centering += 7;
        }
}

for (int i = 0; i < 5; i++)
{
        hcenter(centering);

        for (int j = 4; j > i; j--)
        {
                putchar(' ');
        }

        for (int j = 0; j < strlen(str); j++)
        {
                switch(str[j])
                {
                        case ' ':
                                fputs("  ", stdout);
                                break;

                        case 'A':
                                if (i == 0 || i == 2)
                                {
                                        fputs("///////", stdout);
                                }
                                else
                                {
                                        fputs("//   //", stdout);
                                }

                                break;

                        case 'B':
                                if (i == 1 || i == 3)
                                {
                                        fputs("//   //", stdout);
                                }
                                else
                                {
                                        fputs("////// ", stdout);
                                }

                                break;

                        case 'C':
                                if (i == 0 || i == 4)
                                {
                                        fputs("///////", stdout);
                                }
                                else
                                {
                                        fputs("//     ", stdout);
                                }

                                break;

                        case 'D':
                                if (i == 0 || i == 4)
                                {
```

```
                        fputs("////// ", stdout);
                }
                else
                {
                        fputs("//   //", stdout);
                }

                break;

        case 'E':
                if (i == 0 | | i == 4)
                {
                        fputs("///////", stdout);
                }
                else if (i == 2)
                {
                        fputs("/////  ", stdout);
                }
                else
                {
                        fputs("//     ", stdout);
                }

                break;

        case 'F':
                if (i == 0)
                {
                        fputs("///////", stdout);
                }
                else if (i == 2)
                {
                        fputs("/////  ", stdout);
                }
                else
                {
                        fputs("//     ", stdout);
                }

                break;

        case 'G':
                if (i == 1)
                {
                        fputs("//     ", stdout);
                }
                else if (i == 2)
                {
                        fputs("// ////", stdout);
                }
                else if (i == 3)
                {
                        fputs("//   //", stdout);
                }
                else
                {
                        fputs("///////", stdout);
                }

                break;

        case 'H':
                if (i != 2)
                {
                        fputs("//   //", stdout);
                }
                else
                {
```

```
                fputs("///////", stdout);
        }

        break;

case 'I':
        fputs("//", stdout);
        break;

case 'J':
        if (i < 3)
        {
                fputs("     //", stdout);
        }
        else if (i == 3)
        {
                fputs("//   //", stdout);
        }
        else
        {
                fputs("///////", stdout);
        }

        break;

case 'K':
        if (i == 0 || i == 4)
        {
                fputs("//   //", stdout);
        }
        else if (i == 2)
        {
                fputs("///    ", stdout);
        }
        else
        {
                fputs("// //  ", stdout);
        }

        break;

case 'L':
        if (i < 4)
        {
                fputs("//     ", stdout);
        }
        else
        {
                fputs("///////", stdout);
        }

        break;

case 'M':
        if (i == 1)
        {
                fputs("///  ///", stdout);
        }
        else if (i == 2)
        {
                fputs("// // //", stdout);
        }
        else
        {
                fputs("//    //", stdout);
        }

        break;
```

```
case 'N':
        if (i == 1)
        {
                fputs("///   //", stdout);
        }
        else if (i == 2)
        {
                fputs("// // //", stdout);
        }
        else if (i == 3)
        {
                fputs("//   ///", stdout);
        }
        else
        {
                fputs("//    //", stdout);
        }

        break;

case 'O':
        if (i == 0 | | i == 4)
        {
                fputs("///////", stdout);
        }
        else
        {
                fputs("//   //", stdout);
        }

        break;

case 'P':
        if (i == 0 | | i == 2)
        {
                fputs("///////", stdout);
        }
        else if (i == 1)
        {
                fputs("//   //", stdout);
        }
        else
        {
                fputs("//     ", stdout);
        }

        break;

case 'Q':
        if (i == 0)
        {
                fputs("/////// ", stdout);
        }
        else if (i == 3)
        {
                fputs("//  /// ", stdout);
        }
        else if (i == 4)
        {
                fputs("////////", stdout);
        }
        else
        {
                fputs("//   // ", stdout);
        }

        break;
```

```
case 'R':
        if (i == 0)
        {
                fputs("///////", stdout);
        }
        else if (i == 2)
        {
                fputs("////// ", stdout);
        }
        else
        {
                fputs("//   //", stdout);
        }

        break;

case 'S':
        if (i == 1)
        {
                fputs("//     ", stdout);
        }
        else if (i == 3)
        {
                fputs("     //", stdout);
        }
        else
        {
                fputs("///////", stdout);
        }

        break;

case 'T':
        if (i != 0)
        {
                fputs("   //   ", stdout);
        }
        else
        {
                fputs("////////", stdout);
        }

        break;

case 'U':
        if (i != 4)
        {
                fputs("//   //", stdout);
        }
        else
        {
                fputs("///////", stdout);
        }

        break;

case 'V':
        if (i != 4)
        {
                fputs("//  //", stdout);
        }
        else
        {
                fputs("  //  ", stdout);
        }

        break;
```

```
case 'W':
        if (i == 0)
        {
                fputs("//    //", stdout);
        }
        else if (i == 4)
        {
                fputs(" //  // ", stdout);
        }
        else
        {
                fputs("// // //", stdout);
        }

        break;

case 'X':
        if (i == 0 || i == 4)
        {
                fputs("//    //", stdout);
        }
        else if (i == 2)
        {
                fputs("   //   ", stdout);
        }
        else
        {
                fputs(" //  // ", stdout);
        }

        break;

case 'Y':
        if (i == 0)
        {
                fputs("//    //", stdout);
        }
        else if (i == 1)
        {
                fputs(" //  // ", stdout);
        }
        else
        {
                fputs("   //   ", stdout);
        }

        break;

case 'Z':
        if (i == 1)
        {
                fputs("      //", stdout);
        }
        else if (i == 2)
        {
                fputs("  ///   ", stdout);
        }
        else if (i == 3)
        {
                fputs("//      ", stdout);
        }
        else
        {
                fputs("////////", stdout);
        }

        break;
```

```
case '1':
        if (i == 0)
        {
                fputs("////", stdout);
        }
        else
        {
                fputs("  //", stdout);
        }

        break;

case '2':
        if (i == 0 | | i == 4)
        {
                fputs("//////", stdout);
        }
        else if (i == 1)
        {
                fputs("    //", stdout);
        }
        else if (i == 2)
        {
                fputs("  //  ", stdout);
        }
        else
        {
                fputs("//    ", stdout);
        }

        break;

case '3':
        if (i == 0 | | i == 4)
        {
                fputs("//////", stdout);
        }
        else if (i == 2)
        {
                fputs(" /////", stdout);
        }
        else
        {
                fputs("    //", stdout);
        }

        break;

case '4':
        if (i == 0 | | i == 1)
        {
                fputs("//  //", stdout);
        }
        else if (i == 2)
        {
                fputs("//////", stdout);
        }
        else
        {
                fputs("    //", stdout);
        }

        break;

case '5':
        if (i == 3)
        {
                fputs("    //", stdout);
        }
        else if (i == 1)
        {
                fputs("//    ", stdout);
        }
        else
        {
                fputs("//////", stdout);
        }

        break;

case '6':
        if (i == 3)
        {
                fputs("//  //", stdout);
        }
        else if (i == 1)
        {
                fputs("//    ", stdout);
        }
        else
        {
                fputs("//////", stdout);
        }

        break;

case '7':
        if (i == 0)
        {
                fputs("//////", stdout);
        }
        else if (i == 1)
        {
                fputs("    //", stdout);
        }
        else if (i == 2)
        {
                fputs("   // ", stdout);
        }
        else if (i == 3)
        {
                fputs("  //  ", stdout);
        }
        else
        {
                fputs(" //   ", stdout);
        }

        break;

case '8':
        if (i % 2 == 0)
        {
                fputs("//////", stdout);
        }
        else
        {
                fputs("//  //", stdout);
        }

        break;

case '9':
        if (i % 2 == 0)
        {
```

```
                        fputs("//////", stdout);
                    }
                    else if (i == 1)
                    {
                        fputs("//  //", stdout);
                    }
                    else
                    {
                        fputs("    //", stdout);
                    }

                    break;

                case '0':
                    if (i == 0 || i == 4)
                    {
                        fputs("//////", stdout);
                    }
                    else
                    {
                        fputs("//  //", stdout);
                    }

                    break;

                case '!':
                    if (i == 3)
                    {
                        fputs("  ", stdout);
                    }
                    else
                    {
                        fputs("//", stdout);
                    }

                    break;

                default:
                    fputs("!ERROR!", stdout);
                    break;
            }

            if (j < strlen(str) - 1)
            {
                putchar(' ');
            }
        }

        putchar('\n');
    }
}

#endif
```

3.3 superior.hpp

```
/*
    Name: superior.hpp (Project Superior Core for C) v1.0 beta 1
    Copyright: (c) 2016 Marian Dolinský
    Author: Marian Dolinský
    Date: 29/05/16 23:44
    Description: Lots of usefull functions, enumerations and structures for creating simple UI in Windows console.

    TODO:
        more rows in button, textblock, textbox text, in centers
        listbox
        combobox
        textbox
```

```
                        fontwriter - 3d array for fonts
                        popups, notifications
*/

#ifndef SUPERIOR_HPP
#define SUPERIOR_HPP

#include <stdio.h>
#include <stdarg.h>
#include <windows.h>
#include <conio.h>

typedef enum
{
            Backspace           = 8,
            Enter               = 13,
            Esc                             = 27,
            Space               = 32,
            Up                              = 72, // *
            Left                = 75, // **
            Right               = 77, // *** sending -32 || (unsigned)224 before these values
            Down                = 80, // **
            Delete              = 127 // *
} KEY;

typedef enum
{
            SingleLine,
            DoubleLine,
            Block,
            None
} LINETYPE;

typedef enum
{
            Horizontal,
            Vertical,
            Edge_Top_Left,
            Edge_Top_Right,
            Edge_Bottom_Left,
            Edge_Bottom_Right,
            T_Horizontal_Up,
            T_Horizontal_Down,
            T_Vertical_Left,
            T_Vertical_Right,
            Cross
} LINESHAPE;

typedef enum
{
            HLeft,
            HCenter,
            HRight
} HORIZONTALALIGNMENT;

typedef enum
{
            VTop,
            VCenter,
            VBottom
} VERTICALALIGNMENT;

typedef enum
{
            Visible,
            Collapsed
} VISIBILITY;
```

```
typedef enum
{
   Black,
   DarkBlue,
   DarkGreen,
   DarkCyan,
   DarkRed,
   DarkMagenta,
   DarkYellow,
   Gray,
   DarkGray,
   Blue,
   Green,
   Cyan,
   Red,
   Magenta,
   Yellow,
   White
} COLOR;

typedef struct
{
		char Char;
		COLOR Color;
} VISUAL;

typedef struct
{
		LINETYPE BorderType;
		VISIBILITY Visibility;

		bool BackgroundUnderBorder;
		COLOR BorderColor;
		COLOR Background;

		int Width;
		int Height;

		HORIZONTALALIGNMENT HorizontalAlignment;
		VERTICALALIGNMENT VerticalAlignment;
		COORD Margin;
} BORDER;

typedef struct
{
		char *Text;

		VISIBILITY Visibility;

		COLOR Foreground;
		COLOR Background;

		int Width;
		int Height;

		HORIZONTALALIGNMENT HorizontalAlignment;
		VERTICALALIGNMENT VerticalAlignment;
		COORD Margin;
} TEXTBLOCK;

typedef struct
{
		char *Text;
		HORIZONTALALIGNMENT HorizontalTextAlignment;
		VERTICALALIGNMENT VerticalTextAlignment;

		bool BackgroundUnderBorder;
		bool IsEnabled;
```

```
        bool IsFocused;

        LINETYPE BorderType;
        VISIBILITY Visibility;

        COLOR Foreground;
        COLOR UnfocusedForeground;
        COLOR DisabledForeground;

        COLOR Background;
        COLOR UnfocusedBackground;
        COLOR DisabledBackground;

        COLOR BorderColor;
        COLOR UnfocusedBorderColor;
        COLOR DisabledBorderColor;

        int Width;
        int Height;

        HORIZONTALALIGNMENT HorizontalAlignment;
        VERTICALALIGNMENT VerticalAlignment;
        COORD Margin;
} BUTTON;

/* advio.hpp */
void cls();
char getkey(char key);
char getkey();
char *createline(char start, char middle, char end, int countOfMiddle);
char *createline(char ch, int count);
void drawline(char ch, int count);
COORD hcenter(int left, int right, int width);
COORD hcenter(int left, int right, int width, const char *format, ...);
COORD hcenter(int left, int right, const char *format, ...);
COORD hcenter(int width);
COORD hcenter(int width, const char *format, ...);
COORD hcenter(const char *format, ...);
COORD vcenter(int top, int bottom, int height);
COORD vcenter(int height);
COORD center(int left, int right, int width, int top, int bottom, int height);
COORD center(int left, int right, int width, int top, int bottom, int height, const char *format, ...);
COORD center(int left, int right, int top, int bottom, const char *format, ...);
COORD center(int width, int height);
COORD center(int width, int height, const char *format, ...);
COORD center(const char *format, ...);
COORD vhcenter(int left, int right, const char *format, va_list args);

/* border.hpp */
BORDER newBORDER();
void draw(const BORDER &b);
void erase(const BORDER &b);

/* button.hpp */
BUTTON newBUTTON();
void draw(const BUTTON &b);
void erase(const BUTTON &b);

/* cnslsz.hpp */
COORD getconsolesize();

/* cursor.hpp */
void setcursor(bool isVisible, int size);
void setcursor(bool isVisible);
COORD getcursorposition();
void movecursor(COORD position);
void movecursor(int x, int y);
```

```
/* operators.hpp */
bool operator ==(COORD c1, COORD c2);
bool operator !=(COORD c1, COORD c2);
bool operator <(COORD c1, COORD c2);
bool operator >(COORD c1, COORD c2);
bool operator <=(COORD c1, COORD c2);
bool operator >=(COORD c1, COORD c2);
bool operator ==(SMALL_RECT r1, SMALL_RECT r2);
bool operator !=(SMALL_RECT r1, SMALL_RECT r2);

/* strext.hpp */
char *stradd(char *str, char ch, int index);
char *strrem(char *str, int index);
char *strndup(const char *source, int count);
char *strcat(char *dest, int sourcesCount, const char *source, ...);

/* textblock.hpp */
TEXTBLOCK newTEXTBLOCK();
void draw(const TEXTBLOCK &t);
void erase(const TEXTBLOCK &t);

/* uibscs.hpp */
char line(LINETYPE type, LINESHAPE shape);
COLOR getforeground();
COLOR getbackground();
void fillforeground(COLOR foreground, COORD startPosition, int count);
void fillforeground(COLOR foreground, int startPositionX, int startPositionY, int count);
void fillbackground(COLOR background, COORD startPosition, int count);
void fillbackground(COLOR background, int startPositionX, int startPositionY, int count);
void setforeground(COLOR foreground);
void setbackground(COLOR background);
void draw(const VISUAL &v);
SMALL_RECT measure(int left, int right, int width, int top, int bottom, int height, COORD margin, HORIZONTALALIG-
NMENT horizontalAlignment, VERTICALALIGNMENT verticalAlignment);
SMALL_RECT measure(int width, int height, COORD margin, HORIZONTALALIGNMENT horizontalAlignment, VER-
TICALALIGNMENT verticalAlignment);

// Returned from measure functions when arguments are out of enums ranges
const SMALL_RECT RECT_ERROR = { -1, -1, -1, -1 };
// Returned from line function when arguments are out of íenums ranges
const char LINE_ERROR = 'X';

const COORD COORD_ORIGIN = { 0, 0 };

/* Drawing chars */
const char DOT_SMALL       = 250;
const char DOT_BIG                 = 249;

const char BLOCK_HALF_TOP                = 223;
const char BLOCK_HALF_BOTTOM     = 220;
const char BLOCK_HALF_LEFT               = 221;
const char BLOCK_HALF_RIGHT              = 222;
const char BLOCK_HALF_CENTER     = 254;

const char BLOCK_PERFORATED_MUCH        = 176;
const char BLOCK_PERFORATED_NORMAL      = 177;
const char BLOCK_PERFORATED_FEW                 = 178;
const char BLOCK_NORMAL                                 = 219;

/* Defaults for UI elements */
const int DCURSOR_SIZE = 20;

const COLOR DCOLOR_FORE_FOCUSED                 = White;
const COLOR DCOLOR_FORE_UNFOCUSED      = Gray;
const COLOR DCOLOR_FORE_DISABLED       = DarkGray;

const bool DBACKGROUND_UNDER_BORDER  = true;
const COLOR DCOLOR_BACK_FOCUSED                 = Black;
const COLOR DCOLOR_BACK_UNFOCUSED     = Black;
const COLOR DCOLOR_BACK_DISABLED       = Black;

const int DWIDTH  = 10;
const int DHEIGHT = 3;

const LINETYPE DBORDER_TYPE = SingleLine;

#include "advio.hpp"
#include "border.hpp"
#include "button.hpp"
#include "cnslsz.hpp"
#include "cursor.hpp"
#include "operators.hpp"
#include "strext.hpp"
#include "textblock.hpp"
#include "textbox.hpp"
#include "uibscs.hpp"

#endif
```

3.4 advio.hpp

```
/*
	Name: advio.hpp (Advanced I/O) v1.0
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 29/05/16 23:28
	Description: Advanced I/O functions for Windows console.
*/

#ifndef ADVIO_HPP
#define ADVIO_HPP

#include "superior.hpp"

void cls()
{
	DWORD attribsWritten;
	COORD consoleSize = getconsolesize();

	FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), getbackground() + (getbackground() <<
4), consoleSize.X * consoleSize.Y, COORD_ORIGIN, &attribsWritten);
	system("cls");
}

char getkey(char key)
{
	if (key == -32 || key == 224)
	{
		return getch();
	}

	return key;
}

char getkey()
{
	return getkey(getch());
}

char *createline(char start, char middle, char end, int countOfMiddle)
{
	if (countOfMiddle < 0)
	{
		return NULL;
	}
```

```
        char *output = (char *)malloc(countOfMiddle + 3);

        if (output == NULL)
        {
                return NULL;
        }

        output = ((char *)memset(output + 1, middle, countOfMiddle)) - 1;

        *output = start;
        *(output + countOfMiddle + 1) = end;
        *(output + countOfMiddle + 2) = 0;

        return output;
}

char *createline(char ch, int count)
{
        if (count < 0)
        {
                return NULL;
        }

        char *output = (char *)malloc(count + 1);

        if (output == NULL)
        {
                return NULL;
        }

        output = (char *)memset(output, ch, count);
        *(output + count) = 0;

        return output;
}

void drawline(char ch, int count)
{
        if (count <= 0)
        {
                return;
        }

        while(count-- > 0)
        {
                putchar(ch);
        }
}

COORD hcenter(int left, int right, int width)
{
        COORD position = getcursorposition();
        position.X = (right - left - width) / 2 + left;

        movecursor(position);
        return position;
}

COORD hcenter(int left, int right, int width, const char *format, ...)
{
        va_list ap;
        va_start(ap, format);

        COORD position = hcenter(left, right, width);
        vprintf(format, ap);

        va_end(ap);
```

```
	return position;
}

COORD hcenter(int left, int right, const char *format, ...)
{
	va_list ap;
	va_start(ap, format);

	COORD position = vhcenter(left, right, format, ap);

	va_end(ap);
	return position;
}

COORD hcenter(int width)
{
	return hcenter(0, getconsolesize().X, width);
}

COORD hcenter(int width, const char *format, ...)
{
	va_list ap;
	va_start(ap, format);

	COORD position = hcenter(width);
	vprintf(format, ap);

	va_end(ap);
	return position;
}

COORD hcenter(const char *format, ...)
{
	va_list ap;
	va_start(ap, format);

	COORD position = vhcenter(0, getconsolesize().X, format, ap);

	va_end(ap);
	return position;
}

COORD vcenter(int top, int bottom, int height)
{
	COORD position = getcursorposition();
	position.Y = (bottom - top - height) / 2 + top;

	movecursor(position);
	return position;
}

COORD vcenter(int height)
{
	return vcenter(0, getconsolesize().Y, height);
}

COORD center(int left, int right, int width, int top, int bottom, int height)
{
	COORD position =
	{
		hcenter(left, right, width).X,
		vcenter(top, bottom, height).Y
	};

	return position;
}

COORD center(int left, int right, int width, int top, int bottom, int height, const char *format, ...)
```

```
{
	va_list ap;
	va_start(ap, format);

	COORD position = center(left, right, width, top, bottom, height);
	vprintf(format, ap);

	va_end(ap);
	return position;
}

COORD center(int left, int right, int top, int bottom, const char *format, ...)
{
	COORD position;
	position.Y = vcenter(top, bottom, 1).Y;

	va_list ap;
	va_start(ap, format);

	position.X = vhcenter(left, right, format, ap).X;

	va_end(ap);
	return position;
}

COORD center(int width, int height)
{
	COORD consoleSize = getconsolesize();
	return center(0, consoleSize.X, width, 0, consoleSize.Y, height);
}

COORD center(int width, int height, const char *format, ...)
{
	va_list ap;
	va_start(ap, format);

	COORD consoleSize = getconsolesize();
	COORD position = center(0, consoleSize.X, width, 0, consoleSize.Y, height);

	vprintf(format, ap);

	va_end(ap);
	return position;
}

COORD center(const char *format, ...)
{
	COORD position;
	position.Y = vcenter(1).Y;

	va_list ap;
	va_start(ap, format);

	position.X = vhcenter(0, getconsolesize().X, format, ap).X;

	va_end(ap);
	return position;
}

COORD vhcenter(int left, int right, const char *format, va_list args)
{
	size_t length = (size_t)(strlen(format) * 1.5);
	char *output = (char *)malloc(length);

	if (output == NULL)
	{
		return COORD_ORIGIN;
	}
```

```
        while (vsprintf(output, format, args) < 0)
        {
                length = (size_t)(length * 1.5);

                if ((output = (char *)realloc(output, length)) == NULL)
                {
                        return COORD_ORIGIN;
                }
        }

        COORD position = hcenter(left, right, strlen(output));

        if (position != COORD_ORIGIN)
        {
                fputs(output, stdout);
        }

        va_end(args);
        free(output);

        return position;
}

#endif
```

3.5 cnslcz.hpp

```
/*
        Name: cnslsz.hpp (Console size) v1.0
        Copyright: (c) 2016 Marian Dolinský
        Author: Marian Dolinský
        Date: 29/05/16 12:51
        Description: Functions for working with console size in Windows console.
*/

#ifndef CNSLSZ_HPP
#define CNSLSZ_HPP

#include "superior.hpp"

COORD getconsolesize()
{
        CONSOLE_SCREEN_BUFFER_INFO bufferInfo;
  GetConsoleScreenBufferInfo(GetStdHandle(STD_OUTPUT_HANDLE), &bufferInfo);

        COORD consoleSize =
        {
                bufferInfo.srWindow.Right - bufferInfo.srWindow.Left + 1,
                bufferInfo.srWindow.Bottom - bufferInfo.srWindow.Top + 1
        };

        return consoleSize;
}

#endif
```

3.6 cursor.hpp

```
/*
        Name: cursor.hpp v1.0
        Copyright: (c) 2016 Marian Dolinský
        Author: Marian Dolinský
        Date: 29/05/16 16:40
```

```
	Description: Functions for controlling cursor in Windows console.
*/

#ifndef CURSOR_HPP
#define CURSOR_HPP

#include "superior.hpp"

void setcursor(bool isVisible, int size)
{
	CONSOLE_CURSOR_INFO cursor;
	cursor.bVisible = isVisible;
	cursor.dwSize = size;

	SetConsoleCursorInfo(GetStdHandle(STD_OUTPUT_HANDLE), &cursor);
}

void setcursor(bool isVisible)
{
	setcursor(isVisible, DCURSOR_SIZE);
}

COORD getcursorposition()
{
	CONSOLE_SCREEN_BUFFER_INFO bufferInfo;
	GetConsoleScreenBufferInfo(GetStdHandle(STD_OUTPUT_HANDLE), &bufferInfo);

	return bufferInfo.dwCursorPosition;
}

void movecursor(COORD position)
{
	SetConsoleCursorPosition(GetStdHandle(STD_OUTPUT_HANDLE), position);
}

void movecursor(int x, int y)
{
	COORD position = { x, y };
	movecursor(position);
}

#endif
```

3.7 operators.hpp

```
/*
	Name: operators.hpp v1.0
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 29/05/16 12:54
	Description: Operators used for comparing structures.
*/

#ifndef OPERATORS_HPP
#define OPERATORS_HPP

#include "superior.hpp"

bool operator ==(COORD c1, COORD c2)
{
	return c1.X == c2.X && c1.Y == c2.Y;
}

bool operator !=(COORD c1, COORD c2)
{
	return !(c1 == c2);
}
```

```
bool operator <(COORD c1, COORD c2)
{
	return c1.X < c2.X && c1.Y < c2.Y;
}

bool operator >(COORD c1, COORD c2)
{
	return c1.X > c2.X && c1.Y > c2.Y;
}

bool operator <=(COORD c1, COORD c2)
{
	return c1.X <= c2.X && c1.Y <= c2.Y;
}

bool operator >=(COORD c1, COORD c2)
{
	return c1.X >= c2.X && c1.Y >= c2.Y;
}

bool operator ==(SMALL_RECT r1, SMALL_RECT r2)
{
	return r1.Left == r2.Left && r1.Top == r2.Top && r1.Right == r2.Right && r1.Bottom == r2.Bottom;
}

bool operator !=(SMALL_RECT r1, SMALL_RECT r2)
{
	return !(r1 == r2);
}

#endif
```

3.8 strext.hpp

```
/*
	Name: strext.hpp (String extensions) v1.0
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 29/05/16 12:54
	Description: New and overload functions for working with strings in Windows console.
*/

#ifndef STREXT_HPP
#define STREXT_HPP

#include "superior.hpp"

char *stradd(char *str, char ch, int index)
{
	if (index >= 0 && index <= strlen(str))
	{
		str = (char *)memmove(str + index + 1, str + index, strlen(str) - index + 1);
		*(str + index) = ch;
	}

	return str;
}

char *strrem(char *str, int index)
{
	if (index >= 0 && index < strlen(str))
	{
		//
			don't add -1 to copy even terminating char
		str = (char *)memmove(str + index, str + index + 1, strlen(str) - index);
	}

	return str;
}

char *strndup(const char *source, int count)
{
	if (count < 0)
	{
		count = 0;
	}
	else if (count >= strlen(source))
	{
		return (char *)source;
	}

	char *output = (char *)malloc(count + 1);

	if (output == NULL)
	{
		return NULL;
	}

	strncpy(output, source, count);
	*(output + count) = 0;

	return output;
}

char *strcat(char *dest, int sourcesCount, const char *source, ...)
{
	strcat(dest, source);

	if (sourcesCount <= 1)
	{
		return dest;
	}

	va_list ap;
	va_start(ap, source);

	while (sourcesCount-- > 0)
	{
		strcat(dest, va_arg(ap, char *));
	}

	va_end(ap);
	return dest;
}

#endif
```

3.9 uibscs.hpp

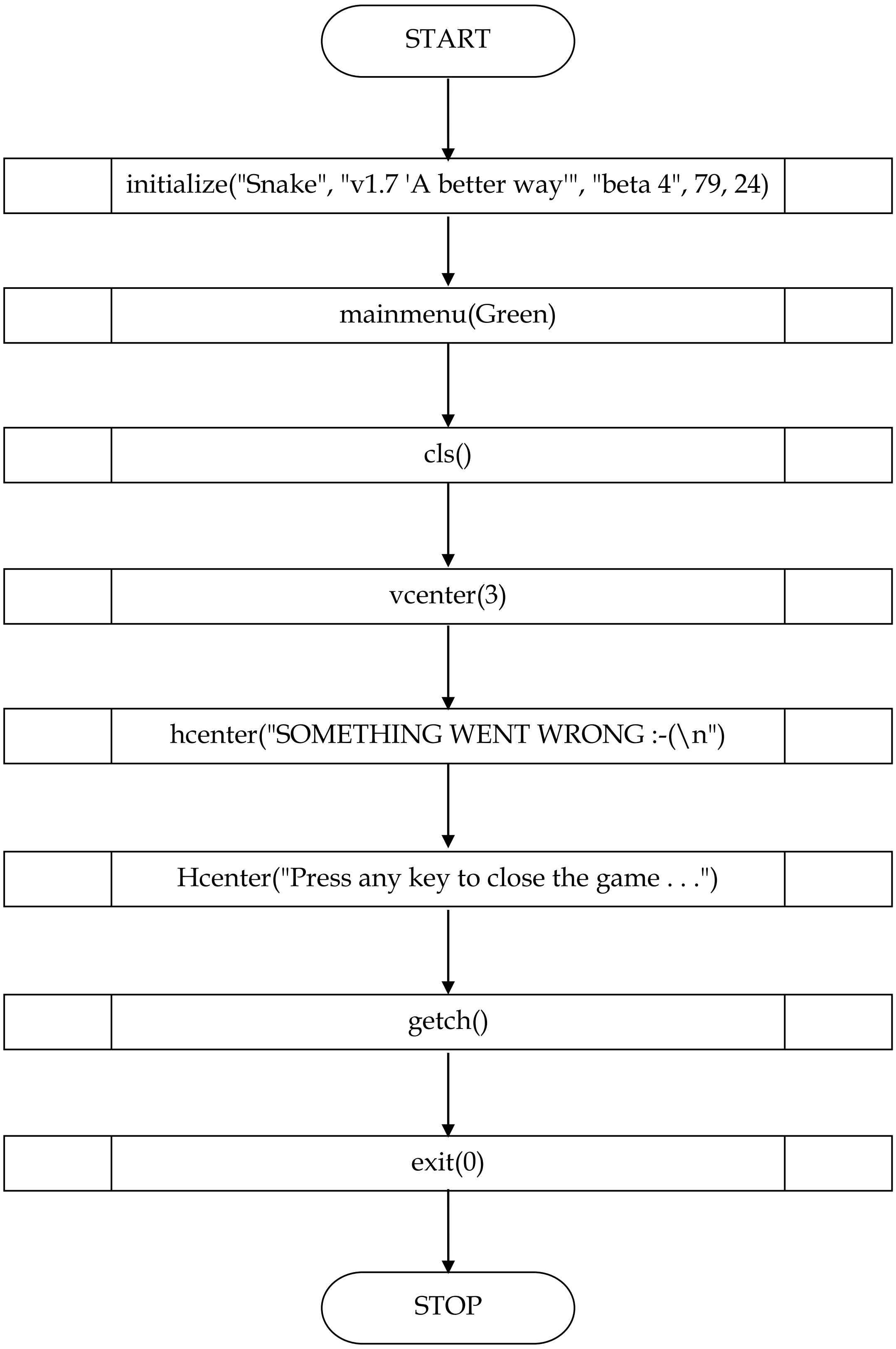
```
/*
	Name: uibscs.hpp (UI basics) v1.0
	Copyright: (c) 2016 Marian Dolinský
	Author: Marian Dolinský
	Date: 29/05/16 16:43
	Description: Basic function, enumerations and structures for creating UI in Windows console.
*/

#ifndef UIBSCS_HPP
#define UIBSCS_HPP

#include "superior.hpp"
```

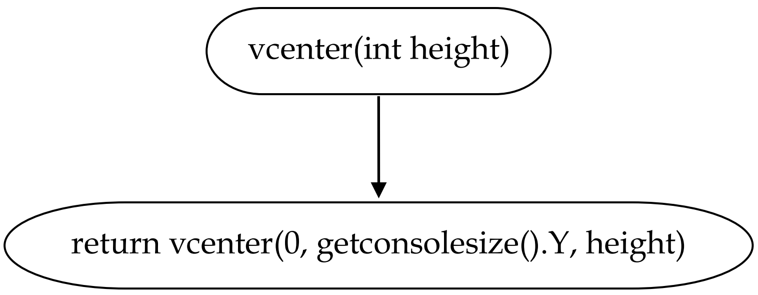
```
char line(LINETYPE type, LINESHAPE shape)
{
	switch (type)
	{
		case SingleLine:
			switch (shape)
			{
				case Horizontal:		return 196;
				case Vertical:			return 179;
				case Edge_Top_Left:		return 218;
				case Edge_Top_Right:		return 191;
				case Edge_Bottom_Left:		return 192;
				case Edge_Bottom_Right:	return 217;
				case T_Horizontal_Up:		return 193;
				case T_Horizontal_Down:	return 194;
				case T_Vertical_Left:		return 180;
				case T_Vertical_Right:		return 195;
				case Cross:				return 197;
				default:			return LINE_ERROR;
			}

		case DoubleLine:
			switch (shape)
			{
				case Horizontal:		return 205;
				case Vertical:			return 186;
				case Edge_Top_Left:		return 201;
				case Edge_Top_Right:		return 187;
				case Edge_Bottom_Left:		return 200;
				case Edge_Bottom_Right:	return 188;
				case T_Horizontal_Up:		return 202;
				case T_Horizontal_Down:	return 203;
				case T_Vertical_Left:		return 185;
				case T_Vertical_Right:		return 204;
				case Cross:				return 206;
				default:			return LINE_ERROR;
			}

		case Block:		return BLOCK_NORMAL;
		case None:		return ' ';
		default:	return LINE_ERROR;
	}
}

// These two variables shouldn't be visible from another files
// But in Dev-C++ 'static' it most likely doesn't work as it is supposed to
// Maybe because of this files are compiled by C++ compiler instead of C conpiler
static COLOR foregroundColor = White;
static COLOR backgroundColor = Black;

COLOR getforeground()
{
	return foregroundColor;
}

COLOR getbackground()
{
	return backgroundColor;
}

void fillforeground(COLOR foreground, COORD startPosition, int count)
{
   foregroundColor = foreground;

	DWORD written;
	FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), foregroundColor + (backgroundColor <<
4), count, startPosition, &written);
}
```

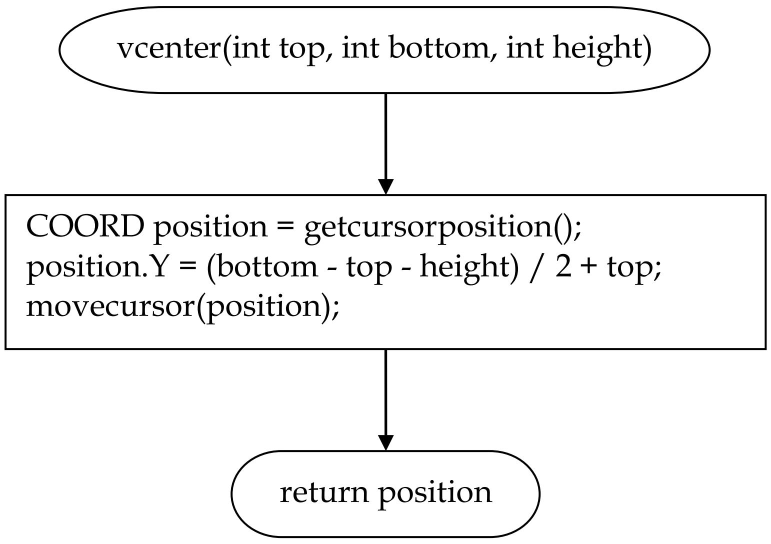
```
void fillforeground(COLOR foreground, int startPositionX, int startPositionY, int count)
{
   COORD startPosition = { startPositionX, startPositionY };
   fillforeground(foreground, startPosition, count);
}

void fillbackground(COLOR background, COORD startPosition, int count)
{
   backgroundColor = background;

            DWORD written;
            FillConsoleOutputAttribute(GetStdHandle(STD_OUTPUT_HANDLE), foregroundColor + (backgroundColor <<
4), count, startPosition, &written);
}

void fillbackground(COLOR background, int startPositionX, int startPositionY, int count)
{
   COORD startPosition = { startPositionX, startPositionY };
   fillbackground(background, startPosition, count);
}

void setforeground(COLOR foreground)
{
   foregroundColor = foreground;
   SetConsoleTextAttribute(GetStdHandle(STD_OUTPUT_HANDLE), foregroundColor + (backgroundColor << 4));
}

void setbackground(COLOR background)
{
   backgroundColor = background;
   SetConsoleTextAttribute(GetStdHandle(STD_OUTPUT_HANDLE), foregroundColor + (backgroundColor << 4));
}

void draw(const VISUAL &v)
{
            COLOR foregroundBackup = getforeground();

            setforeground(v.Color);
            putchar(v.Char);

            setforeground(foregroundBackup);
}

SMALL_RECT measure(int left, int right, int width, int top, int bottom, int height, COORD margin, HORIZONTALALIG-
NMENT horizontalAlignment, VERTICALALIGNMENT verticalAlignment)
{
            SMALL_RECT output;
            COORD consoleSize = getconsolesize();

            switch (horizontalAlignment)
            {
                        case HLeft:                         output.Left = left + margin.X;
                                            break;
                        case HCenter:       output.Left = ((right - left - width) / 2) + left + margin.X;      break;
                        case HRight:        output.Left = right - width + margin.X;
                        break;
                        default:            return RECT_ERROR;
            }

            switch (verticalAlignment)
            {
                        case VTop:                          output.Top = top + margin.Y;
                                            break;
                        case VCenter:       output.Top = ((bottom - top - height) / 2) + top + margin.Y; break;
                        case VBottom:       output.Top = bottom - height + margin.Y;
                        break;
                        default:            return RECT_ERROR;
```

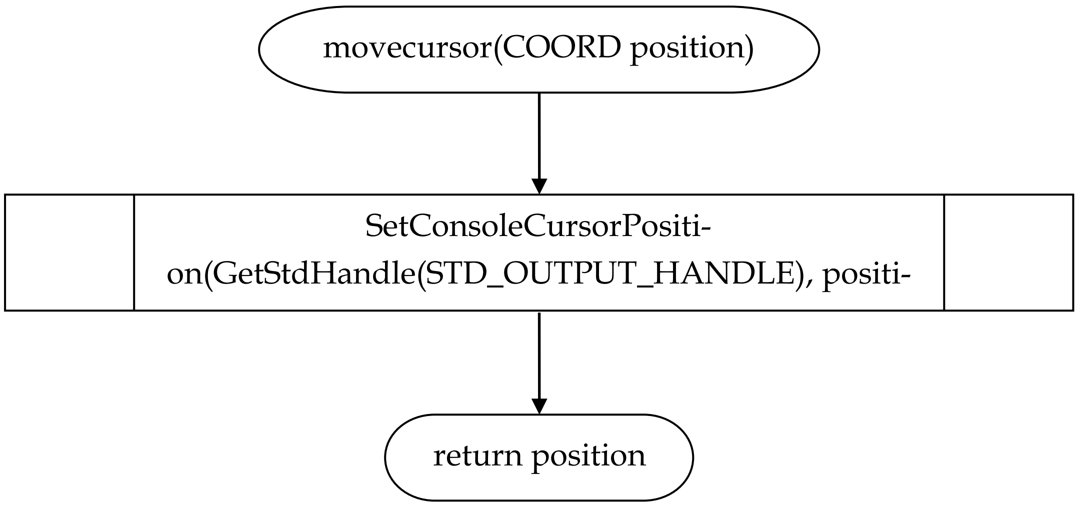
```
	}

	output.Right = output.Left + (width - 1);
	output.Bottom = output.Top + (height - 1);

	return output;
}

SMALL_RECT measure(int width, int height, COORD margin, HORIZONTALALIGNMENT horizontalAlignment, VER-
TICALALIGNMENT verticalAlignment)
{
	COORD consoleSize = getconsolesize();
	return measure(0, consoleSize.X, width, 0, consoleSize.Y, height, margin, horizontalAlignment, verticalAlign-
ment);
}

#endif
```

4 Vývojový diagram


START
initialize("Snake", "v1.7 'A better way'", "beta 4", 79, 24)
mainmenu(Green)
cls()
vcenter(3)
hcenter("SOMETHING WENT WRONG :-(\n")
Hcenter("Press any key to close the game . . .")
getch()
exit(0)
STOP


vcenter(int height)
return vcenter(0, getconsolesize().Y, height)


vcenter(int top, int bottom, int height)
COORD position = getcursorposition();
position.Y = (bottom - top - height) / 2 + top;
movecursor(position);
return position


movecursor(COORD position)
SetConsoleCursorPositi-
on(GetStdHandle(STD_OUTPUT_HANDLE), positi-
return position

5 Závěr

Jsem velmi rád, že jsem mohl na této hře pracovat, i když ji nakonec odevzdávám ne v tak „dokonalém“ stavu jak bych si ji představoval. Tuto hru jsem sice začal vytvářet už v září roku 2015 a až do půlky prosince jsem na ní velmi intenzivně pracoval, avšak poté mě již takovéto nadšení přešlo, a i přesto, že za posledních pět měsíců jsem se naučil velkou spoustu nových věcí, které jsem chtěl do této hry použít, ne všechny jsem do ní z časových důvodů nakonec zakomponoval, popřípadě nejsou úplně dokončené.

I přes nedostatek času jsem však od ledna stihl přepsat prakticky všechen kód. Původně totiž hra používala můj vlastní vykreslovací engine, který však byl velmi pomalý, protože bylo nutno vše vykreslovat od levého horního rohu konzole. V lednu jsem tedy začal pracovat na verzi 1.7, která přinesla do hry nový dech a právě díky novému, rychlejšímu způsobu vykreslování jsem měl možnost přidat spoustu nových věcí, i když hra nakonec zdaleka neobsahuje všechny, které jsem měl v plánu. Bohužel, časové nedostatky také způsobily, že mi nezbylo dost času na optimalizace a je tedy možné, že některé části programu by mohly fungovat lépe. I přesto si myslím, že vývoj této hry mi hodně pomohl v celkovém pochopení jazyka C a obecně mě posunul v programování o velký kus dále. Právě při jejím vývoji jsem se totiž naučil spoustu nových věcí, jako jsou například struktury, pointery, bitový posun, vlastní datové typy, enumerace, funkce s proměnlivým počtem argumentů a další, které mi také pomohly v pochopení přesného fungování základních funkcí jazyka C, jako jsou printf, scanf a podobné. Spoustu z těchto znalostí jsem měl také možnost naučit i své spolužáky, kteří některé tyto znalosti později mohli využít ve svých ročníkových pracích.