CZ1106 Problem Solving and Computation II

Programming Lab 1

TURBO C++ Compiler, Debugger, Command-Line

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Part I : Compiler

1 The Turbo C++ Integrated Development Environment (IDE)

Our laboratories are installed with the Turbo-C compiler. To start from scratch, you should login your NUSNET account when you go to the computer lab.

Click DOS Prompt and you will go to drive H. Now you can invoke the Turbo-C compiler stored in drive C from your current drive H using this command:

H:\> **c:\tcpp30\bin\tc**

and pressing the Enter key, and you can do your work now.

Everything you need to write, edit, compile, link, and debug your programs is at your fingertips when you are in the Turbo C++ **I**ntegrated **D**evelopment **E**nvironment (IDE). There are three components in the IDE:

- the menu bar at the top provides primary access to all the menu commands
- the window area in the middle is a screen area that you can move, resize, overlap, open, close, zoom and tile
- the status line at the bottom offers on-line hints, tells you what the program is doing, etc.

To choose a menu command, you can either use the keyboard or a mouse. As an illustration, to choose the menu item Open contained in the menu File (the meaning of **File|Open**):

- Using Keyboard: press Alt and the highlighted letter F to display the menu (observe the changes on the status line); then press the highlighted letter O to choose the command once the menu is displayed. From the keyboard, you press **ESC** to cancel an action. You can use a number of keyboard shortcuts or *hot keys* to access menu bar and choose commands. If hot key(s) for a command is available, it (they) will appear on the right-hand side of that command on the menu or listed on the status line below. To open a file, you can simply press **F3**. A list of Turbo C++ IDE hot keys is attached at the end of this part. You should memorize the most-used ones and use them where applicable. *Programming speed is important during tests.*

- Using Mouse: move the mouse pointer to **File** on the menu bar and click the left mouse button; then move the mouse pointer to **Open** and click. From this point on, the word *click* means press and release the left mouse button. Click anywhere outside the menu to cancel an action.

2 An Exercise

In this section, you will learn to create, edit, save, load, compile, and run C programs from the keyboard and mouse. A list of commonly used keyboard editor commands is attached at the end of the part. Go through the following warming-up exercise before creating your first program.

2.1 Creating a New Program [File|New]

- Click **File** on the Menu bar to get a pull-down menu.
- Click **New**. You will see a cursor at the upper left corner of the active window. You will now edit your first C program. Key in the following program that contains some errors. Ignore the line numbers. (C is case-sensitive so do not change *include* to *Include* or *main* to *MAIN* and so on. However, the number of spaces need not be exactly the same as that in the given program.)

```
/* first.c */
#include <stdio.h>
#include <conio.h>
void main(void)
{
   float a, b, sum, diff;
   scanf("%f%f", &a, &b);
   printf("/n/n Enter two numbers: ");
   sum = a + b;
   diff = a - b;
   printf("The sum is %f \n", SUM);
   printf("The difference is %f \n", diff);
}
```

2.2 Saving a Program [F2]

If this is your very first time using the Turbo C++ 3.0 Compiler, you need to do the followings:

- Select **Options** from the menu bar. Click the **Directories** to open a dialogue box. Check that the Include directories and the Library directories are `c:\TCPP30\INCLUDE` and `c:\TCPP30\LIB` respectively. If not, make the necessary changes and click **OK**.
- Select **Options** from the menu bar. Click **Environment** and select **Editor**. Change the **D**efault Extension from `CPP` to `C` and click **OK**.
- Select **Options** from the menu bar. Click **Save**. Mark all the Save Options and click **OK**.

Once done, you do not have to repeat the above steps when you login some other time.

A program can be saved in a disk for future use. If the edit window is opened using **File|New**, it will have the default name NONAMExx.C (xx stands for a number from 00 to 99). Press **F2**. Turbo C++ prompts you for a filename. You may specify the location where you want your file to be stored by typing the path name before the filename (eg. A:first.c). The default directory is the current directory and the default file extension is `.cpp`. *Remember to save your program after each reasonable amount of editing and before execution in case of power failure or system crash*. Save your file as **first.c**

2.3 Editing a Program

Take the above sample program `first.c` for example:

- in line 8, `/n/n` should be changed to `\n\n`.
- exchange line 7 and line 8.
- in line 11, `SUM` should be `sum`.

Press **F2** to save the program.

2.4 Getting Helps [F1]

There is help information on virtually all aspects of the IDE and Turbo C++ in the Help menu which can be opened by **F1**. To get help on things like function names (eg. `printf, scanf`), header files (eg. `stdio.h`), reserved words (eg. `include`), and so on, position the cursor on the item in an Edit window and press **Ctrl-F1**. Alternatively you can simply put the mouse cursor on the word and click the right mouse button.

2.5 Compiling a Program [Alt-F9]

A compiler is a program that translates a high-level language (e.g., C or C++) program into machine language to be understood by the computer. Each completed C program can be compiled by loading it into the Turbo C++ IDE and press **Alt-F9**. If syntax errors are detected during compilation, a list of messages will appear in the Message window telling you where and what the errors are. Press **ENTER** to return to the Edit window and make corrections before re-compiling the program. If compilation is successful, an object code (with extension .obj) of the program is generated.

2.6 Running a Program [Ctrl-F9]

To run your program, press **Ctrl-F9**. It will also compile and link the program so you do not have to compile it using **Alt-F9**. To stop a program while it is running, press **Ctrl-Break**. When your program `first.C` is running, you will see on the User/Output screen:

```
Enter two numbers:
```

Type any two integers, separated by one space (e,g., **3 2**), and press **ENTER**. The following sentences will flash past and you are placed in the Edit window:

```
The sum is 5
The difference is 1
```

You may encounter run-time errors as you go along developing programs. A common one is division by zero. You will be taught how to debug programs in Laboratory Exercise 2.

2.7 Viewing Screen Output [Alt-F5]

To review your program output on the screen, you should press **Alt-F5**. Return to the editor by pressing any key.

2.8 Entering the DOS Environment

To go to the DOS command prompt temporarily, select **File|DOS Shell**. You can now copy, delete, or rename files or view directory contents. Note that you have not quitted the IDE, rather you have just left the IDE a while to do some DOS work. Type `EXIT` and press **ENTER** to return to the IDE.

2.9 Quit Turbo C++

To quit Turbo C++, press **Alt-X** or select the menu **File|Exit**.

Logoff before you leave.

3. Turbo C++ IDE Hot Keys Reference

- `CUA`: **C**ommon **U**ser **A**ccess command set (industrial standard user interface)
- `Alt`: **Alt**ernate command set (default for all Borland's products)

3.1 General IDE Hot Keys

CUA	Alt	Menu item	Function
F1	F1	Help	Displays a help screen.
	F2	File|Save	Saves the file that's in the active edit window.
	F3	File|Open	Brings up a dialog box so you can open a file.
	F4	Run|Go to Cursor	Runs your program to the line where the cursor is positioned.
	F5	Window|Zoom	Zooms the active window.
Ctrl+F6	F6	Window|Next	Cycles through all open windows.
F7	F7	Run|Trace Into	Runs your program in debug mode, tracing into functions.
F8	F8	Run|Step Over	Runs your program in debug mode, stepping over function calls.
F9	F9	Compile|Make	Invokes the Project Manager to make an .EXE file.
F10	none	none	Takes you to the menu bar.

3.2 Menu Bar Hot Keys

CUA	Alt	Menu item	Function
Alt+Spacebar	Alt+Spacebar	_ menu	Takes you to the _ (System) menu
Alt+C	Alt+C	Compile menu	Takes you to the Compile menu
Alt+D	Alt+D	Debug menu	Takes you to the Debug menu
Alt+E	Alt+E	Edit menu	Takes you to the Edit menu
Alt+F	Alt+F	File menu	Takes you to the File menu
Alt+H	Alt+H	Help menu	Takes you to the Help menu
Alt+O	Alt+O	Options menu	Takes you to the Options menu
Alt+P	Alt+P	Project menu	Takes you to the Project menu

Alt+R	Alt+R	Run menu	Takes you to the Run menu
Alt+S	Alt+S	Search menu	Takes you to the Search menu
Alt+W	Alt+W	Window menu	Takes you to the Window menu
Alt+F4	Alt+X	File|Quit	Exits Borland C++

3.3 Editing Hot Keys

CUA	Alt	Menu item	Function
Ctrl+Del	Ctrl+Del	Edit|Clear	Removes selected text from window; doesn't put it in Clipboard
Ctrl+Ins	Ctrl+Ins	Edit|Copy	Copies selected text to Clipboard
Shift+Del	Shift+Del	Edit|Cut	Places selected text in Clipboard, deletes selection
Shift+Ins	Shift+Ins	Edit|Paste	Pastes text from Clipboard into the active window
Alt+Bksp c	Alt+Bksp c	Edit|Undo	Restores text in active window to previous state
F3	Ctrl+L	Search|Search Again	Repeats last Find or Replace command
	F2	File|Save	Saves file in active edit window
	F3	File|Open	Opens file

3.4 Window Management Hot Keys

CUA	Alt	Menu item	Function
Alt+#	Alt+#		Displays a window, where # is the number of the window you want to view
Alt+0	Alt+0	Window|List All	Displays a list of open windows
Ctrl+F4	Alt+F3	Window|Close	Closes the active window
Shift+F5		Window|Tile	Tiles all open windows
Alt+F5	Alt+F4	Debug|Inspect	Opens an Inspector window
Shift+F5	Alt+F5	Window|User Screen	Displays User Screen
	F5	Window|Zoom	Zooms/unzooms the active window
Ctrl+F6	F6	Window|Next	Switches the active window
	Ctrl+F5		Changes size or position of active window

3.5 Online Help Hot Keys

CUA	Alt	Menu Item	Function
F1	F1	Help|Contents	Opens a context-sensitive help screen
F1 F1	F1 F1	Help|Using Help	Brings up Help on Help. (Just press F1 when you're already in the help system.)
Shift+F1	Shift+F1	Help|Index	Brings up Help index
Alt+F1	Alt+F1	Help| Previous Topic	Displays previous Help screen
Ctrl+F1	Ctrl+F1	Help|Topic Search	calls up language-specific help in the active edit window

3.6 Debugging/Running Hot Keys

CUA	Alt	Menu Item	Function
Alt+F5	Alt+F4	Debug|Inspect	Opens an Inspector window
Alt+F7	Alt+F7	Search|Previous Error	Takes you to previous error
Alt+F8	Alt+F8	Search|Next Error	Takes you to next error
Alt+F9	Alt+F9	Compile|Compile	Compiles to .OBJ
Ctrl+F2	Ctrl+F2	Run|Program Reset	Resets running program
	Ctrl+F3	Debug|Call Stack	Brings up call stack
	Ctrl+F4	Debug|Evaluate/Modify	Evaluates an expression
Ctrl+F5	Ctrl+F7	Debug|Add Watch	Adds a watch expression
F5	Ctrl+F8	Debug|Toggle Breakpoint	Sets or clears conditional breakpoint
Ctrl+F9	Ctrl+F9	Run|Run	Runs program
	F4	Run|Go To Cursor	Runs program to cursor position
F7	F7	Run|Trace Into	Executes tracing into functions
F8	F8	Run|Step Over	Executes skipping function calls
F9	F9	Compile|Make	Makes (compiles/links) program

Assignment

Write a program named as **sums.c** to ask the user to enter eight integers, and print the following contents on the screen:

- sum of the square of each odd term (1^{st}, 3^{rd}, 5^{th} and 7^{th})
- sum of the square of each even term (2^{nd}, 4^{th}, 6^{th} and 8^{th})
- Difference of the above sums

The screen output is shown below:

```
Enter Eight Integers: 8 3 6 2 4 5 9 1
Sum of the square of each odd term: 197
Sum of the square of each even term: 39
Difference of two sums: 158
```

Help

The following instructions will help you in writing the program.

- print on the screen the message asking the user to enter 8 integers (use printf)
- scan in 8 integers from the keyboard (use scanf)
- compute sum of the square of each odd term, sum of the square of each even term, and the difference of the two sums
- print the complete output on the screen

Part 2: Command Line Execution

The **encode.c** is given in the CZ1106 course web. A file called **unknown.inf** contains the ciphered text generated by encode.c. Write a C program called **decode.c** that takes unknown.inf as an input file from the command line and deciphers the contents. The resulting plain text should be stored in a text file called **known.ouf**. You should make use of encode.c in decode.c.

unknown.inf

```
Prev rnkligzmg gsrmth nfhg yv wlmv vevib wzb:
- gl zkkivxrzgv
- gl kizrhv
- gl ivdziw
- gl zkloltrav
- gl ivkzri
~ YMD 1996

Oevib tznv szh rgh ifovh zmw ivtfozgrlmh.
Kmw vevm gsv mzgfiv szh z ozd gl uloold.
Dsviv rh ml uivv kozb rm gsrh dliow.
~ YMD 1996

Su dv dzmg kvlkov gl gifhg fh dv nfhg wvorevi
  dszg dv szev kilnrhvw.
Su dv dzmg gl tzrm gsvri ivhkvxg dv nfhg wvorevi nliv gszm
  dszg dv szev kilnrhvw,
~ COZ 1996

Zirerovtv rh mlg gl yv zhpvw uli li gl yv xozrnvw zh zm vmgrgovnvmg.
Zirerovwv rh trevm fklm lfi xivwryrorgb.
~ Tfob 1997

Sg rh yvggvi gl yv ivhkvxgzyov gszm gl yv uznlfh.
~ Tfob 1999
```

Assignment

Write a program named as **compute.c** that accepts an arbitrary number of integers from the command line and displays their sum, mean, maximum and minimum on the screen as shown below. The number of arguments entered from the command line is assumed to be unknown. These are a few test cases:

```
C:\> compute 28
 Sum = 28
 Mean = 28.00
 Maximum = 28
 Minimum = 28

C:\> compute
 Error !! No Data.


C:\> compute -4 89 9 3987 -389
```

```
Sum = 3692
Mean = 738.40
Maximum = 3987
Minimum = -389
```

The following logic is suggested. If you have alternatives, please go ahead to code every thing in your own way.

```
if the number of arguments is less than 2
  print error messages and exit;

convert the first integer to a numerical value
  and initialize max, min, sum to the value;

if the number of arguments is greater than 2
  for the remaining integers
  {
     convert a remaining integer to a numerical value;
     accumulate the numerical value to sum;
     change max to the numerical value if necessary;
     change min to the numerical value if necessary;
  }

compute mean;
print sum, mean, max, min;
```