Installation, configuration and use of software to perform an individual assignments in the discipline “Parallel and Multithreaded Programming” (2024-2025 academic year, 4th year, 7th semester)

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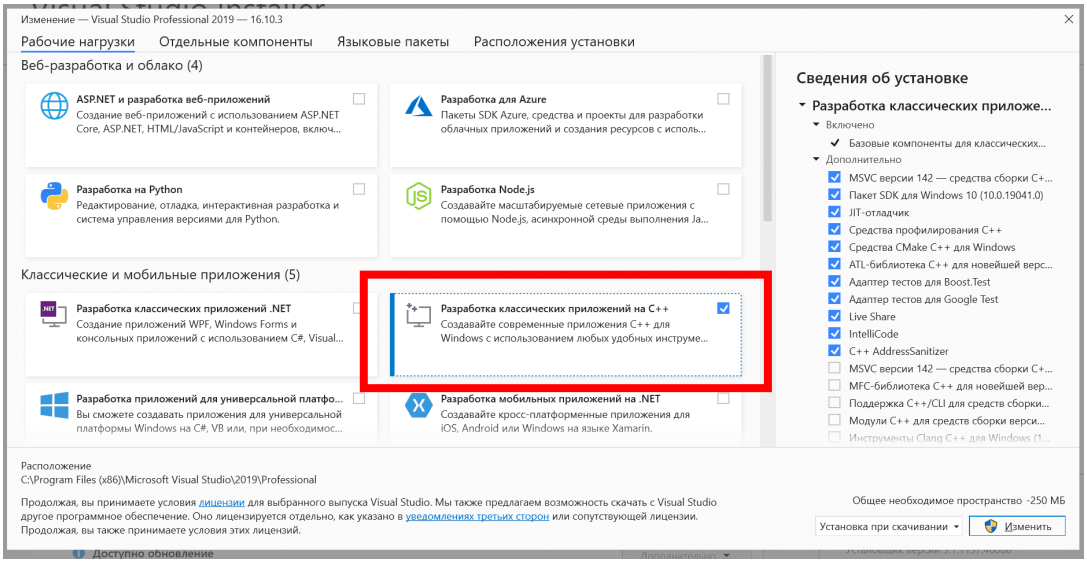
- **Dev-C++ 6.30**: http://ptaskbook.com/download/Embarcadero_Dev-Cpp_6.3_TDM-GCC_9.2_Setup.exe
- **Visual Studio Code** (version ***Windows***, ***System Installer***, ***64 bit***): http://ptaskbook.com/download/VSCodeSetup-x64-1.63.2.exe
- **Microsoft MPI 10.1.2:** http://ptaskbook.com/download/msmpisetup10_1_2.exe

During the installation process, select the default options.

Microsoft Visual Studio versions **2017** , **2019** or **2022** also may be used. To work correctly with C++ programs in the **Microsoft Visual Studio**, you need to install the **C++ Classical Application Development** extension, using the **Visual Studio Installer** (to install new extensions for one of the available Visual Studio version, you need to press the **Change** button next to the description of this version).

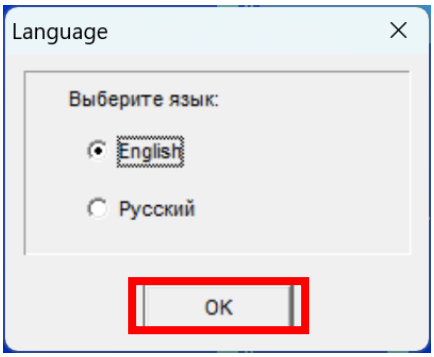


2. Installing the Programming Taskbook 4.25

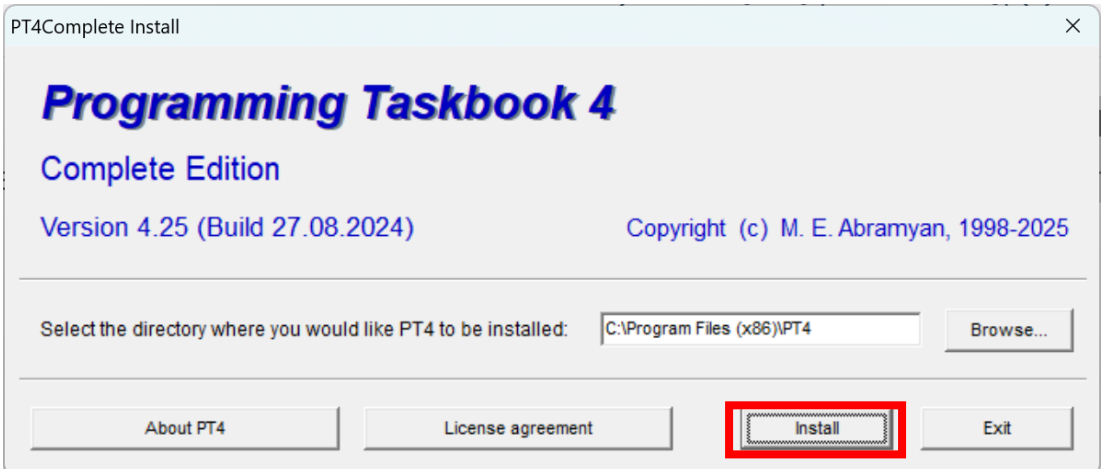
Download and run the following installation program (the distribution of the taskbook is also available on the course page in the Moodle system):

http://ptaskbook.com/download/PT4Complete_v4_25ruen.exe

If the interface language selection window appears at startup, select the **English** option:



When installing the taskbook, you should not change the default directory.

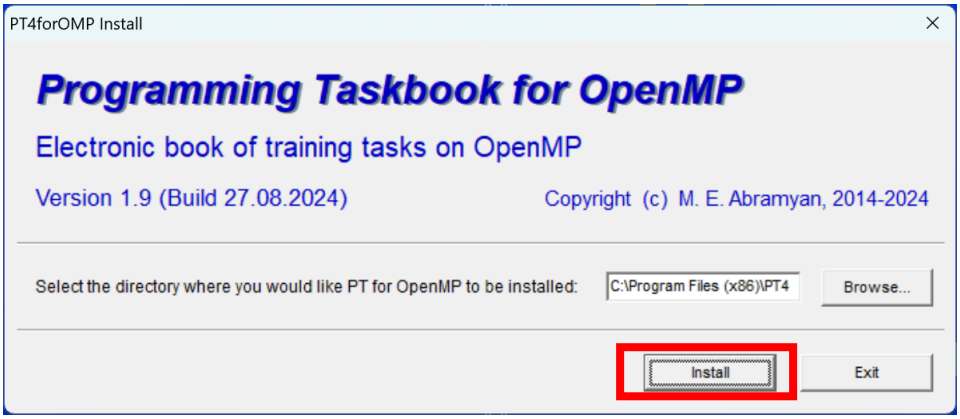


After installing the Programming Taskbook, you will see a window of the **PT4 Setup** program, designed to configure various parameters of the taskbook. The **Programming Taskbook registration** section does not require any action, just leave the registration number as zero. Close the **PT4 Setup** program by pressing the **Exit** button or the Esc key.

3. Installing additional extensions for the Programming Taskbook

Install **Programming Taskbook for OpenMP 1.9:**

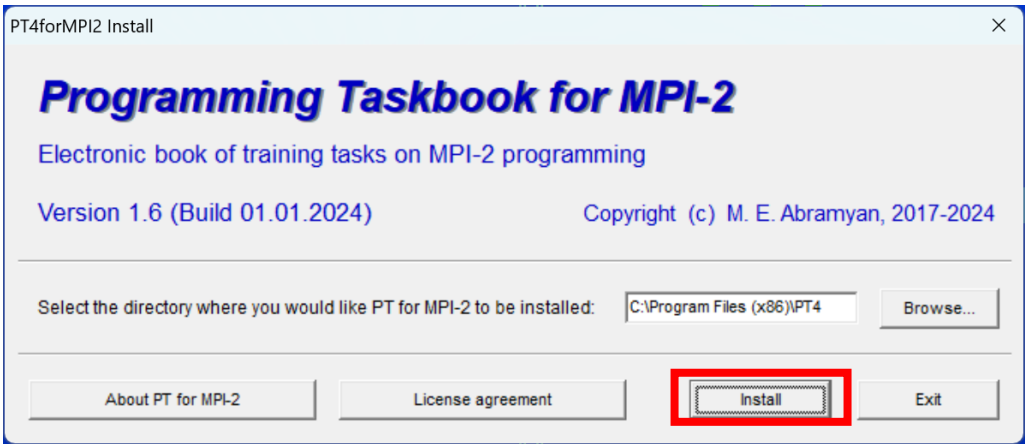
http://ptaskbook.com/download/PTforOMP_v1_9ruen.exe).



Immediately close the **PT4 Setup** window that appears after the **Programming Taskbook for OpenMP** installation is complete.

Then install **Programming Taskbook for MPI-2 1.6**:

http://ptaskbook.com/download/PTforMPI2_v1_6ruen.exe



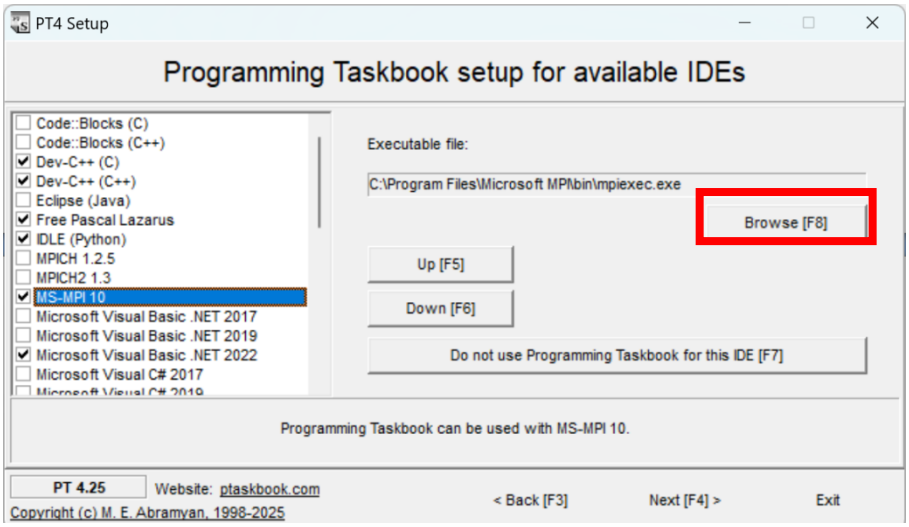
After installing the Programming Taskbook for MPI -2, the **PT4 Setup** program will be automatically launched, in which you must perform the actions described in the following sections. In the future, the **PT4 Setup** program can be launched from the Windows menu (**Start | Programs | Programming Taskbook 4 | PT4 Setup**) or using the **PT4 Panel** program of the **Programming Taskbook**.

4. Setting up programming environments for the Programming Taskbook

After launching the **PT4 Setup** program , go to the section with a list of programming environments by pressing the **Next button (F4)** or the F4 key.

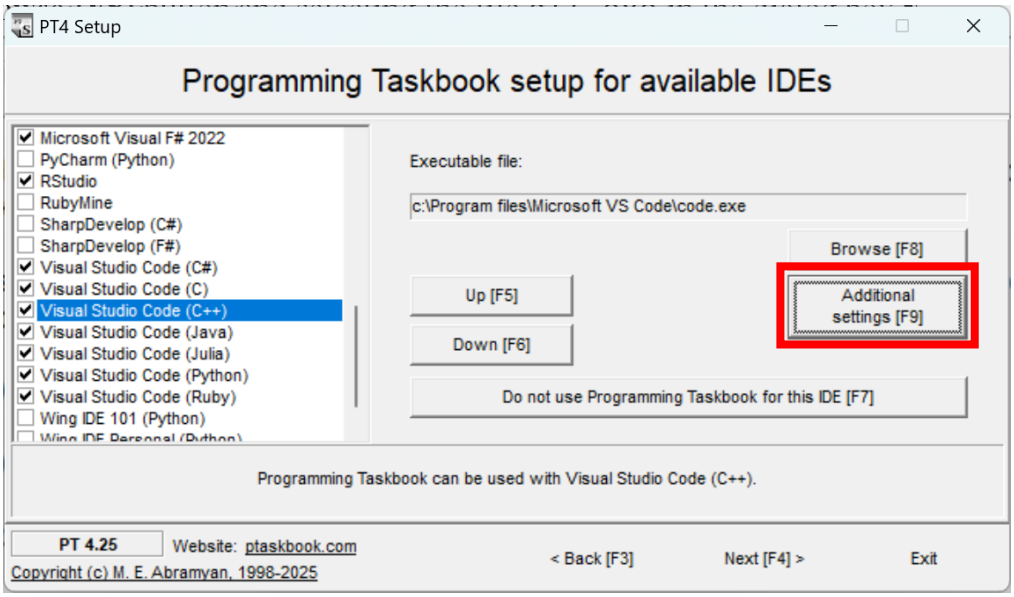
In the section with a list of programming environments, you need to check that the taskbook has detected the systems **Dev-C++ (C++)** , **Visual Studio Code (C++)** or **Visual Studio C++ 2017**, **2019** or **2022** , and the **MS MPI 10** package (in this case, the checkbox next to the specified environment list items will be selected). Use the scroll bar to view the whole environment list.

If the checkboxes for some required environments are not selected, you can try to find the required exe files yourself by selecting the required environment in the list and pressing the **Browse (F8)** button or the F8 key.

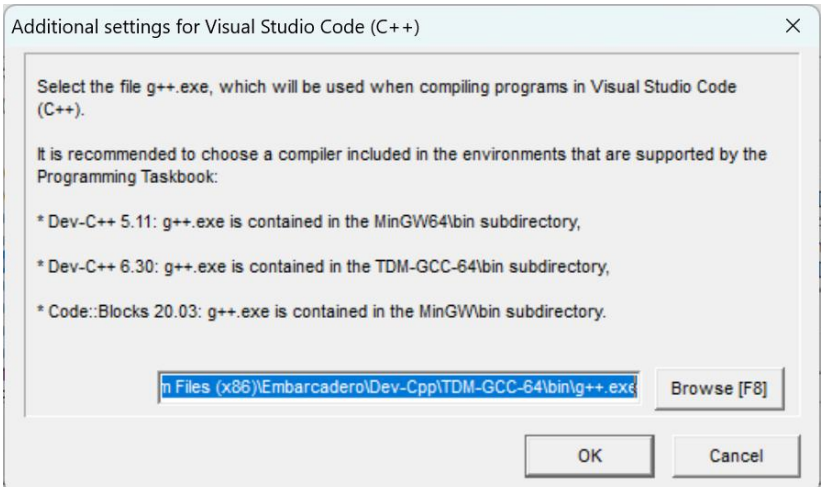


- For **Dev-C++ (C++)**, you need to specify the `devcpp.exe` file (for version 6.30, this file is located in the `C:\Program files (x86)\Embarcadero\Dev-Cpp` directory).
- For **Visual Studio Code (C++)**, you need to specify the `code.exe` file (for the **System Installer** version of **Visual Studio Code**, the file is located in the `C:\Program files\Microsoft VS Code` directory).
- For **MS-MPI 10**, you need to specify the `mpiexec.exe` file (located in the `C:\Program files\Microsoft MPI\bin` directory).

For **Visual Studio Code (C++)** environment, additionally click the **Additional settings (F9)** button.



The **Additional settings** window appears, which will indicate the path to the `g++.exe` file from the **Dev-C++** environment. If the path is not specified, you must specify it by clicking the **Browse (F8)** button and selecting the file `g++.exe` in the dialog box.

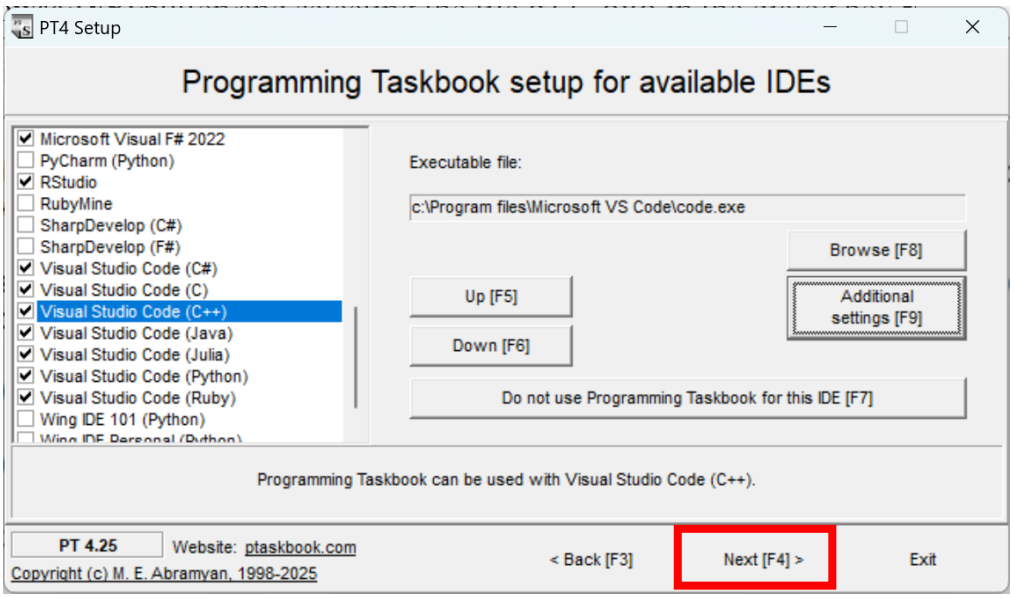


For **Dev-C++ 6.30,** the `g++.exe` file is located in the `C:\Program Files (x86)\Embarcadero\Dev-Cpp\TDM-GCC-64\bin` directory.

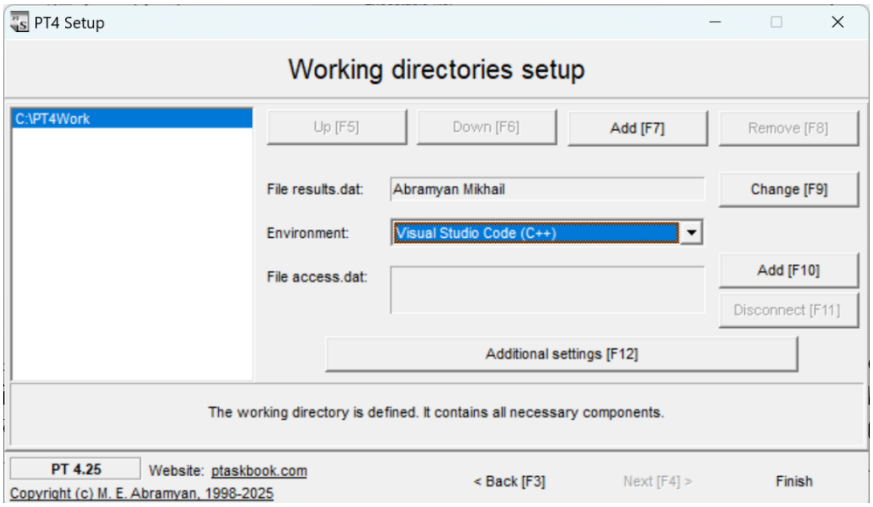
After setting the path to the `g++.exe` file, close the **Additional settings** window by clicking **OK**.

5. Setting up working directories for the Programming Taskbook

Proceed to the next section of the **PT4 Setup** program by pressing the **Next (F4)** button again.



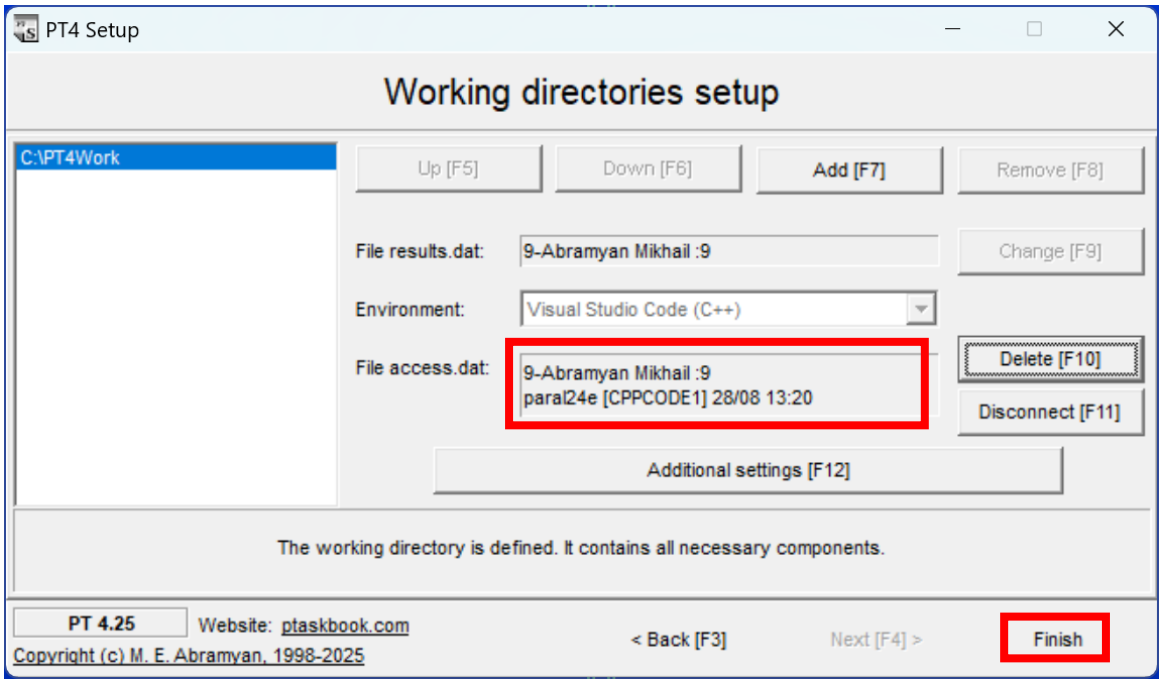
In the **Working directories** section that appears, you need to configure the working directory for executing tasks. The list of working directories will already include the `C:\PT4Work` directory. For **Environment**, select **Visual Studio Code (C++)** or other variant for the C++ language.



To complete the setup of the working directory, you need to add *an access certificate* `access.dat` to it (see the next section).

6. Adding an access certificate to the working directory

Download the archive of certificates for this course: http://ptaskbook.com/download/access-paral24e.zip, find the directory with your name in the archive and extract the `access.dat` file from this directory. To add this file to the working directory, return to the **PT4 Setup** program window (see the previous screenshot), click the **Add (F10)** button and select the `access.dat` file extracted from the certificate archive in the dialog box that appears. As a result, in the **File access.dat** field, information related to the access certificate should appear (this should include your name). After adding the `access.dat` file, the text of the **Add (F10)** button will change to **Delete (F10)**.



Once you have completed setting up the working directories, close the **PT4 Setup** program window by clicking the **Finish** button or the Esc key.

Go to the `C:\PT4Work` directory and make sure it contains the files, `access.dat` and a set of shortcuts `Demo`, `Load`, `Panel` and `Results`.

When performing subsequent actions, as well as when solving tasks, the computer must be connected to the Internet!

7. Activation of the access certificate, acquaintance with the variant of individual tasks and creation of a template for the selected task

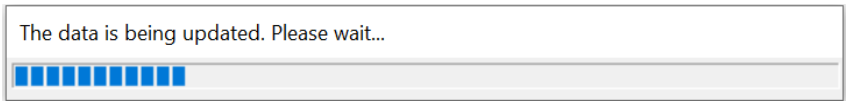
While in your working directory, launch `the Panel` shortcut. The *Programming Taskbook toolbar* will appear at the bottom of the screen, which is already set to the working directory `C:\PT4Work`. Press the button  corresponding to the **PT4 Load** program (you can also press L, F3 or spacebar key).

When you launch the **PT4 Load** program for the first time, *an access certificate activation window* will appear , in which you must specify the activation code.

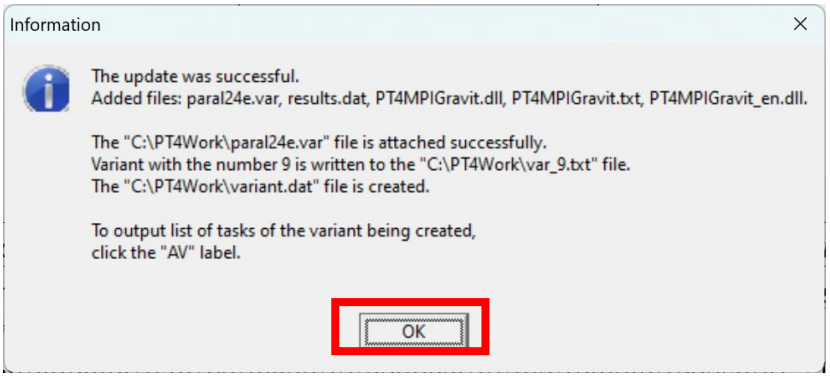
The certificate activation code will be given to you by the teacher at the first class.

After this, an attempt will be made to connect to the remote repository. The following describes the actions that must be performed if the connection to the repository is successful.

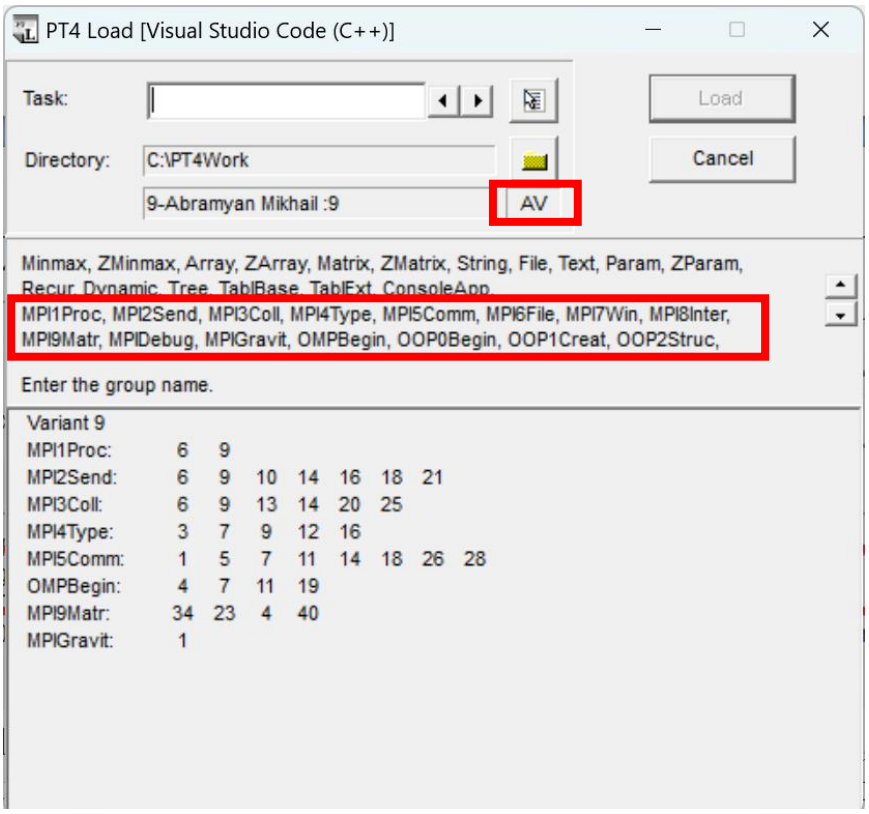
First, the required files will be downloaded from the remote repository. This may take several minutes.



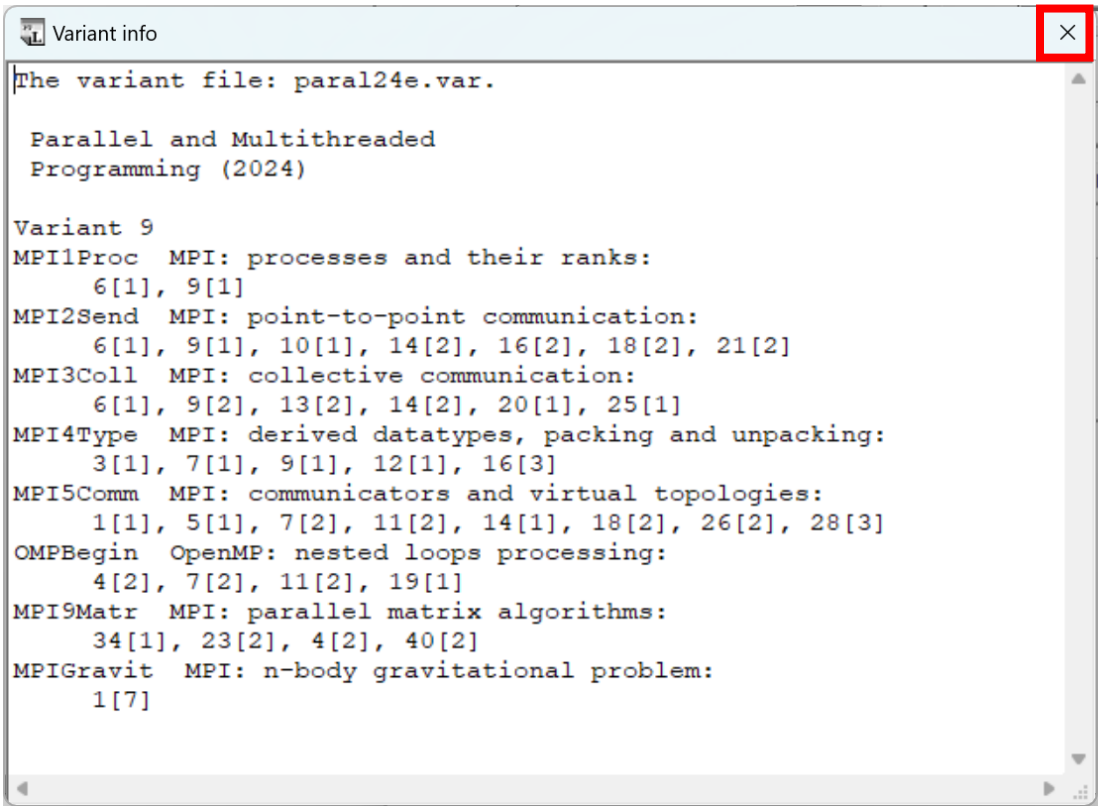
After successful download, the following message will be displayed:



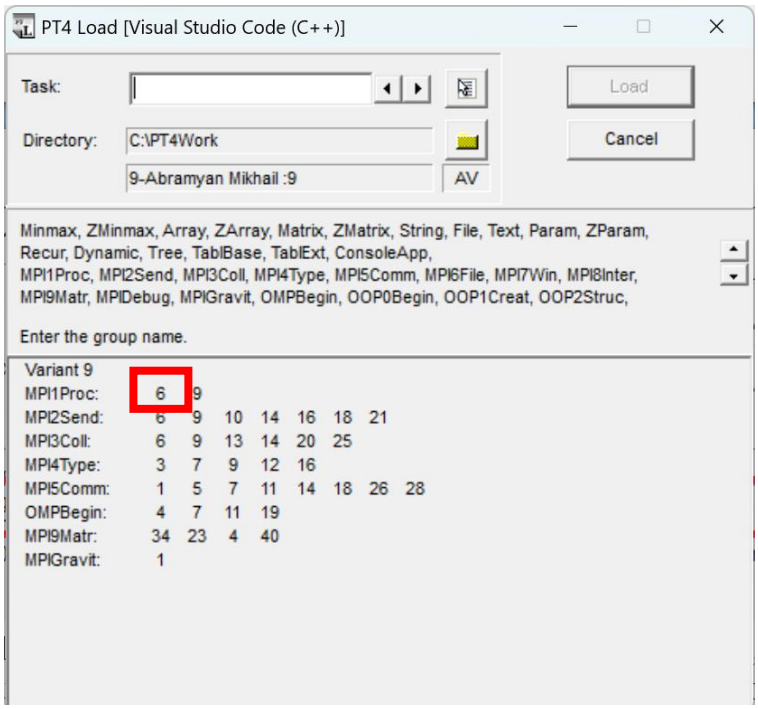
After clicking the **OK** button**,** the **PT4 Load** program window will appear on the screen. Make sure that the list of task groups contains groups with the prefixes **MPI** (including the **MPI-Gravit** group) and **OMP** and that the window contains a label with the text **AV** (the list of groups can be scrolled using the ↑and ↓ keys). At the bottom of the window, a list of the tasks included in your variant will be displayed.



Clicking on the **AV** label will display the same task list with additional information about the points associated with each tasks (in square brackets). To close the window, click the **x** button in the right corner of the window or press the Esc key.



To select the required task in the **PT4Load** window, you can either specify the task name in the **Task** input field (and press the **Load** button or the Enter key), or simply click on the task number at the bottom of the window. A template for this task will be created and the preset will be automatically loaded into the selected programming environment (the programming environment is specified in the window header).



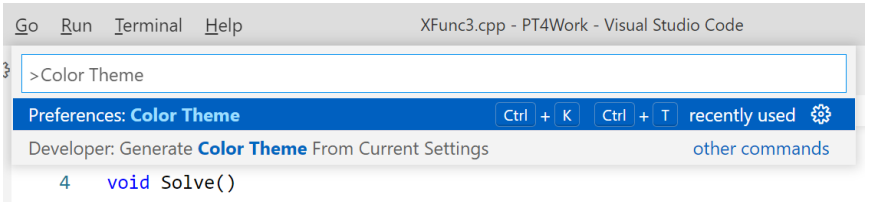
8. Running the program

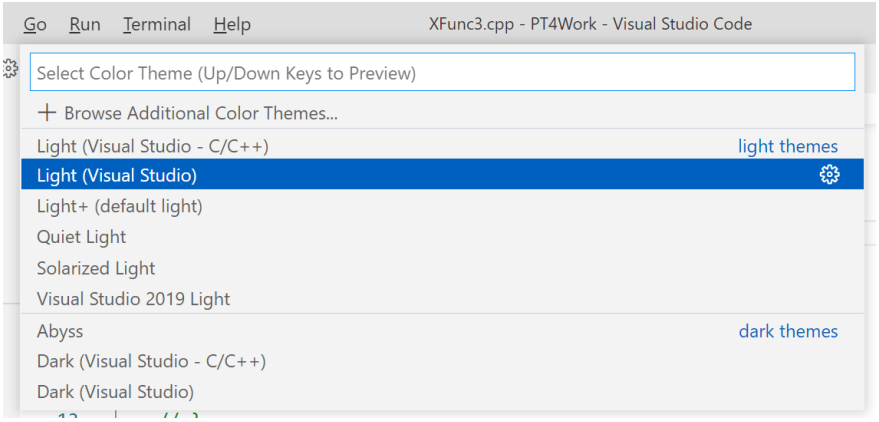
In the **VS Code** editor settings, it is recommended to change the values of two parameters. To display the **Settings** tab, run the command **File | Preferences | Settings**.

You need to select the **Text section Editor | Files** and set the **Hot Exit** parameter equals **off**. This setting will ensure that you are prompted to save the file when you close the **VS Code** if the file has been changed since the last save.

Next, you need to select the **Application | Update** and set the **Mode** parameter to **none**. This setting will block the periodic window asking you to update your **VS Code** version.

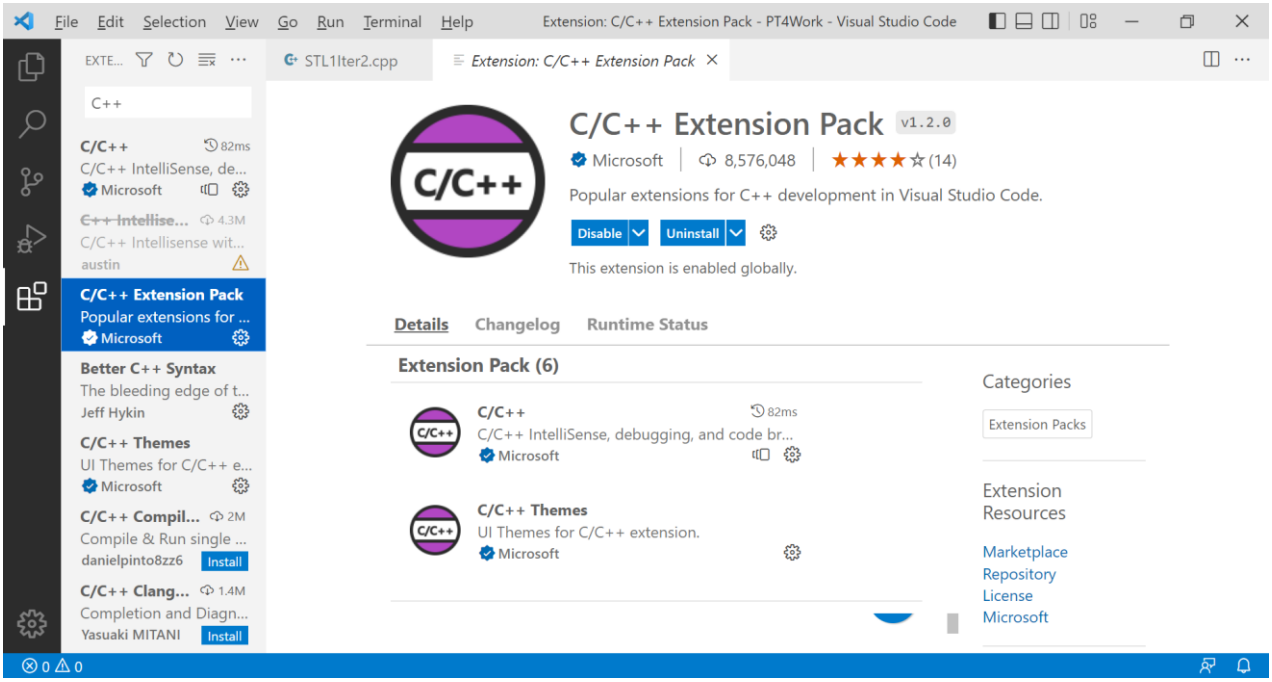
In the **VS Code** window, you can also change the dark color scheme to light. To do this, press the F1 key and enter the text **Color Theme** in the input field that appears**,** select text **Preferences: Color Theme** from the list of options, then select a new color theme from the list that appears, for example, **Light (Visual Studio)**.





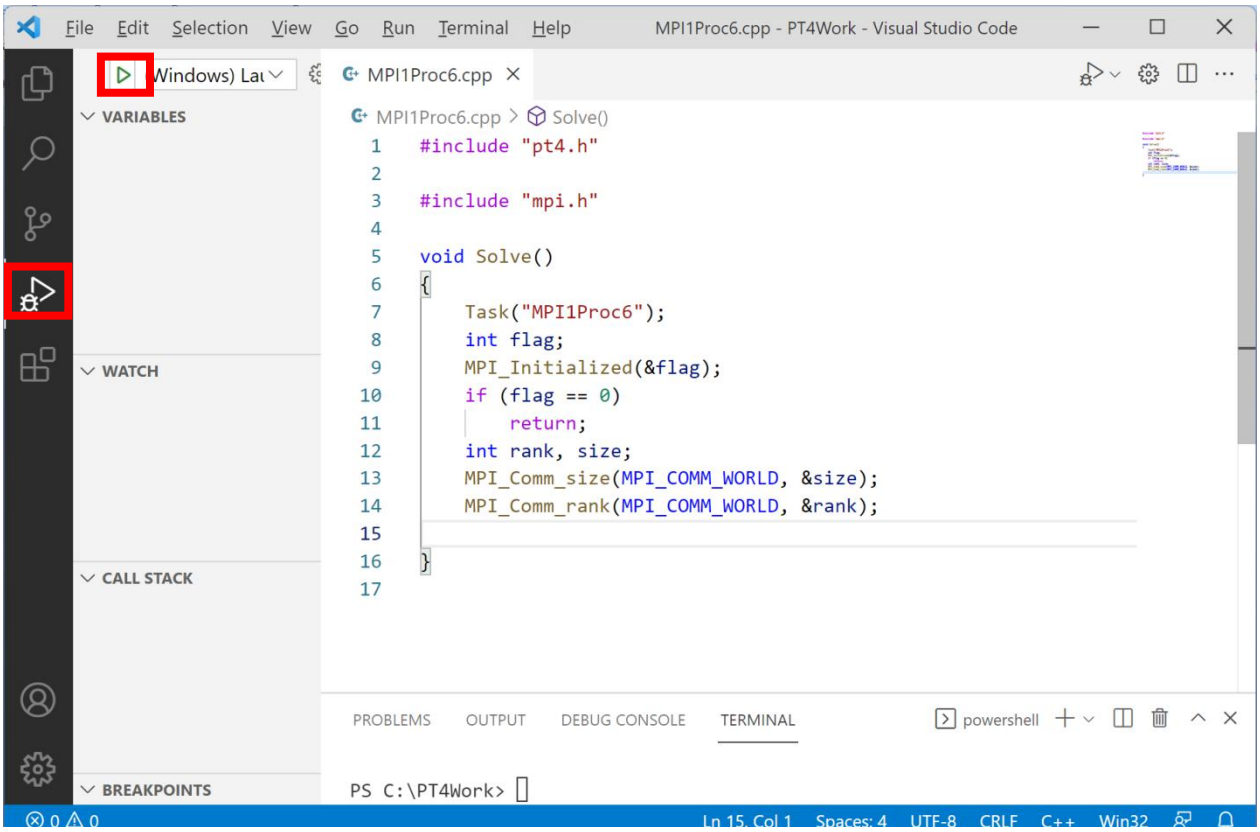
When loading a C++ program file for the first time, the **VS Code** editor will display a message asking if you want to install recommended extensions for C++: **Do you want to install recommended extensions for C++?** In response to this message you should select the option **Install**.

If the message with such a request does not appear, you should install the C++ extension yourself. To do this, go to **Extensions** mode in **VS Code** window (press Ctrl+Shift+X) and choose **C/C++ Extension Pack** (Microsoft) from the list of available extensions for C++ language and click **Install**. To get the list of extensions for C++, just enter the text **C++** in the search field at the top of the **Extensions** panel. Note that the required extension is listed third in the list of C/C++ extensions. The figure below shows the view of the window after successful installation of the extension.



As a result, the **VS Code** editor window will take the following form.

After the editor loads the extension for the C++ language, it will be possible to run programs in this language from it. To start, just press the F5 key. You can also go to **Run and Debug** mode (Ctrl+Shift+D) and click on the button with a triangle in the upper left corner of the window.



Features of performing tasks on parallel programming based on MPI technology will be described in lectures and seminars.

9. Running tasks in other development environments

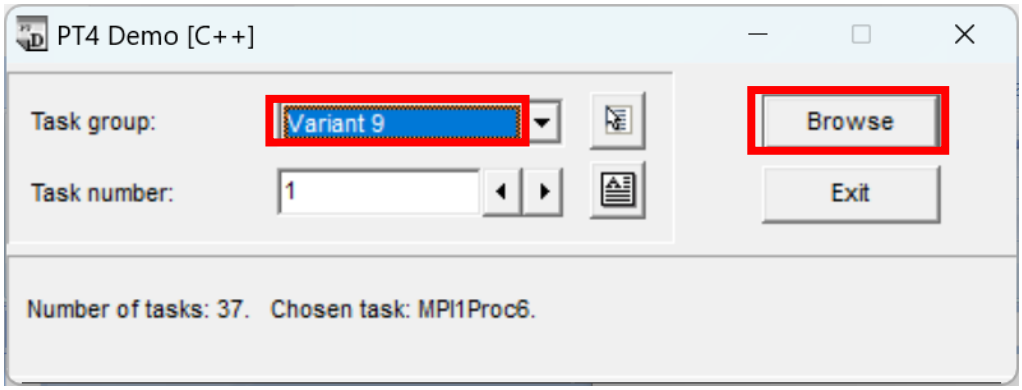
If you're having trouble setting up **VS Code e**ditor to run programs in C++, then you can use other environments to perform tasks, in particular, the **Dev-C++** environment.

The easiest way to select a new environment is to use *the context menu* of the **PT4 Load** program. If the directory contains an access certificate, you can only select an environment that matches the programming language specified in the certificate.

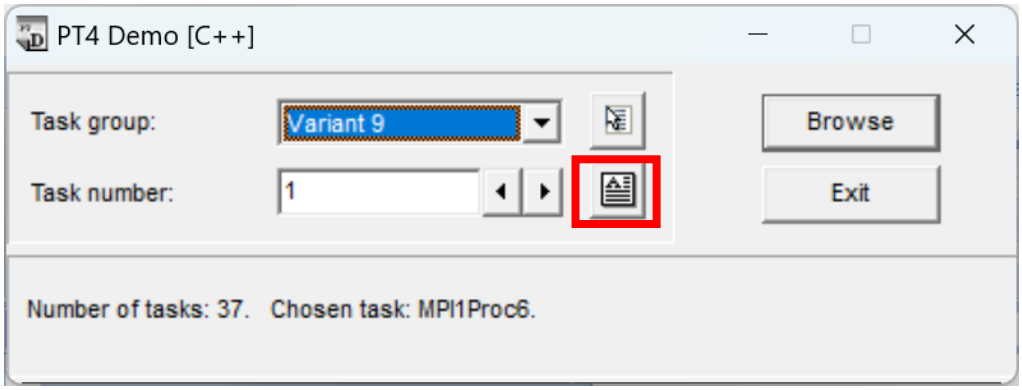
10. Viewing tasks in demo mode

Using the **PT4 Demo** program, you can quickly view all the tasks included in the option.

To do this, after launching the **PT4 Demo** program, select the item starting with the word **Variant** in the drop-down list and click on the **Browse** button.



You can also generate an HTML document with the wording of all the tasks included in the variant if you click on the button to the right of the **Task number** field or F2 key:



To close the **PT4 Demo** program , press the **Exit** button or the Esc key.

11. Checking and reviewing solutions by the teacher

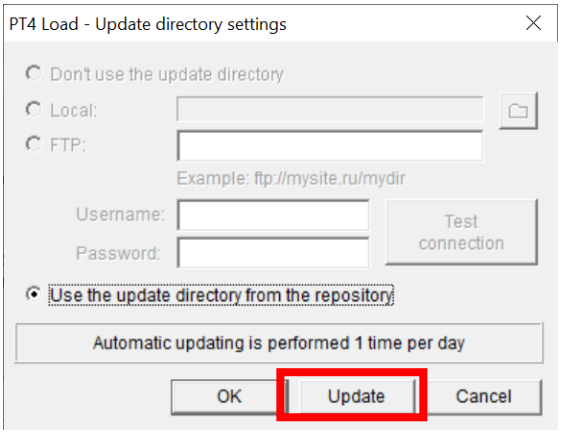
The teacher checks the programs with solutions uploaded to the repository, and if they meet all the requirements, he accepts them. If some problems have not yet been solved, then it marks them as *reviewed* (i. e., not containing the correct solution).

Information about the test results is automatically sent to the student and displayed on the screen when he launches the **PT4 Load** program. This information is saved in the `teacher.txt` file in the working directory.

If you have solved some task, but in the teacher. txt file sou see the information that the repository does not have a version with the correct solution (*No version in the repository with the correct solution*), this means that for some reason the correct solution was not sent to the repository.* In this case, load the program with the correct solution and run it again, making sure that the taskbook window displays a message stating that the program has been successfully saved in the repository. *If such a message does not appear, then slightly change the program text by adding an empty comment // to it, and run the program again. If this does not help, then contact your teacher.

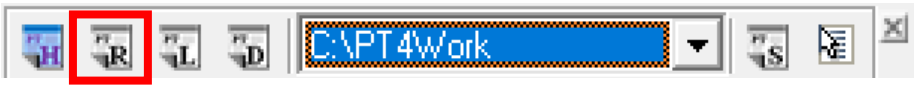
The repository is checked automatically by **PT4 Load** once a day, when it is first launched. You can also perform this check explicitly using the **Update command data** from the context menu of the **PT4 Load** window.

In this case, a window will appear on the screen in which you need to click the **Update** button.

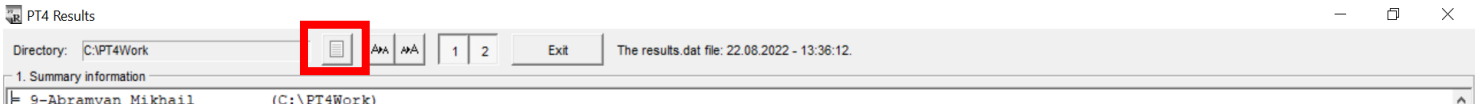


12. Viewing results using the PT4 Results program

You can view the results using the **PT4 Results** program by launching it from the **PT4 Panel** taskbar:



The same window will appear on the screen, which can be called up from the taskbook window by pressing the F2 key. If there is a `teacher.txt` file in the working directory, then you can view it by clicking on the first button at the top of the results window (or pressing the F2 key).



13. Toolbar features

The **PT4 Panel** toolbar of Programming Taskbook is always located on top of other windows on the screen and allows you to quickly launch all the taskbook's programs, as well as select one of the previously configured working directories. In addition, it allows you to launch the taskbook *help system* (button ) and select an option for this help system using the context menu (button ):

To launch all programs, *keyboard shortcuts are provided*, which are displayed on tooltips for the corresponding buttons.

Using the Home, Up, PgUp, End, Down, PgDn keys, you can move the toolbar to one of the corners of the screen working area or position it at the bottom or top center of the working area.

To close the toolbar, just press the X or Alt+F4 key or the **x** button located in the upper right corner of the toolbar.