CS 3005: Programming in C++

Image Menu Code Improvements

Assignment

In this assignment you will clean up the code in `image_menu.cpp` and `image_menu.h` to improve its structure.

The first change will be to add a new class `ActionData` to store all of the objects that functions commonly work on, such as the input and output streams, the PPM objects, the grid object, and the color table. This class will be used to replace the parameter lists of most of the functions in `image_menu.{h,cpp}`, especially those called by `takeAction()` or `imageMenu()`.

Potential Session

# There is no specific sample session for this assignment
# If you have completed the work correctly, all previous
# sample sessions will still work the same.

Programming Requirements

**ActionData** class

The `ActionData` class should be declared in `image_menu.h` and implemented in `image_menu.cpp`.

The `ActionData` class needs the following data members:

- `std::istream& mIS;` A reference to the input stream to read user input from.
- `std::ostream& mOS;` A reference to the output stream to display data to user.
- `PPM mInputImage1;` The “input image 1”.
- `PPM mInputImage2;` The “input image 2”.
- `PPM mOutputImage;` The “output image”.
- `NumberGrid* mGrid;` A pointer to the current grid-like object. Should be initialized to 0.
- `ColorTable mTable;` The color table object, should be initialized to the colors as described in the Color Table assignment.
- `bool mDone;` Is the user done or not.

The `ActionData` class needs the following methods:

- `ActionData(std::istream& is, std::ostream& os);` Initialize all data members. The color table should be size 16, and have the gradient from `Color(0,255,0)` to `Color(255,0,255)`. This is the same as was created in `imageMenu` previously. `mDone` should be initialized to `false`.
- `-ActionData();` If `mGrid` is not 0, delete it.
- `std::istream& getIS();` Return the data member.
- `std::ostream& getOS();` Return the data member.
- `PPM& getInputImage1();` Return the data member.
- `PPM& getInputImage2();` Return the data member.
- `PPM& getOutputImage();` Return the data member.
- `NumberGrid& getGrid();` Return `*mGrid`, a reference to the object pointed to by `mGrid`.
- `void setGrid(NumberGrid* grid);` If `mGrid` is not 0, delete it, then assign `mGrid` to `grid`.
- `ColorTable& getTable();` Return the data member.
- `bool getDone() const;` Return the data member.
- `void setDone();` Set `mDone` to `true`.

**ActionFunctionType**

Define `typedef void (*ActionFunctionType)(ActionData& action_data);` in `image_menu.h`.

**MenuData** class

The `MenuData` class should be declared in `image_menu.h` and implemented in `image_menu.cpp`.

The `MenuData` class needs the following data members:

- `std::vector<std::string> mActionNames;` A vector of action names users are allowed to use.
std::map<std::string, ActionFunctionType> mActionFunctions; // A map from action names to action function pointers.
std::map<std::string, std::string> mActionDescriptions; // A map from action names to action descriptions.

The MenuData class needs the following methods:

- **MenuData();** Constructor, no initialization required.
- void addAction(const std::string& name, ActionFunctionType func, const std::string& description); // Add name to mActionNames, name:func to mActionFunctions, and name:description to mActionDescriptions. If name has already been added, do nothing.
- const std::vector<std::string>& getNames() const; // Returns the data member.
- ActionFunctionType getFunction(const std::string& name); // If name is registered, return the function pointer. Otherwise, return 0.
- const std::string& getDescription(const std::string& name); // If name is registered, return the description. Otherwise, throw an exception. The exception should be a std::string with the value “Action NAME has no description.”, where NAME is the value of name.

### image_menu functions

Replace the parameter list for the functions of image_menu with ActionData& action_data. This will require replacing the previous parameters in the function body with a call to the getter method. For example input_image1 would be replaced with action_data.getInputImage1().

A few of the functions also receive the MenuData object. Here is a partial list of the functions to change. This includes some of my solutions to previous exam questions. You don’t have to add them if they aren’t already in your code. But, if they are, update them, don’t delete them.

- std::string getString( ActionData& action_data, const std::string& prompt );
- int getInteger( ActionData& action_data, const std::string& prompt );
- double getDouble( ActionData& action_data, const std::string& prompt );
- int assignment1( ActionData& action_data );
- short getShort( ActionData& action_data, const std::string& prompt );
- int inquisitor( ActionData& action_data );
- void writeUserImage( ActionData& action_data );
- int assignment2( ActionData& action_data );
- int four_square( ActionData& action_data );
- std::string getChoice( ActionData& action_data );
- void commentLine( ActionData& action_data );
- void setSize( ActionData& action_data );
- void setMaxColorValue( ActionData& action_data );
- void setChannel( ActionData& action_data );
- void setPixel( ActionData& action_data );
- void clearAll( ActionData& action_data );
- void drawDiamond( ActionData& action_data );
- void drawCircle( ActionData& action_data );
- void drawBox( ActionData& action_data );
- void drawTestPattern( ActionData& action_data );
- void drawSquare( ActionData& action_data );
- void plus( ActionData& action_data );
- void plusEquals( ActionData& action_data );
- void minus( ActionData& action_data );
- void minusEquals( ActionData& action_data );
- void times( ActionData& action_data );
- void timesEquals( ActionData& action_data );
- void divide( ActionData& action_data );
- void divideEquals( ActionData& action_data );
- void plusEqualsInt( ActionData& action_data );
- void blendImages( ActionData& action_data );
- void timesEqualsPPM( ActionData& action_data );
- void configureGrid( ActionData& action_data );
- void setGrid( ActionData& action_data );
- void applyGrid( ActionData& action_data );
- void applyGridColorTable( ActionData& action_data );
- void setFractalPlaneSize( ActionData& action_data );
- void calculateFractal( ActionData& action_data );
These functions have additional changes:

- void readUserImage1( ActionData& action_data ); This is a copy of readUserImage() from before, but operates on action_data.getInputImage1();
- void readUserImage2( ActionData& action_data ); This is a copy of readUserImage() from before, but operates on action_data.getInputImage2();
- readUserImage() Remove
- void takeAction(const std::string& choice, MenuData& menu_data, ActionData& action_data); Calls getFunction() from the menu data, which returns a function pointer. If the function pointer returned is 0, send the message “Unknown action ‘CHOICE’.” to the output stream from action data, where CHOICE is the user’s choice. If the function pointer return is not 0, then call the function at the function pointer, with action_data as the parameter.
- void showMenu( MenuData& menu_data, ActionData& action_data ); Retrieves the list of action names from menu_data, loops over them, displaying a line of the name, “)”, and the description for each name. The display goes to the output stream from action_data. That’s it.

These functions are new. They are mostly created to operate on the data members inside ActionData. For example copyImage() will do action_data.setOutputImage() = action_data.getInputImage1(); as its function body. These were mostly 1 line statements in the previous takeAction() if/else chain.

- void quit( ActionData& action_data ); Calls setDone();
- void copyImage( ActionData& action_data ); Copies input image 1 to output image.
- void grayFromRed( ActionData& action_data ); Sets output image to the red gray filter of input image 1.
- void grayFromGreen( ActionData& action_data ); Sets output image to the green gray filter of input image 1.
- void grayFromBlue( ActionData& action_data ); Sets output image to the blue gray filter of input image 1.
- void grayFrom linearColorimetric( ActionData& action_data ); Sets output image to the linear colorimetric gray filter of input image 1.
- void sepiaFilter( ActionData& action_data ); Sets output image to the sepia filter of input image 1.
- void rotateColorFilter( ActionData& action_data ); Sets output image to the rotate color filter of input image 1.
- void tealFilter( ActionData& action_data ); Sets output image to the teal filter of input image 1.
- void verticalEdgeFilter( ActionData& action_data ); Sets output image to the vertical edge filter of input image 1.
- void horizontalEdgeFilter( ActionData& action_data ); Sets output image to the horizontal edge filter of input image 1.
- void configureMenu( MenuData& menu_data ); Calls addAction() for all functions that need to be callable from takeMenu(). For the actions use the user action as the name, such as “copy” or “julia”. For the function use the correct function, such as copyImage() or setJuliaFractal(). For the description, use the string that used to be displayed in showMenu(), without the “name” piece. For example “Copy input image 1 to output image.” or “Choose to make a Julia set.”.

All of the set•Fractal functions, such as void setJuliaFractal( ActionData& action_data ) need to be updated. Their body is very simple now: action_data.setGrid(new JuliaSet()); This is because setGrid() will delete the old pointer for us. All of these functions need to be added to the menu in configureMenu(). imageMenu() will be changed internally, but not the parameter list.

- int imageMenu( std::istream& is, std::ostream& os ); This function should be simplified now. For initialization it will complete these steps: It creates an ActionData object, using the is and os passed to it for initialization. It also creates a MenuData object, then calls configureMenu() on it. It also calls setGrid() on the ActionData object with a new JuliaSet() as the parameter. Now the while loop will continue while the action data objects is not done and the action data object’s input stream object is good (action_data.getIS().good()). Inside the loop, call showMenu(), getChoice() and takeAction(). That’s it.

Additional Documentation

- C++ Reference
- Examples from class
Show Off Your Work

To receive credit for this assignment, you must

- complete the unit tests available in CodeGrinder (if available)
- use git to add, commit and push your solution to your repository for this class.

Additionally, the program must build, run and give correct output.

Extra Challenges (Not Required)