

Math 157 Sample Final Exam Questions

The final exam is Wednesday, March 18, 2009, 9:00pm-11:00pm MS 6201

[1] In the assignments involving GUI programming, you used the class QLineEdit for input and output. Data was obtained from QLineEdit instances using the text() member functions. When dealing with numerical data, it is clearly desirable to read the numerical data directly from the widget; i.e. have member functions available such as getDouble() or getInt(). How would you create a class that behaves like a QLineEdit widget but has the additional feature of member functions such as getDouble() and getInt()?

[2] In modern GUI programming, it is primarily through (or by) _____ that we obtain the functionality provided by high level class libraries (such as _____). This mechanism for obtaining functionality from a class library has not been widely used in scientific/technical computation. One reason for this is that it requires a language which supports _____, and this is not present in FORTRAN. Additionally, one must create class libraries in a particular way; and this uses programming constructs which most "established" programmers in scientific and technical computation are unfamiliar with. It's possible (though not yet fully established) that class libraries will be an effective means of "packaging" scientific/technical computational routines so that they can easily be used. If this is true, then there is lot's of work to be done on appropriate class design and class implementation. However, we don't want to re-write implementations and so we will probably become very good at learning how to _____

[3](a) Describe two ways in which the time taken in a "cpu intensive" component of an application can be reduced.

(b) In a Qt based GUI, how are the associations between the main window and child widgets (controls, buttons, etc.) implemented? (The programming construct.)

(c) Describe the difference between a static library and a dynamically linked library.

(d) Why is there the convention of placing class declarations in .h files and class implementation code in .cpp files?

Problems [4] and [5] concern the design of an application that will allow first quarter calculus students to test their ability for differentiating polynomial functions. In problem [4], you are asked to design and document the application. In problem [5] you are asked to design a polynomial function class, that, if implemented, would provide the computational capability that your application requires. These problems are inter-dependent, and it is expected that you will work on them simultaneously.

[4] You are given the task of constructing software that will allow first quarter calculus students to test their ability for differentiating polynomial functions. The student should be presented with a polynomial function (of modest degree), have the capability for entering the derivative, and then have that answer checked. The program should be able to determine the correctness of the students response and also be able to present the student with the correct answer.

On the following pages give the answers to parts (a),(b) and (c). After you have completed (a)-(c) please answer question (d)

(a) A sketch of the user interface.

(b) A “high-level” class diagram that indicates the classes used to construct your application.

(c) A state diagram which exhibits the dynamic behavior of the application.

(d) Your application is set up to work with polynomial functions; what could be done (or was done) to your application design that would facilitate a future modification to allow for general mathematical expressions?

[5] Give a complete class diagram for a polynomial function class that, if implemented, would provide computational capability for the application in problem [4]. Please limit your description to include only those data attributes and member functions that are required for the problem [4] application.