These questions ask you to use UML Class and Object models to describe various software designs. The grade weight for each question is equally distributed, except where noted. Note that you may be graded on programming style as well as the functional correctness of your program. *Use concepts of good style and object-oriented design (as much as you know them) when you complete this assignment.*

For questions that ask you to draw a class diagram, you must submit either a Word document or PDF document with your design. If you use a package that outputs your diagram as a picture, you can either paste that picture into word, or print the picture to a PDF. *Do not forget to put your name on that part of your submission.*

1. **To Coin a Phrase (30 points)**
   
   **1.1 Got Any Change? (15/30 points)**
   
   Create a UML class diagram that shows the static structure of the *distributed* code for Homework 1, Question 2. You do not need to include the `main` function from `example.cpp`, and you only need to provide members of the “Big Four” for constructors that are non-default.

   **1.2 Object of One’s Affection (15/30 points)**

   Create a UML object diagram that shows the dynamic structure of the example *executable* distributed for Homework 1, Question 2, *just after* line 22:

   ```
   22: std::cout << ex.run() << std::endl;
   ```

   This object diagram should show all existing objects, and their attribute values after line 22.

2. **Conn-Sonar—Crazy Ivan! (20 points)**

   Signals are an important domain of Electrical and Computer Engineering. Provide a class diagram that shows how a signal might be composed of various measurements that are time stamped. Use the names `Signal`, `Value`, and `Time` as important features of your design. You should be able to have time/value pairs that say what a signal is doing at a certain point in time. Further, be aware that some signals are sparsely populated (i.e., you have irregular sampling of the signal), but the timing is still important.

   As in the previous question, members of the “Big Four” can be omitted from the class diagram, unless they have a non-default constructor.

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*You can arbitrarily choose a value for the coin toss as either true or false.*
3 Acceleration Station (30 points)

An accelerometer is a useful device for robotics, autonomous system, avionics, space, and other applications. Consider that an accelerometer produces the following values:

- Linear acceleration in $x, y, \text{ and } z$
- Angular acceleration in $\phi, \theta, \text{ and } \psi$

There are properties of an accelerometer as well, which can be important to know, and are true for all values produced by the accelerometer:

- Offset from center of mass of vehicle, in $x, y, z$
- Size of the sensor enclosure in 3 dimensions (assume it has rectangular faces that intersect at right angles)
- Orientation of enclosure to the vehicle’s direction of travel, in 3 angular offsets

Provide a class diagram that shows how an accelerometer class might be designed to encapsulate these values, as well as the properties of an accelerometer. On the same class diagram, reuse your design from Question 2 as best as you can, to show how to turn data produced by an accelerometer object into a signal using concepts of class diagrams.

As in the previous question, members of the “Big Four” can be omitted from the class diagram, unless they have a non-default constructor.

4 My ge-ge-ge-ge-Generation (20 points)

On the website you will find a collection of classes in a distribution archive for this homework. These classes specify the organization of C++ header, and implementation, files.

Structure (20/20 points)

Create a UML class diagram that gives the structure of the distribution archive classes for this question. You only need to provide members of the “Big Four”, if the constructor is non-default.