

CSE 460
Software Analysis and Design
(Fall 2022)

Homework #4

Assigned: October 17, 11:59 pm

Due: October 26, 11:59 pm

Posting ID |_|_|_|_|-|_|_|_|_|

Note 1: Your submission to **Gradescope** must include the above header shown in maroon color. Do not include your name in your submission.

Note 2: Homework is to be done individually. You may discuss the homework with your fellow students, but you are NOT allowed to copy – either in part or in whole – anyone else’s answers. You are also encouraged to meet the TA, UGTA, and instructor.

Note 3: All submitted materials must be legible. Text-based answers must be typed. Figures/diagrams must follow the given instructions.

Note 4: Please check the Canvas Discussions for further instructions, questions, answers, and hints.

Note 5: The format Hw#-PostingID.pdf (e.g., Hw1-1234-987.pdf) should be used for naming homework assignment files.

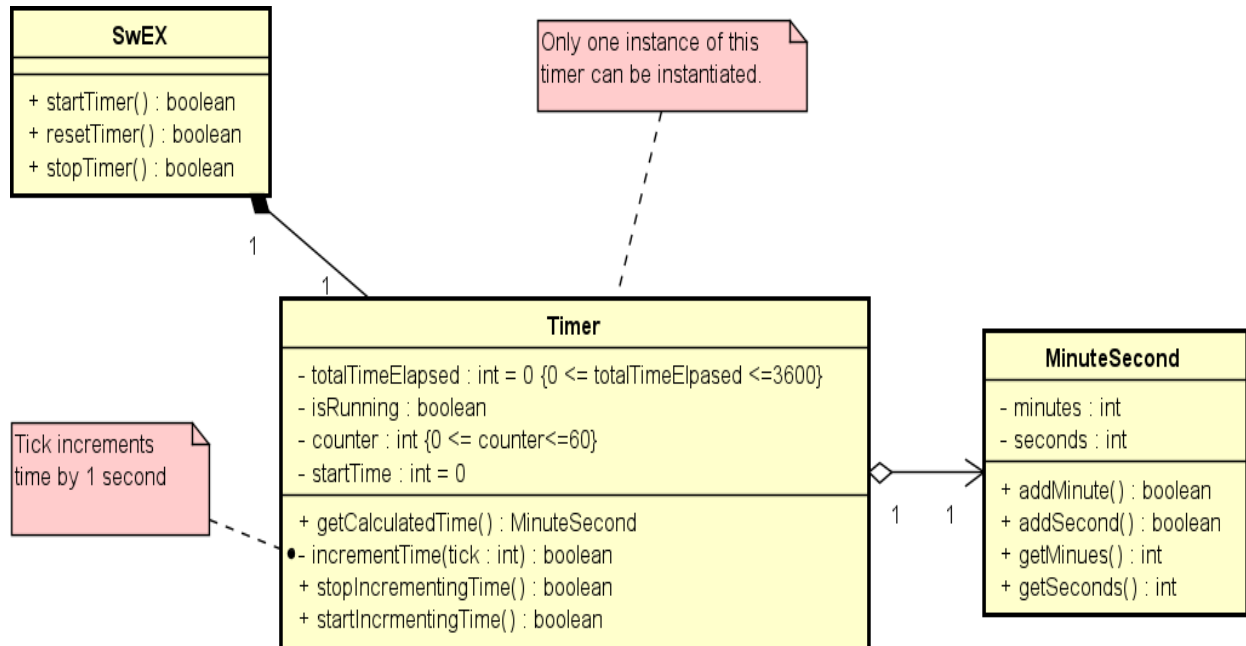
1. [54 points] A stopwatch that measures the passage of time in minutes and seconds was considered in homework assignment 2. The measurement of time is independent of the time the stopwatch starts (i.e., the passage of 27 minutes is the same whether or not the stopwatch starts at 10:10 am or 22:22 pm). This stopwatch is for the planet Earth (https://en.wikipedia.org/wiki/Solar_System).

Suppose an experiment should be carried out on two fictitious planets EarthX and VenusX using their stopwatches called SwEX and SwVX, respectively. Both experiments should start at the time. If an experiment on EarthX takes n minutes and m seconds, the duration of this experiment on VenusX should be the amount of time it takes on EarthX. Assume a day on EarthX is 24 hours, the same as planet Earth. A day on VenusX is 12 hours as measured on EarthX. The passage of time for SwEX on EarthX should be calculated separately from the calculation of the passage of time for SwVX and VenusX.

Below is a UML class diagram defined for a stopwatch for EarthX. The class diagram with partially generated source code is provided in the “CSE460 Hw4 F2022.zip” file. This zip file is available in Canvas.

Assumptions:

- The maximum amount of time that can be calculated on EarthX is sixty minutes and zero seconds.
- Do not include classes for displaying the passage of time.
- Do not include button classes for starting, resetting, and stopping stopwatches.
- The passage of time on EarthX is calculated at 1 second intervals.



To Do:

- Develop UML class diagram(s) for the VenusX stopwatch. Name this class SwVX.
 - Answer should include one class that has the attributes and methods that can be common for SwEX and SwVX. Provide an appropriate name for this class.
 - Answer should include a detailed specification for each class – a *definition* with the settings for the *Visibility*, *Abstract*, and *Leaf* elements (see the Base tab for class).
 - Answer should include a detailed specification for each attribute – a *definition* with the settings for the *Type*, *Initial Value*, *Visibility*, *ReadOnly*, and *Multiplicity* elements (see the Base tabs for attributes).
 - Answer should include a detailed specification for each method – a *definition* with the settings for *Return Type*, *Visibility*, *Abstract*, and *Leaf* elements (see the Base tabs for methods).
- Provide the source code files generated from the class diagram(s) using Astah forward engineering.

Note: The settings for the classes, attributes, methods, and relationships elements should be chosen (i.e., designed for). Their default settings are not necessarily appropriate, correct, or complete.

2. [20 points] Interfaces are essential for designing high-quality developing software systems. Name and describe two of their benefits compared to the *abstract* and *concrete* classes.
3. [20 points] Revise the specification in Problem 1 using at least one interface. The elements of this specification should have detailed specifications as in problem 1.

[6 points] Submission and Formatting: Submission is only for Gradescope. The submitted pdf file has the UML class diagrams, texts, and the code generated from the UML specifications. The class diagrams should have suitable visual layouts with texts. The UML diagrams should be readable. The content of the PDF file should be ordered as follows:

- 1) Problem 1
 - 1.1 Class diagram(s)
 - 1.2 Code generated from the class diagram(s)
- 2) Text for Problem 2
- 3) Class diagram(s) for Problem 3