H63ESD Coursework 2 (65%)

Due date: Wed 20 Apr 2016 (Week 12)

Zip your report and codes (if any) together and submit into the coursework link

Previously in CW1, this was the vague description of the requirement:

The experiment involves a container that should be filled with water to ¾ of its capacity. A heavy dense object will be dropped into the container and it will sink to the bottom of the container. The object is expected to be totally submerged in water. Peter's client, Takahashi, wants to find out the answers to two questions: 1) will water overflow the container? And 2) how much will the water level increase?

REVISED REQUIREMENT

This is now the revised requirement from Peter (for Coursework 2):

Apparently, Takahashi the client, is the director of a construction company. He has secured a project to build one large water container that supplies water to a small community.

Large Water Container

The large water container is cylindrical in shape. It is intended to store up water to about 75% of its capacity. Two rather large rectangular-box shaped sensor modules need to be placed inside. You should make sure the water does not overflow. Provided the water does not overflow, then subsequently special stones each in the shape of a cylinder will be deposited into the container to keep the water clean. As many stones as possible will be deposited one at a time until the water level is at the brink of overflowing (i.e., adding another stone will cause the water to overflow). You should help determine the number of cleansing / purifying stones.

Now Peter the consultant, wishes to build a model of the water container that is about 100 times smaller than the actual container. All the dimensions of the container, the box-shape sensor modules and cylindrical stones will be measured in centimeters (cm), accurate to within one decimal point, using a ruler. Your program should however be able to cope easily with the storage of the measured dimensions in cm as **integers** for the actual water tank that is >100 times larger (since the extra precision provided by the decimal point is not required for such a big tank).

For this coursework (CW2), note that marks are NOT directly given for writing this new program. Instead, you should answer according to the following topics that are related to the learning outcomes of H63ESD. However, you will find that you can get extra marks / bonus marks if you manage to successfully relate your new program to the learning outcomes.

Design patterns (20%)

With reference to "Design Patterns" by Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Addison Wesley publisher, (20th Print – 2000), found in our library, there are 23 design patterns that were catalogued in their book. Out of these 23, there are 5 **Creational Patterns**.

Please review and write a short report (1-3 pages for each pattern) for the **Singleton** and one of the following Creational Patterns:

1. **Abstract Factory,**
2. **Builder, and**
3. **Factory Method.**

Please cite one or more examples of usage with codes written and verified by yourself. 2% is automatically awarded for each pattern that you have incorporated / implemented in your NEW program for Peter and Takahashi. Each pattern is allocated 10%.

Marks breakdown for each pattern:

- Short description of the pattern (5%)
- One good example (either in your program [please provide justification why is it appropriate to use that pattern] or in an unrelated example) (3%)
- Pattern being used in the program (2%)

Templates (20%)

Please write a short report of 1-4 pages on:

1) why you think that there is a need or a clear benefit of writing templates (in general and/or for your NEW program) [15%]
2) how do templates solve particular design challenges in the new requirements [5%]. You should make reference to your codes by:
    a. giving the line numbers of your codes; and/or
    b. clearly commenting your codes and/or properly highlighting or bolding your codes.

Data Structures (25%)

Provide a short report of 1-3 pages (for each data structure) on the following:

1) A review of **two** data structures from these (10% each): Vector, List, Queue, and Stack, including at least one good coding example and the benefits of using them. Please ask Dr Lim if you want to review a different data structure.

    [20 marks]

2) Have you been able to use one or both of the data structures to write the codes with the revised specifications? If yes, state the line numbers of the data structure (2%) and briefly describe the benefits that are reaped by using your approach (3%).

    [5 marks]