The University of Melbourne

Department of Computing and Information Systems

SWEN30006 Software Modelling and Design

Semester 1 Exam 2017

Reading Time: 15 minutes
Writing Time: 2 hours
Total marks for this paper: 120

This paper has 8 pages including this page.

Authorised materials: No materials are authorised.

Instructions to invigilators:
Each student should initially receive a script book.

Instructions to Students:

- Answer all questions.
- The marks for each question are indicated at the beginning of each question.
- The marks are an indication of how much time should be spent on the question.
- *Clearly number* each question.
- Make sure that you add your student number to each answer script.

This examination contributes 60% of your total marks for the subject.

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Question 1. [15 marks]

Briefly define each of the following terms and explain its importance in relation to software design:

1. Representation gap
2. Coupling
3. Cohesion

Question 2. [6 marks]

Describe the controller pattern, including the options the pattern provides. Use the example below to illustrate these options, and justify which is the best choice in this case.

> A proposed call centre software system will be used by operators who work with the system for long periods every day. The use case which takes up most of the operators' time is complex and supports many different interactions. The system also provides for a substantial set of administrative capabilities and a set of reporting capabilities.

Question 3. [6 marks]

An application requires a small number of sophisticated statistical analyses to be applied to data sets generated with the application. A highly configurable, comprehensive statistical package with a complex interface is available which is more than capable of supporting the required analyses. Which software pattern would assist in designing for this situation and why?

Question 4. [7 marks]

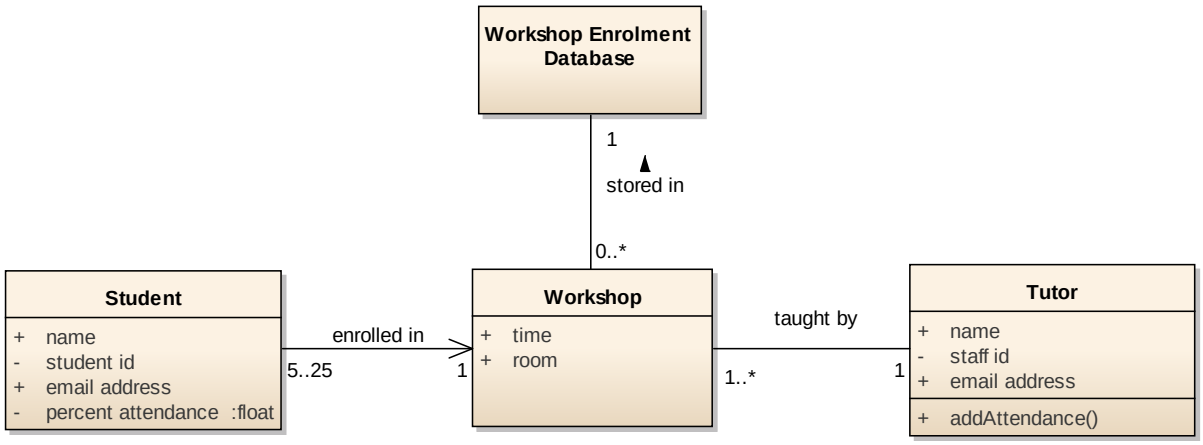
Describe a layered architecture and the advantages it provides from a design perspective, using a three-layer architecture as an example.

Question 5. [6 marks]

Describe the Inception phase of a software project, and its key outcomes and artefacts.

Question 6. [10 marks]

Identify five elements of the following domain model which should not be part of a domain class diagram.

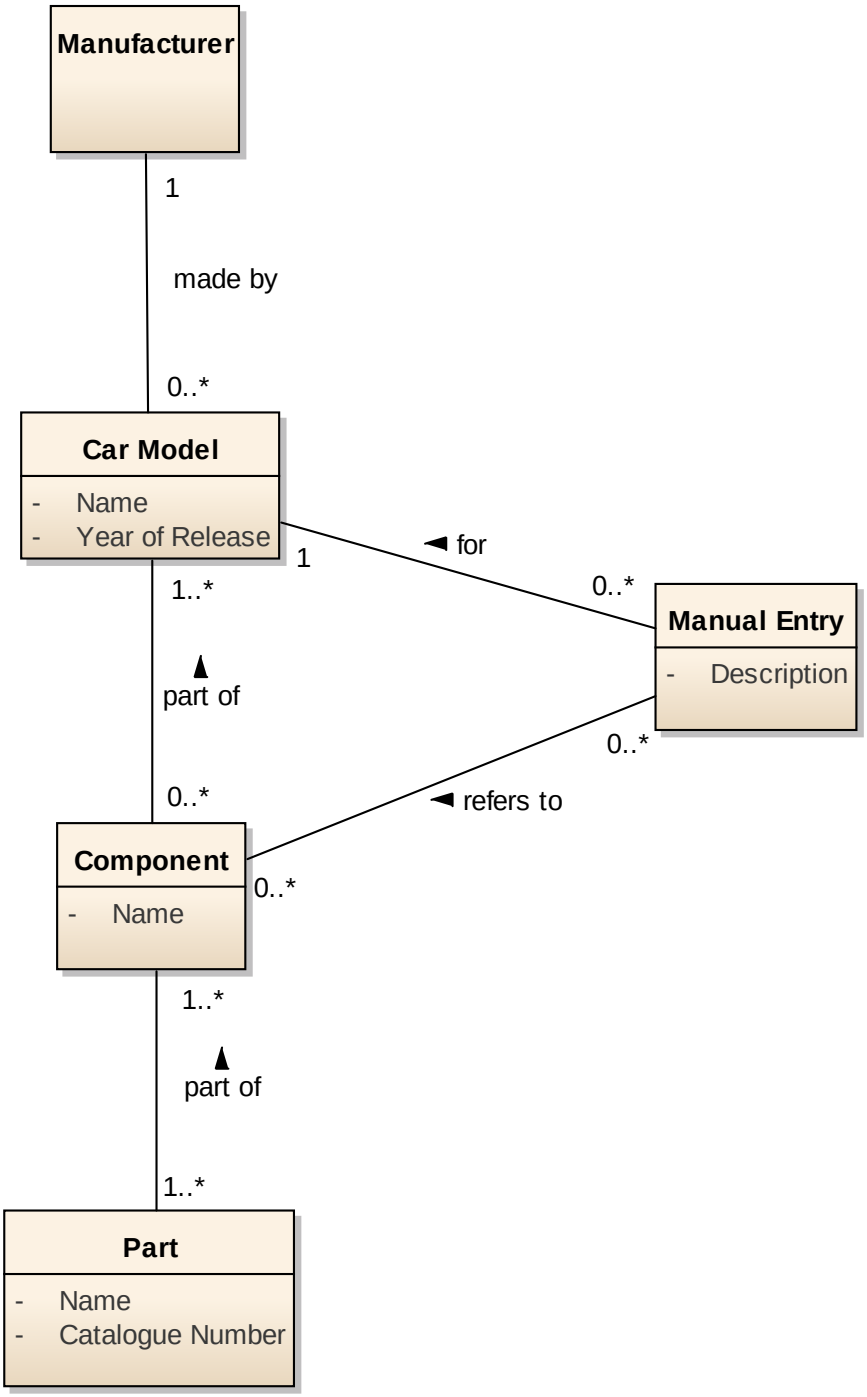


Question 7. [20 marks]

This question relates to the diagram which follows, showing a partial domain model for a car mechanics' repair library.

Below is a list of proposed changes to the repair library. For each change, describe precisely or draw the corresponding change (if any) that should be made to the repair library domain diagram. Each change is independent, and should be applied to the original diagram. You should not redraw the whole diagram.

a. [2 marks] There is a list of standard body types, including "sedan", "coupe", and "station wagon". The library domain model should include the body type for every car model.
b. [4 marks] Every component is tied to a particular car model; if a car model is removed, all the corresponding components are also removed.
c. [7 marks] Some car models are part of a series. (They can only be part of one series.) A series has a name, and the car models in that series are ordered. There is also a list of shared manual entries that apply across all car models in that series.
d. [7 marks] Complex components can be made up of other components, including complex components and/or parts. There's no particular limit to the number of layers in the component hierarchy.



Question 7: Partial Domain Model

Question 8. [10 marks]

Draw a use case diagram for the system outlined below.

An online news organisation runs a site that hosts blogs written by journalists with expertise in a particular area such as crime or real estate. If the organisation agrees to host a journalist, the administrator creates a blog specifically for that journalist, a process that involves checking the journalist's credentials with an external Author Validation service. Any member of the public can read blog entries and post comments. Authors can also read blog entries and post comments while blogging. An update of the system is planned that adds security to blog creation, requiring the editor to authorize the account creation.

Question 9. [20 marks]

The passage below describes a mine pump system. The sentence numbering is provided to make it easier for you to track the various elements of the description. Draw a state machine diagram for the mine pump system, based on this description.

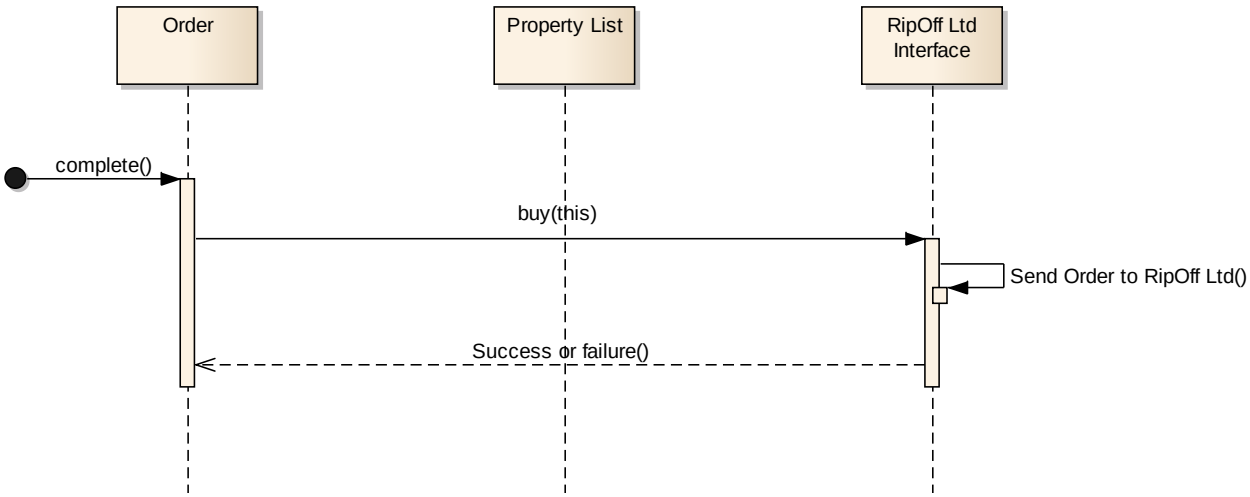
1. The mine pump system is designed to safely maintain the water level in an in-mine reservoir.
2. The system monitors regular updates on the current water level: *update(level)*.
3. If the water level is detected to drop below *min_level*, the pump will start pumping water in until the level reaches *min_level + lower_threshold*.
4. If the water level is detected to rise above *max_level*, the pump will start pumping water out until the level reaches *max_level – upper_threshold*.
5. When the pump is running, it may *overheat*, in which case it will suspend pumping for a period of *cooldown* seconds, before continuing.
6. At any stage, if gas is detected (*gas_detected*), the pump system will perform an emergency shutdown, and will remain in the shutdown state until the *safe_restart* signal is received. It will then go back to normal monitoring of the water level.

Question 10. [20 marks]

This question requires you to draw a sequence diagram, based on the description below.

A bulk food broker FoodIsUs buys bulk food items like flour and rice on behalf of bakers, restaurants and similar organisations. They run a number of sites, connected to their central administration. Until recently, FoodIsUs have bought bulk foods through a single supplier, RipOff Ltd, but were surprised to find they were not getting good market prices. They plan to modify their purchasing system to allow them to dynamically switch suppliers, based on analysis from central administration. When a new purchase is to be made, it should be made from the supplier specified by central administration; a background process will update a property list to provide the name of the adaptor class to be used to access that supplier. A singleton factory should be used to create the adaptors.

Below is a partial sequence diagram showing how a FoodIsUs site currently sends orders through to RipOff Ltd. Your task is to show, using a modified sequence diagram, the sequence of actions that will occur once you have modified the purchasing system according to the description above. Your sequence diagram should include notes to explain how it matches the description.



End of the Exam Questions

End of the Exam Paper