

The University of Melbourne
Department of Computing and Information Systems
SWEN30006 Software Modelling and Design
Semester 2 Exam 2016

Reading Time: 15 minutes

Writing Time: 2 hours

Total marks for this paper: 120

This paper has 10 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.

This page intentionally left blank.

Question 1. [8 marks]

- a. Define “representation gap” and explain its importance in software design
- b. Define “refactoring” and explain its importance in agile development

Question 2. [6 marks]

List two elements present in UML design class diagrams but not present in UML domain class diagrams. For each, explain what the element is and why it should not appear in a domain class diagram.

Question 3. [6 marks]

“There is no point commencing design until we have a complete set of use cases, a complete domain model and a full set of system sequence diagrams”.

Is this ever a valid position to take? What is the alternative? Discuss.

Question 4. [6 marks]

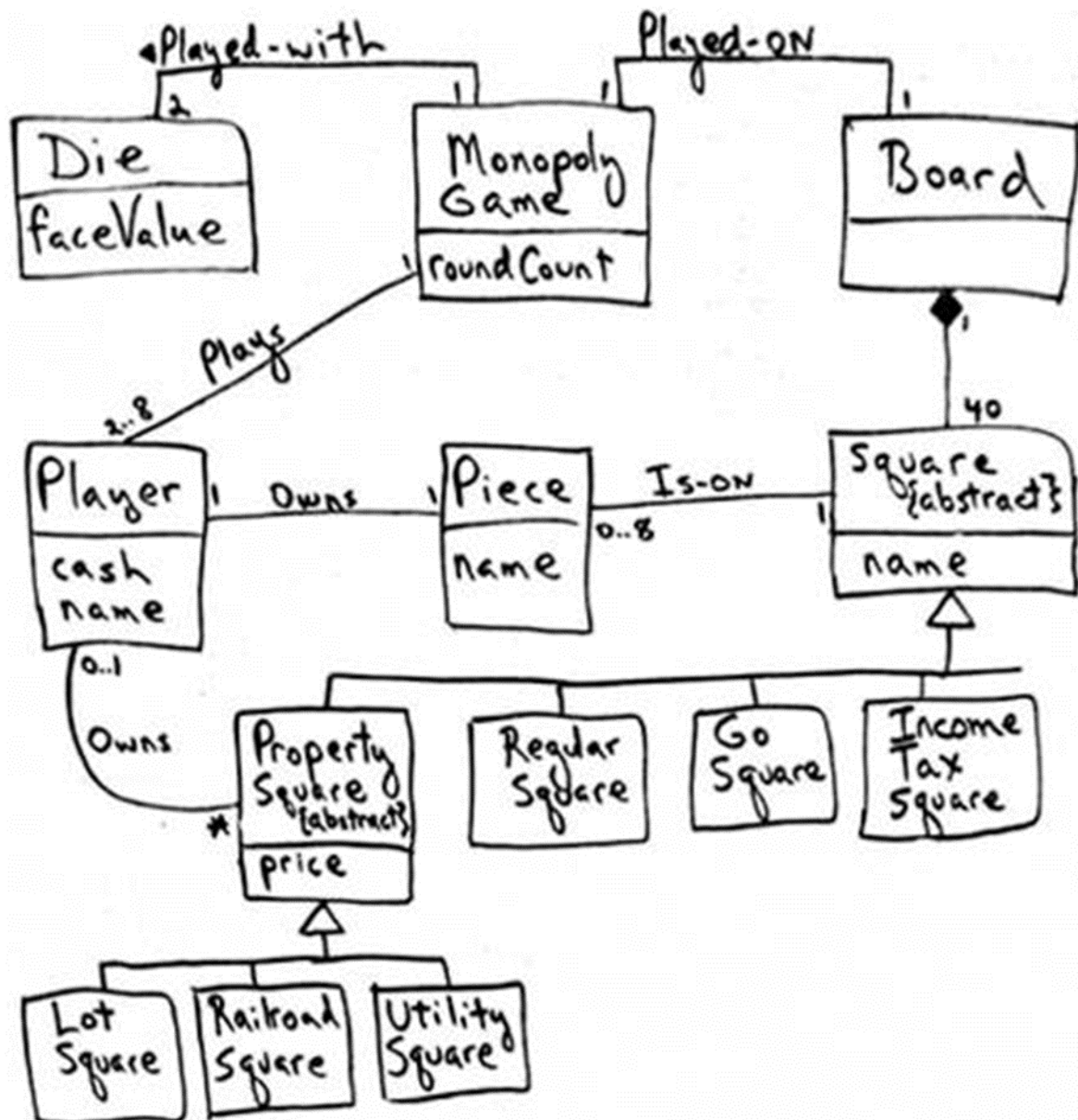
Describe the purpose of UML sequence diagrams and UML communication diagrams, explain how they differ, and provide reasons why you might choose one over the other.

Question 5. [9 marks]

Describe protected variations, variation points, evolution points, and the role they play in the tradeoff between brittle and overly generalized designs.

Question 6. [20 marks]

This question relates to the following domain model. This is the iteration-3 domain model for the Monopoly case study from Applying UML and Patterns, 3rd Ed. by Larman.

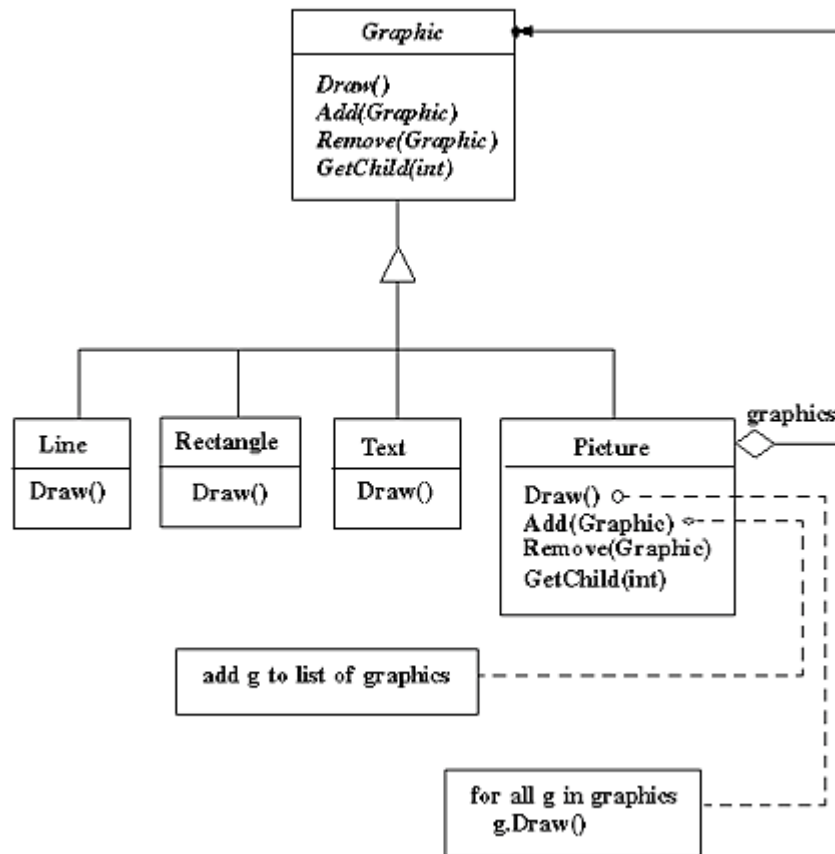


Below is a list of changes to the Monopoly game. For each change, describe precisely or draw the corresponding change (if any) that should be made to the Monopoly domain diagram. You should not redraw the whole diagram.

- a. [3 marks] A new move rule is introduced. If a Player P is about to move their Piece to a Square, and there is already another Player's Piece on that Square, Player P will instead move their Piece to the next Square without a Piece already on it.
- b. [3 marks] One of the Railroad Property Squares is replaced by another Income Tax Square.
- c. [6 marks] A new kind of square called a Park is created; there are four different Parks. Every Player is required to choose their favourite Park at the start of the game (they can choose the same Park if they wish).
- d. [8 marks] *For this change you should assume that (i) all turns (whoever's turn it is) are numbered in sequence starting with 1, and (ii) Properties can be bought and sold by Players, and once a Property has been bought, it will always be owned by some Player.* New rules are introduced that depend on knowing for which turns a particular Player owned a Property. An example of such a rule is: a previous owner of a Property who lands on that Property gets a discount on rental based on the total number of turns for which they owned the property. Note that the simple existing concept of ownership should not get lost in your proposed changes.

Question 7. [9 marks]

Identify the primary pattern represented in the example shown in the class diagram below. Clearly state the problem that this GoF pattern solves and how it solves it.



Question 8. [38 marks]

The following questions refer to the passage below which describes the Pennand ATM (Automated Teller Machine). The sentence numbering is provided to make it easier for you to track the various elements of the description.

1. The ATM allows an account holder to conduct transactions (withdrawal or deposit).
2. When the ATM is idle, they can insert their transaction card; the ATM will authenticate (via the banking network) their id/account from the card.
3. They then select the transaction type.
4. If the transaction is a withdrawal, they then enter the amount; if their account has sufficient balance (checked via the banking network), the ATM dispenses the amount in cash.
5. If the transaction is a deposit, the customer inserts a sealed envelope containing the cash into the deposit slot; the envelope is captured and stamped by the ATM.
6. A transaction can be cancelled at any point, prior to start of the ATM dispensing cash or accepting an envelope.
7. A successful transaction is recorded via the banking network.
8. Whether or not a transaction is successfully completed, the ATM will return the account holders transaction card, before returning to the idle state.
9. The Pennand ATM also has features designed to support ease of use and maintenance.
10. If the ATM at any stage detects a fault, it switches itself into out-of-service mode; a maintenance technician can then conduct diagnosis/repairs, before restarting the ATM.
11. Finally, if the machine is idle, a teller can activate a Process Deposits operation which generates a report of all deposits (since the operation was last run) to cross check against the captured deposit envelopes. The data for this operation is captured locally by the ATM.

Question 8 Part 1. [8 marks]

Draw a use case diagram, covering the Pennand ATM description above, in which Withdraw and Deposit are explicitly shown.

Question 8 Part 2. [10 marks]

Draw a system sequence diagram covering a scenario where an account holder withdraws \$100 but after the ATM dispenses the cash, the ATM is unable to return the account holder's transaction card. The scenario should start with the ATM being in the idle state, and finish with the ATM in the idle state after it has been repaired.

Question 8 Part 3. [20 marks]

Draw a state machine diagram for the Pennand ATM, based on the description above.

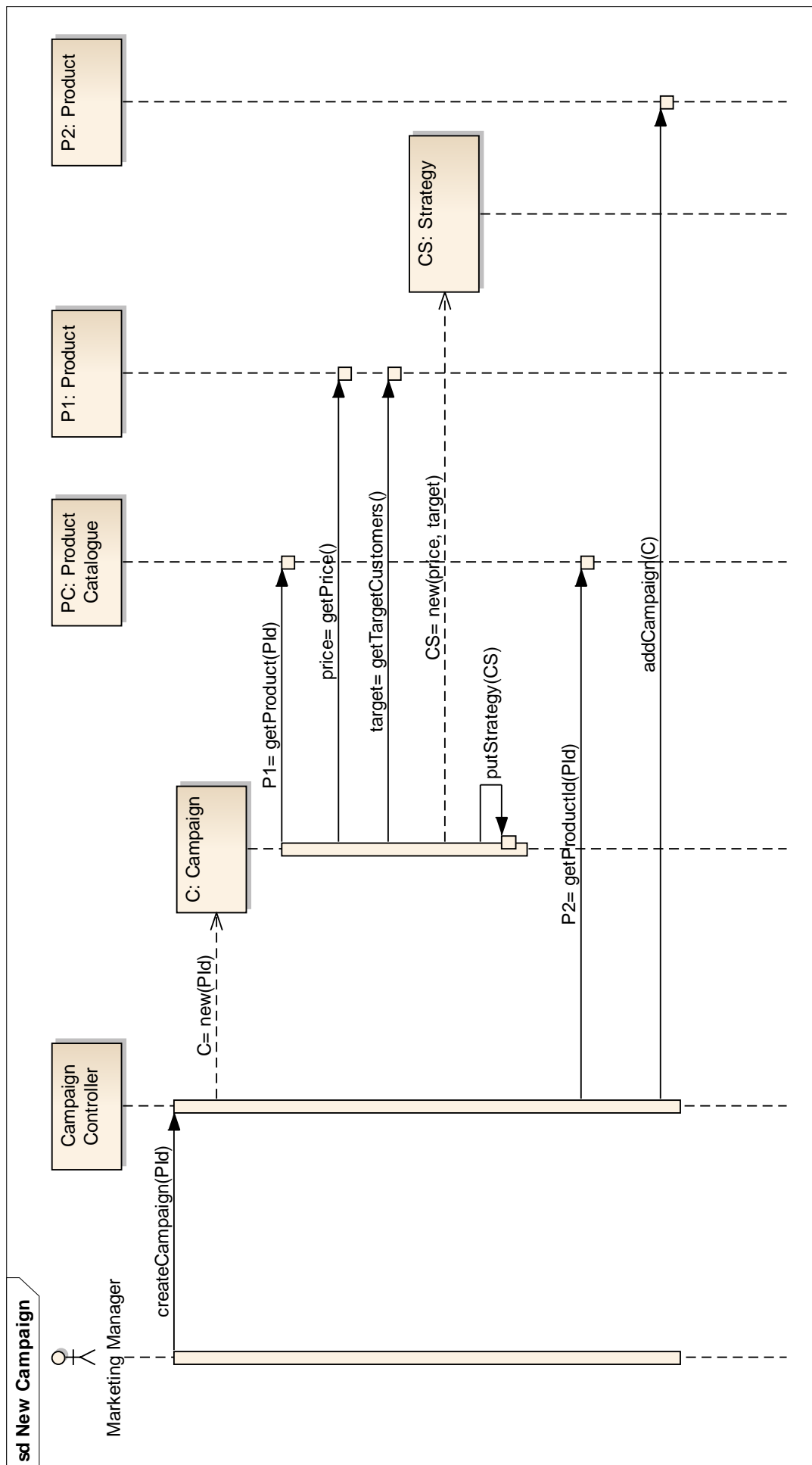
Question 9. [18 marks]

Consider the sequence diagram that follows, relating to creation of a new marketing campaign. The description in the textbox below provides context for this sequence diagram.

The marketing manager for a global online store creates marketing campaigns to increase sales. Each campaign employs a marketing strategy that depends on the details of a specific product. At the moment, a simple strategy is used based only on the product price and the type of customers at which the product is targeted. The store would like to introduce a variety of more sophisticated product-centered marketing strategies.

As a first step towards this, the store wants you to improve the current design to allow for the creation of more complex marketing strategies and support extending the functionality at a later stage. The improvements require introducing a singleton factory, using a strategy context object, and applying the principle of earliest conversion.

Draw a revised sequence diagram for your improved design for the creation of new marketing campaigns. Include notes on your diagram to indicate the principles behind the design changes you have made.



End of the Exam Questions

End of the Exam Paper