

University of Toronto**Faculty of Arts and Science
Dept of Computer Science****CSC302S – Engineering Large Software Systems****April 2009****Instructor: Steve Easterbrook****No Aids Allowed
Duration: 2 hours
Answer all questions.****Make sure your examination booklet has 14 pages (including this one). Write your answers in the space provided.****This examination counts for 35% of your final grade.**Name: _____
(Please underline last name)

Student Number: _____

Question Marks

1 _____ /20

2 _____ /20

3 _____ /20

4 _____ /20

5 _____ /20

Total _____ /100

1. [Short Questions; 20 marks total]

(a) [Verification Techniques – 5 marks] Many companies report that inspection is much cheaper than testing as a way of identifying and removing bugs in their software. Why is this? Can such companies give up testing altogether?

(b) [Software Design – 5 marks] The Law of Demeter states that an object may not call methods of an object that is returned by another method call. Why is this a good design principle? How would you detect violations of this law in your code?

(c) [White Box Testing – 5 marks] A code coverage tool reports that during testing of your Java program, your test suite covered 100% of the statements in your program. However, your project manager tells you that your unit tests still do not sufficiently cover the code. What does she mean?

(d) [Software Estimation – 5 marks] What is 3-point estimation? Why would you use it?

2. **[Black Box Testing – 20 marks]** Given the following use case, what set of black box test cases would you develop to test the software? Briefly describe each type of test case, and the reason why it is needed.

Use Case Name: Reserve Hotel

Summary: The user books a hotel for a given date, and receives confirmation by email.

Precondition: User has navigated to the hotel booking page, and has planned a travel itinerary.

Basic Course of Events:

1. Client enters city, arrival and departure dates, and number of guests.
2. System searches for available hotels, and displays a list of available hotels with base price for each, sorted by average customer rating. User may choose to re-sort the list by price or by quality (star rating).
3. User selects a hotel from the list.
4. System displays available room types with price for each.
5. User selects a room type and selects “Reserve it”.
6. User provides her email address.
7. User provides name, address and phone number.
8. User provides credit card details.
9. System makes the reservation and allocates a reservation number.
10. System displays confirmation screen showing the reservation number.
11. System sends email confirmation to the user.

Postcondition: Hotel Reservation is placed and user has received email confirmation.

Alternative Paths:

- A1) At steps 2, 3 and 5 – User may return to step 1 and enter different itinerary details.
- A2) At step 4 - User returns to previous step and selects a different hotel.
- A3) At step 5 - User selects “Cancel” and exits the system.
- A4) At step 6 - User has existing account and enters a password, then skips step 7.

Exception Paths:

- E1) At step 2, no suitable hotels are found. System displays message and returns to step 1.
- E2) At step 9, credit card information is invalid. System allows user to try re-entering credit card information a maximum of two more times. If these both fail, system cancels the booking and returns to step 1.
- E3) At step 11, email message bounces. Hotel is notified that customer’s email address is incorrect.

[question 2 continued...]

3. [Requirements Analysis – 20 marks] Jackson has proposed a conception of requirements analysis that distinguishes machine domain phenomena from application domain phenomena, as illustrated in the following diagram:



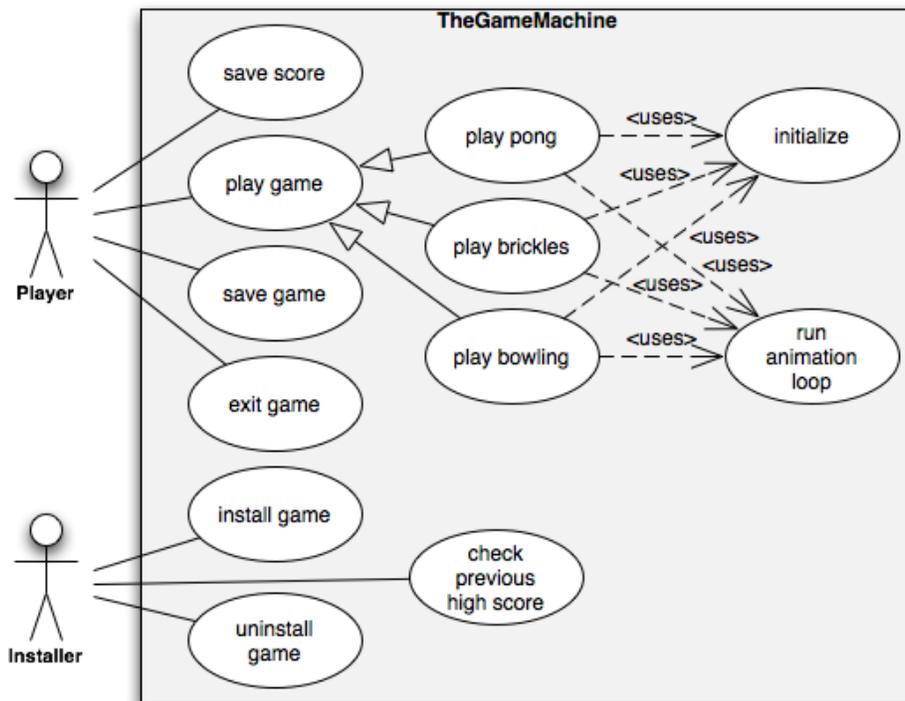
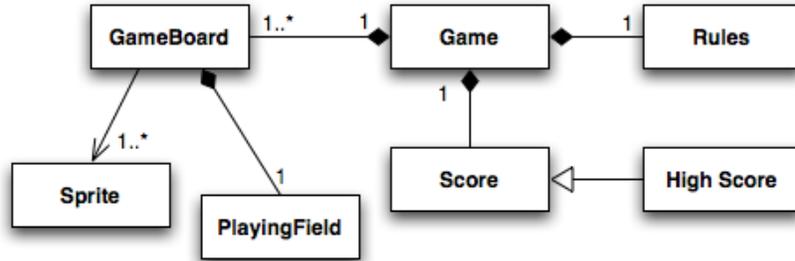
(a) [5 marks] Explain the distinction Jackson makes between Requirements, R, and Specifications, S. What additional properties should a Specification have in order to distinguish it from Requirements?

(b) [5 marks] Give examples of R, D, S, C and P for a particular problem domain.

(c) [5 marks] Using Jackson's conceptual model, explain why checking that a program meets its specification is not a sufficient test of fitness-for-purpose.

(d) [5 marks] Suggest two techniques that you would use for checking whether statements of the Requirements, R, and Domain Properties, D, are valid.

4. **[Robustness Analysis – 20 marks]** The following UML diagrams show an initial domain model and a use case diagram for a proposed computer game system, called TheGameMachine. Complete a robustness analysis for this system. Your analysis should include (at least) two robustness diagrams: (1) a first draft showing all the boundary \square , control \circ and entity \square classes needed to implement each use case, and (2) a refined robustness diagram that combines some of these classes in sensible ways.



[Question 4 continued]

5. **[Process Improvement – 20 marks]** The Capability Maturity Model (CMM) assesses the software development capability of a company as being at one of five levels: initial, repeatable, defined, managed, and optimizing.

(a) *[10 marks]* Describe each of the levels of CMM, and explain their rationale. What are the advantages and disadvantages of this approach to assessing software companies?

(b) *[10 marks]* How well do the ideas of the CMM apply to smaller, more agile teams, and to individual developers? How do they compare with other approaches to improving software quality used in agile software development?

