THE UNIVERSITY OF WESTERN AUSTRALIA

Achieve International Excellence

Computer Science and Software Engineering

SEMESTER 1, 2014 EXAMINATIONS

CITS4401
Software Requirements and Design

FAMILY NAME:_____ GIVEN NAMES: _____

STUDENT ID: | | | | | | | | | SIGNATURE:_____

This Paper Contains: **9** pages **(including title page)**
Time allowed: **2:10 hours (including reading time)**

INSTRUCTIONS:

This paper contains 2 sections, 14 questions
Section A: 10 short answer questions (20 marks)
Section B: 4 questions (40 marks)
TOTAL: 60 marks

All questions are to be answered.
Answers for Section A are to be written in the spaces provided on the exam paper.
Answers for Section B are to be written in the examination answer booklets.
Please start each question on a separate page.

Exam papers are to be collected with the examination answer booklets.

PLEASE NOTE

Examination candidates may only bring authorised materials into the examination room. If a supervisor finds, during the examination, that you have unauthorised material, in whatever form, in the vicinity of your desk or on your person, whether in the examination room or the toilets or en route to/from the toilets, the matter will be reported to the head of school and disciplinary action will normally be taken against you. This action may result in your being deprived of any credit for this examination or even, in some cases, for the whole unit. This will apply regardless of whether the material has been used at the time it is found.

Therefore, any candidate who has brought any unauthorised material whatsoever into the examination room should declare it to the supervisor immediately. Candidates who are uncertain whether any material is authorised should ask the supervisor for clarification.

Supervisors Only - Student left at:

This page has been left intentionally blank

SECTION A

QUESTION 1 [2 marks]

Briefly explain how a Sharktooth model differs from the Spiral model and give an advantage and a disadvantage of each.

QUESTION 2 [2 marks]

Draw a UML class diagram to capture the various toy vehicles produced by a toy company: "A family car can be a sedan or a hatchback. A sedan has four doors while a hatchback has five. All family cars have four wheels, but semi-trailer trucks have eight to ten wheels. Semi-trailer trucks have two doors only. All vehicles have two front headlights and a battery compartment."
Include in your class diagram all the associations and multiplicities.

QUESTION 3 **[2 marks]**

A heater has 3 temperature settings: Low, Medium, and High. It also has an On/Off button, an Up button, and a Down button. When the heater is off, pressing the On/Off button would always turn the heater on at the lowest temperature setting. Pressing the Up button would increase the temperature to the next setting. If the heater is already at the highest temperature setting then pressing the Up button would have no effect. Similarly, pressing the Down button would decrease the temperature to a lower setting. If the heater is already at the lowest temperature setting then pressing the Down button would have no effect. Pressing the On/Off button when the heater is on would simply switch off the heater.

Draw a UML state-chart diagram to show a design for monitoring the different states of the heater.

QUESTION 4 **[2 marks]**

Identify the **actors** and **objects** in the following sequence of events for a participant doing an online registration to a research conference:

The participant must first logon to the web page using the same account that has been previously created. If the participant is an author of a paper, he/she should enter the paper ID that he/she will present at the conference. The conference server will check to verify whether the paper ID indeed belongs to a paper that has been accepted for presentation. There are two categories of registration available: the early bird registration, which is only valid up to a certain cut-off day; and a normal registration, which costs 20% more. The participant should select an appropriate registration category. The conference server will verify the registration date against the cut-off day and issue an error message if an early bird registration is made after that day. If everything goes well, the participant should then enter his bank account details. A security server will check the bank account details and the web page will display a confirmation or a rejection of the registration.

QUESTION 5 **[2 marks]**

Consider the following case for Question 4: The author of an accepted paper tried to register under the early bird category before the cut-off day. Sketch a UML sequence diagram to show the scenario where the author failed to register because the bank account details were not entered correctly.

QUESTION 6 **[2 marks]**

Describe the **pipe and filter** software architecture, and give one advantage and one disadvantage of it.

QUESTION 7 **[2 marks]**

Describe the Abstract Factory design pattern. Give an example to show when it would be suitable to use this pattern.

QUESTION 8 **[2 marks]**

Rewrite the following prose as a structured rationale argument. The prose was drafted by a group of computer programmers developing an online ordering system:

"The main issue is how to handle all the customer orders. We already have a server checking the login names and passwords of customers. One option is to use the same server to handle the orders as a customer must first login before he/she can put in an order. The authentication and order handling never take place in parallel for one customer. The downside of this option is the first server is already in heavy demand and we expect that the number of orders will increase by 20% in the coming months. A second option is to set up a new server to handle orders. The positive aspect of this option is, when there are many customers using the system at the same time, we are not overloading the first server. The negative aspect is a staff member familiar with hardware will be required to set up the server and we are short of staff at the moment. The budget shows that we should have some money to hire a hardware guy to set up a new server. Since a second server will definitely be needed in the near future, we make the decision to take the second option and will hire someone to set up a new server for handling orders."

QUESTION 9 **[2 marks]**

Explain what a test driven design is. Include a diagram in your explanation.

QUESTION 10 **[2 marks]**

Describe how requirements negotiation in agile software development methodologies differs from requirements negotiation in traditional software development methodologies.

SECTION B

Answers for Section B are to be written in the examination answer booklets.

All Questions in Section B refer to the *Google Map* System described below:

Consider the current online *Google Map* system where users can enter text to search for the satellite and street maps of places. The system also displays a few suggested routes when the user enters the names of the starting and destination addresses. If the user clicks on the icon associated with the name of a place, then further information about that place will be shown in a small pop-up window. The system includes a graphical user interface for zooming in and out and for switching among three display modes: *map*, *satellite*, and *terrain*.

QUESTION 11 **[12 marks]**

a) Describe four functional requirements for such a system.

b) Describe four non-functional requirements for the system.

c) Give a prioritized list of design constraints for the system and justify your list and the ordering.

QUESTION 12 **[12 marks]**

Describe a software architecture that would be suitable for the system and present rationale citing the design constraints in Question 11.

QUESTION 13 **[12 marks]**

Propose a set of classes that could be used in your system and present them in a class diagram. Propose a subsystem decomposition for these classes and comments on the coupling and cohesion within this decomposition.

QUESTION 14 **[4 marks]**

Identify two design patterns that would be suitable for the system.

END OF PAPER