THE UNIVERSITY OF WESTERN AUSTRALIA

Computer Science and Software Engineering

SEMESTER 1, 2017 EXAMINATIONS

CITS4401
Software Requirements and Design

FAMILY NAME:_____ GIVEN NAMES: _____

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

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

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

Candidates should attempt ALL questions.
Answers for Section A are to be written in the spaces provided in 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.

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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 you 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.

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SECTION A

Question 1 **(2 marks)**

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

Question 2 **(2 marks)**

A dessert store specializing in making cake and cookies would like their dessert items to be modelled in an object-oriented system. Study the description below and draw a UML class diagram to model the dessert items and their relationships. Include in your class diagram all the multiplicities.

"A cake can be a light chiffon cake, a butter cake, a nut cake, a cheesecake or a fruit cake. A nut cake can have four to six types of nuts and a fruit cake can include two to three types of fruits. A cheesecake may optionally include one type of fruit. The two main types of cookies that the store makes are nut cookies and chocolate cookies. Up to two types of nuts can be included in the nut cookies."

Question 3 **(2 marks)**

A light bulb, when turned on, can be in one of the following modes: slow blinking and fast blinking. The light bulb is controlled by an ON switch and an OFF switch. If the light bulb is already on, then pressing the ON switch toggles the light bulb between the two modes. Pressing the OFF switch turns off the light bulb. Whenever the light bulb is first turned on, it is always in the slow blinking mode.

Draw a UML statechart diagram to show a design for the light bulb which allows full control of the light from the two switches.

Question 4 **(2 marks)**

Identify the **actors** and **objects** in the system described below:

SYT (abbreviated for *Sell Your Toys*) is an online toy club for children to sell their old toys. Access to the SYT website is restricted to registered members only. To register for an account, the child must fill in a SYT online registration form which would be validated by an administration staff. Once an account is successfully created, the registered member can login to SYT to browse pictures of the toys uploaded by other registered members. When a registered member wants to advertise an old toy to sell, he/she must enter the purchase date and purchase price of the toy using an online form on SYT and must upload a picture of the toy. SYT would automatically compute the maximum price that the toy can be sold for and would display the price on the screen. The registered member can either confirm that he/she wants to go ahead with the for sale advertisement or, if not happy with the maximum price, cancel the whole process.

Question 5 **(2 marks)**

Given the system described in Question 4, draw a UML sequence diagram to show the scenario where a registered member wants to advertise a toy to sell and is happy to go ahead with the for sale advertisement.

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 Façade 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 main issue is how to handle the increasing demand of web services from our clients. We currently use a centralized web server in the headquarter so all the web services are directed to the headquarter. One option is to replace our current web server by a more powerful one. An advantage of this option is we only need to do minimum set-up work on the new server. A disadvantage is it is very costly. Moreover, based on the increasing demand, it is likely that we will need to repeat this whole process in about a year's time. A second option is to set up a web server at each branch and let the individual branches handle their own web services. This option is probably a more long-term solution. Furthermore, the web server at each branch does not need to be a very expensive PC. The downside of this option is we will need to train staff members at individual branches to set up and maintain their web servers. We currently have a very limited budget. Based on this criteria, we will go ahead with the second option."

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. In addition, the user can select any of the 3 modes of transport (*walk*, *by bus*, and *drive*) displayed by the system to view the travel time required for each mode. 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) (4 marks) Draw a use case diagram to show all the functionality of the system.

b) (4 marks) Describe in detail four non-functional requirements for the system.

c) (4 marks) Give a prioritized list of design constraints for the system and justify your list and the ordering.

Question 12 **(12 marks)**

a) (6 marks) Describe a software architecture that would be suitable for the system.

b) (6 marks) Present a structured rationale argument for your software architecture using the design constraints that you identify in Question 11 c) above.

Question 13 **(12 marks)**

a) (7 marks) Propose a set of classes that could be used in your system and present them in a class diagram. **Note:** You only need to include entity objects in your class diagram.

b) (5 marks) Propose a subsystem decomposition for these classes and comment on the coupling and cohesion within this decomposition.

Question 14 **(4 marks)**

Identify two design patterns that would be suitable for the system. Briefly explain your answer.

END OF PAPER