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SEMESTER 1, 2019 EXAMINATIONS**CITS4401****Physics, Mathematics & Computing****Software Requirements and Design**Department of Computer Science & Software
EngineeringThis paper contains: **8 Pages (including title page)**Time Allowed: **2:00** hours**INSTRUCTIONS:**

- This examination paper comprises 2 sections.
- Section I contains 7 short answer questions which are required to be attempted on the examination paper (20 marks).
- Section II contains 4 questions which are required to be answered in the examination answer booklets (30 marks).
- Attempt all questions and total marks are 50.
- Marks for each question are mentioned in examination paper.
- **Examination paper must be handed in with answer booklets at the end of the exam.**

THIS IS A CLOSED BOOK EXAMINATION**SUPPLIED STATIONERY**

1 x Answer booklet 10 pages

ALLOWABLE ITEMS

No Allowable items

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.

Candidates must comply with the Examination Rules of the University and with the directions of supervisors.

No electronic devices are permitted during the examination.

All question papers and answer booklets are the property of the University and remain so at all times.

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SECTION I

Answers for Section I are to be written on the examination paper.

Question 1:

2 marks

Briefly explain the difference between waterfall and spiral models. Are there any common characteristics for both the models?

Question 2:

2 marks

How does Extreme Programming (XP) improve a software project and what is its most important factor of success as compared to traditional software development methods?

Question 3:

3 marks

Draw a use case diagram for a ticket distributor for a movie theatre. The system includes two actors: a movie watcher who purchases different movie tickets, and a central computer system that maintains a reference database for the ticket price and cinema type. Use cases should include `BuyGeneralTicket`, `BuyiMAXTicket`, `BuyLUXTicket`, `UpdateTicketPrice`, `UpdateMovieSession` and `SelectMovieSession`. Also include the following exceptional cases: `TimeOut` (i.e., movie watcher took longer than 10 minutes to complete the process), `TransactionAborted` (i.e., movie watcher selected the cancel button without completing the process), `CreditCardTransactionFailure`, `SessionFull` and `SystemOutOfPaper`.

Question 4:

3 marks

Draw a class diagram representing a banking system defined by the following statement:

Each bank has location, unique code and a manager. A bank has many customers and each customer can open maximum of two bank accounts: saving account or current account. A customer has name, address, mobile number, card number and pin code for his account(s). Each bank account (either saving or current) has unique account number and belongs to a particular customer. Customers can deposit or withdraw cash from any of his or her bank accounts.

You must add an abstract class and an inheritance relationship to factor out common attributes into the abstract class (if required).

Question 5:

3 marks

Draw a sequence diagram for the warehouseOnFire scenario provided below. Include the objects bob, alice, john, FRIEND (First Interactive Emergency Navigational Database), and instances of other classes you may need

<i>Scenario name</i>	<u>warehouseOnFire</u>
<i>Participating actor instances</i>	<u>bob, alice:FieldOfficer</u> <u>john:Dispatcher</u>
<i>Flow of events</i>	<ol style="list-style-type: none">1. Bob, driving down main street in his patrol car, notices smoke coming out of a warehouse. His partner, Alice, activates the “Report Emergency” function from her FRIEND laptop.2. Alice enters the address of the building, a brief description of its location (i.e., northwest corner), and an emergency level. In addition to a fire unit, she requests several paramedic units on the scene given that area appears to be relatively busy. She confirms her input and waits for an acknowledgment.3. John, the Dispatcher, is alerted to the emergency by a beep of his workstation. He reviews the information submitted by Alice and acknowledges the report. He allocates a fire unit and two paramedic units to the Incident site and sends their estimated arrival time (ETA) to Alice.4. Alice receives the acknowledgment and the ETA.

Question 6:

2 marks

A head torch worn by bicyclist is controlled by two switches A and B. Switch A switches OFF the light while switch B switches it ON. The head torch can be in one of the following modes: low intensity, high intensity and blinking. The modes of head torch can be changed in the order it is presented by pressing switch B repeatedly. The head torch is always in low intensity mode when switched ON.

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

Question 7:

5 marks

Write the name of the most relevant software design pattern in front of each of the natural language heuristics for the software product.

- The product must be platform and manufacturer independent
- The product must be able to support future protocols
- The product must comply with existing software and must reuse existing legacy component
- All transactions should be logged in the system and be undoable
- The product must allow different algorithms to be interchanged for a task

SECTION II

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

All questions in Section II refer to the Bowling System described below:

A Bowling Club is to be set up for fully automated operation. Customers swipe their credit or debit card through an electronic reader connected to a touch-display terminal and a bowling lane; the credit or debit card is verified by communication with the bank's server, and a number of bowling games limit is established according to the credit or debit card limit. The details of the credit or debit card are stored by the system. The customer may then select the number of players and games on touch-display terminal. When the selection process is complete and 'submit' button on touch-display is pressed, the customer's credit or debit card account is debited with the calculated cost depending on number of players and games. The system also activates the connected bowling lane for selected number of players and games. If the credit or debit card is invalid during authentication process, the touch-display terminal displays appropriate message and returns to the initial state to read electronic reader for new customer's credit or debit card. Customer can cancel the transaction anytime during the process before pressing the 'submit' button on touch-display terminal.

Question 8:

3*3 marks

- a) Describe three functional requirements for the system
- b) Describe three 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 9:

4*2 marks

- a) Describe a software architecture that would be suitable for the system.
- b) Present a structured rationale argument for your software architecture using the design constraints that you identify in Question 8 (c) above.

Question 10:

5*2 marks

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

Question 11:

3 marks

Identify two design patterns that would be suitable for the system. Briefly justify your selection.

END OF EXAM