Programme Code: TU856
Shared with: TU858
Module Code: CMPU 2019
CRN: 22390, 26464

# TECHNOLOGICAL UNIVERSITY DUBLIN

**City Campus - Grangegorman**

---

TU856 - BSc. Degree in Computer Science

TU858 - BSc. Degree in Computer Science (International)

**Year 2**

---

SEMESTER 1 EXAMINATIONS 2024/2025

---

***CMPU2019 Software Engineering 1***

**Internal Examiner(s):**
Mr. Richard Lawlor
Dr. Paul Doyle

**External Examiner:**
Dr. Colm O'Riordan

## Exam Duration:
2 hours

## Instructions To Candidates:
Attempt 4 out of 5 questions. All questions carry equal marks.

## Special Instructions /Handouts/ Materials Required: None

**1. (a)** Provide a usecase description for each of the following 3 usecases for a Library system:

- return book
- borrow book
- borrow book and pay fine

and draw a corresponding usecase diagram.

(8 marks)

**(b)** Draw a simple class diagram appropriate for the usecases in part(a).

(5 marks)

**(c)** Provide a usecase realisation for the usecase *borrow book*.
What is the purpose of this?

(12 marks)

**2. (a)** Explain what is meant by the terms *modularity* and why it is important in programming and software design.

What is meant by encapsulation in object-oriented design and how does it relate to coupling and cohesion? How well is it supported in an object-oriented language you are familiar with?

(10 marks)

**(b)** How are coupling and cohesion affected by inheritance when using object-oriented programming principles?

(7 marks)

**(c)** Explain what an interface is and provide two ways of showing one in UML.
Then comment on the meaning of the UML diagram shown in Figure Q2(c). How does this design affect coupling and cohesion?

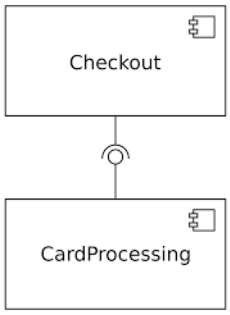


Figure Q2(c)

(8 marks)

**3. (a)** What is meant by *Requirements Engineering*? Describe the activities in requirements engineering and show them and their outputs in a process diagram.

(10 marks)

**(b)** Briefly outline two approaches to Prototyping and describe their main purpose, paying particular attention to the one which relates more to requirements.

(10 marks)

**(c)** Comment on the claim that Agile Methodologies are adaptive rather than predictive.

(5 marks)

**4. (a)** Explain what is meant by Formal Specification and describe two significant advantages and a disadvantage.

(9 marks)

**(b)** You are required to provide a formal specification in Z for software which records passengers boarding and disembarking from an aircraft. Initially, as part of this write a schema ***Aircraft*** representing the state of the aircraft boarding software and ***ΔAircraft*** which describes before and after states for any operation.

(8 marks)

**(b)** Given the two schema from part (b), write one which specifies the ***disembark*** operation using pre and post conditions.

Write a schema which specifies the query operation onboard which checks if a passenger is on board.

(8 marks)

**5. (a)** Given the class diagram in Figure Q5(a) below, write a USE class definitions for the classes ***Order*** and ***OrderLine***. Include a SOIL implementation for the operation ***addLineItem()*** but not for ***calculatePrice()***. Also provide a SOIL implementation for ***processOrderLine(q, p)*** but not for ***getPrice()***.

(15 marks)

**(b)** Write a class constraint or invariant in OCL for class ***Order*** which says: if an order's customer has a poor credit rating, then the order's ***isPrepaid*** attribute must be ***True***.

(4 marks)

**(c)** Write an appropriate precondition and postcondition for ***updateStock(q : Integer)*** in class ***Product***.

(6 marks)

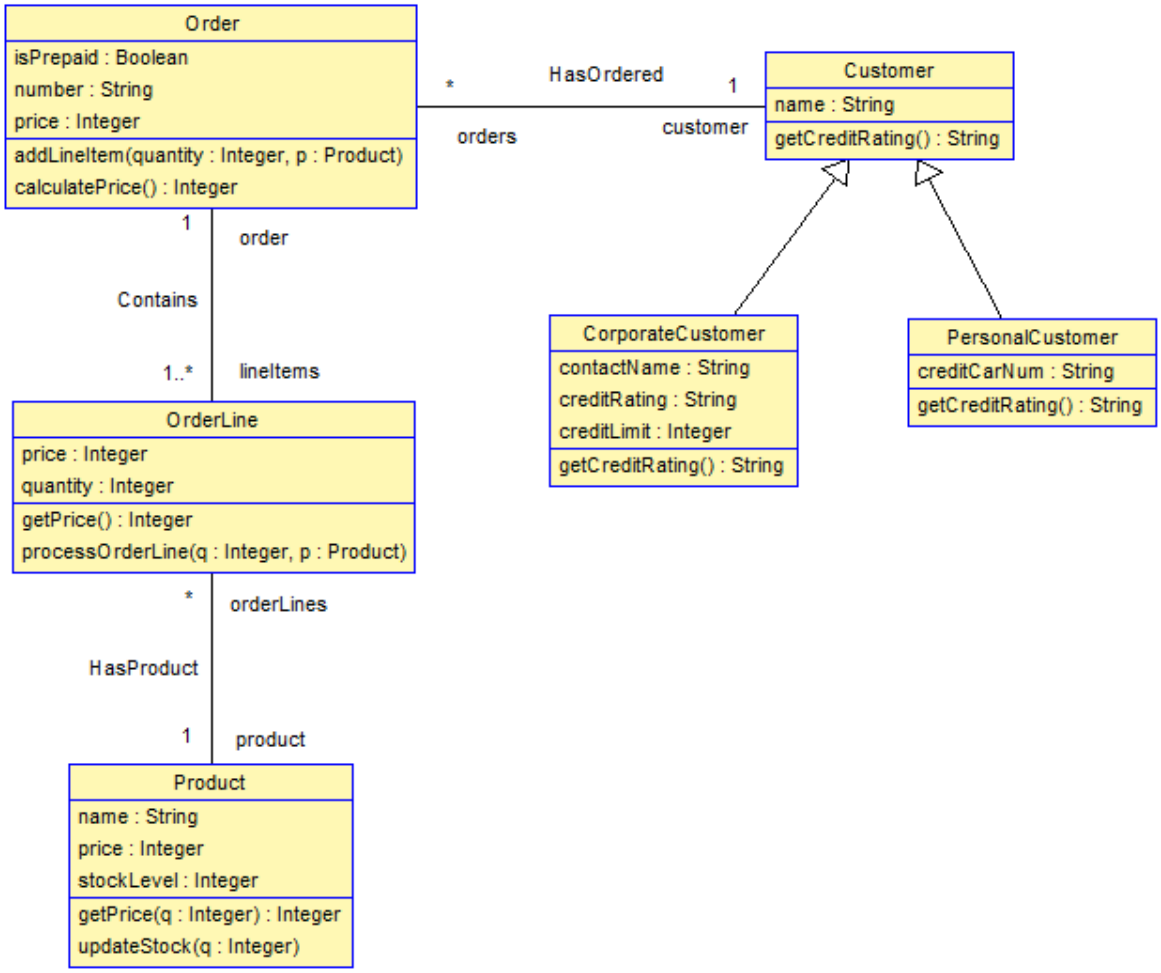


**Figure Q5(a)**