NUI Galway
OÉ Gaillimh

Semester 2 Examinations 2018/2019

Exam Code(s)	2BCT
Exam(s)	Second Year BSc Computer Science & IT
Module Code(s)	CT216
Module(s)	Software Engineering, I
Paper No.	1
External Examiner(s)	Dr. Jacob Howe
Internal Examiner(s)	Prof. Michael Madden *Dr. Enda Barrett *Dr. Matthias Nickles

Instructions: **Answer three questions in total.**

Answer **two** questions from Section A

AND

Answer **one** question from Section B

Use SEPARATE answer books for EACH section!
All questions carry equal marks.

Duration	2 hrs
No. of Pages	6
Discipline(s)	Information Technology
Course Co-ordinator(s)	Dr. Des Chambers
Requirements	None

Release to Library: Yes ☐ **No** ☒

Section A

Answer two questions from this section

Question 1:

(A)

With the aid of examples outline the meaning and define the following terms:

- SCRUM
- The Waterfall Model
- Pair Programming

[9 marks]

(B)

For the system outlined below please construct the following:

- An event list
- A context diagram
- A system level '0' DFD

Multiplex Cinema Web Application

The local multiplex cinema is independently operated and is not part of a larger national chain. They wish to build a web application to provide information about their movies, including screening times and ticket prices. The web application will also allow cinema goers to order and pay for their tickets online. A movie distributor provides an API which will be used to pull the movie details that are currently being screened. Customers using the application may also cancel bookings up to an hour before the screening deadline.

[11 Marks]

PTO

Question 2:

(A)

Draw a UML Activity Diagram to describe the following ATM system. A customer inserts his/her card into the ATM machine. The ATM checks that the card is acceptable. If it is not acceptable, the card is ejected. If it is accepted, the customer is asked to enter their Personal Identification Number (PIN). The customer enters their PIN number. The ATM checks if the PIN is valid. If it is invalid, the card is ejected. If valid, the customer is asked to specify the amount they wish to withdraw. The ATM must check the balance on the account to ensure that the requested amount is less than the balance. If it is not the ATM shows the customer the current balance and ejects the card. If the transaction is authorised, the ATM dispenses the money and debits the account accordingly. It shows the user the balance remaining on screen and ejects the card.

[14 marks]

(B)

Describe in detail the following basic principles of Object Orientation:

- Encapsulation
- Abstraction

[6 marks]

PTO

Question 3:

You have been asked to build a NodeJS (Express) backend, which comprises a collection of RESTful APIs for an Instagram style application. Each image shared by the users of the application should contain a description of the image, the upload time and date, the number of likes and the number of re-shares.

a) Provide a sample JSON document which contains data for a single image shared on the platform.

[4 marks]

b) Write either a MongoDB or Mongoose query (whichever you prefer) which returns all images posted, sorted in **ascending** order by upload time.

[5 marks]

c) Define a server-side API route accessible at '/uploadImages' which handles POST requests. Assume that that MIME type is *application/json* and the payload is processed by the Express middleware and made available as an object in the request body. Using either the object modelling tool Mongoose or a traditional MongoDB query, provide code to save the data in the request body to the MongoDB database. If using Mongoose, you do not need to specify the schema, you may assume a schema named Image is already defined.

[7 marks]

d) Define a server-side API to delete image documents from the collection by parsing the request parameters, extracting the id and removing the document found.

[4 marks]

PTO

Section B (Formal Specification)

Answer one question from this section

Question 4

a) What is a *relation* (in the context of Z) and how can relations be declared in Z notation? [5 marks]

b) A (simplified) hotel room management system records the bookings of rooms on a certain day (the date of that day should be ignored).

RoomBookings

$bookedTo : ROOM \pfun PERSON$

Using given types [*ROOM*] and [*PERSON*] and the state schema above, complete the following tasks:

i. What is, in your own words, the precise meaning of the above state schema? [3 marks]

ii. What would be a suitable initial state (initialization) operation in Z notation? [3 marks]

iii. Based on the given schema, create Z specifications for each of the following operations: [9 marks]

- A given person books a room.
- A guest cancels an existing booking for a room.

Remark: It is not required to handle error situations in these operations.

PTO

Question 5

A public office (e.g., a post office or job centre) uses a queueing system to allocate customers to service counters. New customers are added to a waiting queue (*waiting* in the schema below). When a customer is assigned to a counter, that customer is removed from the waiting queue. Only the customer at the head of the queue can be assigned to a counter.

Using the given types [*COUNTER*] and [*CUSTOMER*] and the following state schema

QueueingSystem

$$allocated : COUNTER \rightarrowtail CUSTOMER$$
$$waiting : \text{seq } CUSTOMER$$

$$\text{ran } allocated \cap \text{ran } waiting = \emptyset$$

complete the following tasks:

a) Explain the precise meaning of the above state schema in your own words. [6 marks]

b) Provide a suitable initial state (initialization) operation in Z notation. [4 marks]

c) Write Z specifications for each of the following operations: [10 marks]

- Add a new customer to the waiting queue.
- Assign a waiting customer to a given counter.

Remark: It is not required to handle error situations in these operations.

End