NUI Galway
OÉ Gaillimh

Semester 2 Examinations 2017/2018

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	5
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/define the following terms:

- SCRUM
- The Waterfall Model
- Continuous Integration
- Test Driven Development

[10 marks]

(B)

For the system outlined below please construct the following:

- An event list
- A context diagram

Multiplex Cinema Web Application

The local multiplex cinema is part of larger national chain and wishes 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.

[10 Marks]

PTO

Question 2:

(A)

Draw a UML Class Diagram to represent the classes needed to model the following. Focus on multiplicity, generalisation and relationships between classes. You do not need to specify the operations.

A hotel has a number of rooms that can be rented by guests. There are also a number of bathrooms, which are either connected to a specific room or are used to service multiple rooms on the floor. The rooms are classified into three types: single rooms, double rooms and family rooms. Each single room can only be rented to at most one guest. Each double room can be rented to at most two guests. Each family room can be rented to a family of up to two adults and two children.

[14 marks]

(B)

Describe in detail the following basic principles of Object Orientation:

- Encapsulation
- Abstraction

[6 marks]

Question 3:

You have been asked to build a backend, which comprises a collection of RESTful APIs for an Instagram style application using NodeJS (Express). Each image shared by the users of the application should contain the GPS coordinates of the location of where the image was taken (Long. and Lat.), 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 a MongoDB or Mongoose query which returns all images posted, sorted in ascending order.

[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. Either using 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 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 <u>one</u> question from this section

Question 4

a) What is a *schema* (in the context of Z)?

[4 marks]

b) You are given the following state schema for a supermarket item (stock) management system. The supermarket *carries* a set of different items. Of the carried items, there are certain numbers currently available per each item (the *level* of that item). For example, the supermarket might carry tinned kidney beans and butter croissants. The current number (level) of kidney bean tins available might be 30, the level of butter croissants might be 20.

SupermarketItems

$carried : \mathbb{P}$ ITEM
level: ITEM $\pfun$ $\mathbb{N}$

---

dom *level* = *carried*

b1) Explain the detailed meaning of the above specification and the notation used.

[3 marks]

b2) Provide a suitable initial state schema (initial state operation) in Z notation.

[3 marks]

b3) Provide Z specifications (in the context of the described item management scenario) for the following two operations:

- Someone buys a quantity *qty?* of a certain item *i?*.
- An item *i?* is discontinued (removed from the set of carried items).

(Remark: it is not necessary to provide error handling in your answers.)

[10 marks]

<u>PTO</u>

Question 5

a) What is an *injective function* (in the context of Z)? Support your explanation with an example of your own choice (in Z notation).

[4 marks]

b) What is the meaning of $\Xi Schema$ (where *Schema* is the name of an existing schema) in the context of Z? Provide an example of your own choice to illustrate your explanation.

[5 marks]

c) You are given the following state schema for a hotel room booking system, using types [ROOM] and [PERSON]:

Hotel

$bookedTo : ROOM \pfun PERSON$

c1) What is the detailed meaning of the given specification? What would be a suitable initial state schema (initial state operation)?

[5 marks]

c2) Write Z specifications for the following two operations:

- Someone books a room.
- Query the number of rooms which are currently booked.

(Remark: it is not necessary to provide error handling in your answers.)

[6 marks]

END