UNIVERSITY OF LONDON

CM2040

BSc EXAMINATION

COMPUTER SCIENCE

Databases, Networks and the Web

This is a mock exam.

This mock exam provides you with examples of the level and style of long answer questions you will encounter in the real exam. It does not provide examples of multiple choice questions, though you will encounter those in the real exam.

Please note that aspects that are about the context and actual writing of the exam are subject to change. These could include: date/time; number of questions and choice available; balance between multiple choice and longform questions; permitted materials; exam platform details; use of calculators; marks awarded; etc.

Full details of the above for your real exams will be communicated in your admission notice, sent out closer to the time of your exams.

Part A

Question 1

Candidates should answer the **TEN** Multiple Choice Questions (MCQs) in Part A.

NOTE: these are not included in the mock paper

Part B

Candidates should answer **BOTH** questions in Part B.

Question 2

This question is about web application development.

(a)

i. What is the purpose of the HTTP protocol in web applications? Briefly explain how it facilitates communication between a client and a server.

[2 marks]

ii. Define the role of the application layer in the OSI or TCP/IP model in the context of web applications. Provide an example of a protocol, other than HTTP and HTTPS, used at this layer.

[2 marks]

iii. Describe the role of the database tier in a three-tier web architecture. Why is it important to separate this tier from the others?

[2 marks]

(b) You are developing a web application for a small garden services company that employs three gardeners. The application must support the following functionality:

- A services page that describes what the company offers (rarely updated).
- A public enquiry form where potential clients submit their details and general job requirements.
- A job management feature where gardeners, using tablet computers on-site, can log job details, upload photos, enter itemised tasks, and generate quotations to be emailed to clients immediately at the end of the site visit.

You decide to implement a web application using the technologies covered in the Databases, Networks and the Web module.

i. Describe a suitable architecture for this web application. Identify and explain the role of each tier in the architecture.

[4 marks]

ii. Explain how you would structure your code, detailing the main code files you would create and their purpose.

[4 marks]

iii. Outline the data model for this web application.

[6 marks]

iv. Explain how data validation should be handled for the public enquiry form. Include the approach for both client-side and server-side in your answer.

[4 marks]

(c) The company wants to extend the web application to allow customers to log in and view the status of their enquiry or quotation. Outline an approach to providing this additional functionality, commenting on additional maintainability and security challenges that this new requirement might bring.

[6 marks]

Question 3

This question is about database modelling.

(a)

i. Explain the concept of a foreign key. How does it help maintain data integrity in relational databases?

[2 marks]

ii. What is a unique constraint in a relational database? How does it differ from a primary key constraint?

[2 marks]

iii. What is the difference between INNER JOIN and OUTER JOIN in SQL? Provide a brief explanation.

[2 marks]

(b) You are designing a database for a company that runs the public transport for a medium-sized town. The town has 36 bus routes, four train routes and a tram route. The database needs to hold information about all the stops on each of these routes, as well as the expected travel time between stops. There is no need to store the bus, train and tram schedules.

i. Devise a data model for the above scenario.

[6 marks]

ii. Bus route 12 has the following stops:

1. Town Hall
2. Leisure Centre (12 mins)
3. Green Park (6 mins)
4. Steele Street (9 mins)
5. Shopping Centre (9 mins)

Show how this data would be represented in your database tables.

[4 marks]

iii. Write a SQL query to show a list of all the routes and their type (bus, train or tram).

[2 marks]

iv. Write a SQL query to show all the stops on a route called ‘Bus 21’ in the correct order.

[3 marks]

v. Write a SQL query showing all the routes and the travel time to complete a journey from the first to last stop for each route.

[3 marks]

(c) The company now wants to extend the database to include information about passengers. Passengers should be able to book tickets for journeys on specific routes.

Evaluate the following two approaches to implementing this extension:

- **Approach A**: Add a new Passengers table with fields such as passenger_id, first_name, last_name, email, and phone_number. Create a new Bookings table to store ticket details, referencing both the Passengers and the Routes they are travelling on.
- **Approach B**: Add a new Passengers table as in Approach A. However, instead of linking passengers directly to routes, create a Bookings table that references the stops they are travelling between.

Compare the two approaches in terms of flexibility and query complexity.

[6 marks]

END OF PAPER