The University of Nottingham Ningbo China

SCHOOL OF COMPUTER SCIENCE

A LEVEL 1 MODULE, Autumn SEMESTER 2022-2023

Database and Interfaces

Time allowed: **TWO Hours**

Candidates may complete the front cover of their answer book and sign their desk card but must NOT write anything else until the start of the examination period is announced

Answer ALL Questions

No calculators are permitted in this examination.

Dictionaries are not allowed with one exception. Those whose first language is not English may use a standard translation dictionary to translate between that language and English provided that neither language is the subject of this examination. Subject specific translation dictionaries are not permitted.

No electronic devices capable of storing and retrieving text, including electronic dictionaries, may be used.

DO NOT turn your examination paper over until instructed to do so

ADDITIONAL MATERIAL: None.

INFORMATION FOR INVIGILATORS: Exam papers must be collected at the end of the exam.

Question ONE – Web Programming [15 marks]

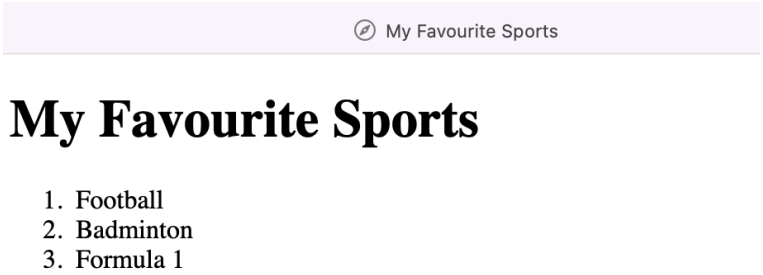
a) Name one protocol a web browser and web server can use to communicate with each other. Which response status code(s) might the web server return?

[2 marks]

b) What is the Document Object Model (DOM)? How does a web browser use the DOM to render a web page?

[2 marks]

c) Write the HTML necessary to represent the following webpage. The text "My Favourite Sports" is a level-1 heading. There is no need to include any CSS rules in your solution.



[4 marks]

d) The following HTML fragment contains a simple form:

```
<!DOCTYPE html>
<html lang="en">
<head><title>Add a New Team</title></head>
<body>
      <form action="add_new_team" method="post">
            <label for="tn"> What is your team's name? </label>
            <input type="text" name="team_name" id='tn'>
            <input type="submit" value="Submit">
      </form>
</body>
</html>
```

Using the Flask Web Application Framework in Python, write a function with the correct routing that returns the user's input (the team's name) preceded by "Your team's name is:". If the user doesn't fill in a team name, your solution should say, "You must give a team name!". Your solution should return the correct output as plain text (there is no need to return HTML). For example:

- If the user enters the team's name "Nottingham", your solution should return: "Your team's name is: Nottingham".
- If the user does not enter a team name, your solution should return: "You must give a team name!"

[7 marks]

Question TWO – Relational DB Design Theory and DBMS [15 marks]

Consider the following relations:

Student

sID	sName
1	Tom
2	John
3	Mike

Module

mCode	mTitle
DBI	Databases and Interfaces
PGA	Programming and Algorithms
MCS	Mathematics for Computer Scientists

Mark

sID	mCode	mark
1	DBI	30
1	PGA	60
1	MCS	80
2	DBI	60
2	MCS	45
3	DBI	71
3	PGA	35
3	MCS	60

a) Write down the results of the following relational algebra expressions. If an expression is not valid, please explain the reason.

i. $\sigma_{\text{sID = 1 and mark > 65}}(\text{Mark})$ **[1 mark]**

ii. $\pi_{\text{mTitle}}(\text{Module} \bowtie \sigma_{\text{mark<40}}(\text{Mark}))$ **[2 marks]**

iii. $\pi_{\text{sName}}(\text{Student} \bowtie \sigma_{\text{mark>70 and mCode=DBI}}(\text{Mark})) \cup \pi_{\text{sName}}(\text{Student} \bowtie \sigma_{\text{mark>70 and mCode=MCS}}(\text{Mark}))$ **[3 marks]**

b) List the output of the following SQL query:

```
SELECT sName, mTitle, mCode, mark
FROM Student NATURAL JOIN Mark NATURAL JOIN Module
WHERE sID NOT IN ( SELECT sID FROM Mark WHERE mark < 40)
 ORDER BY mark;
```

[2 marks]

c) Write an SQL query which returns the name, average mark, and range of marks (an individual student's highest mark minus their lowest mark) for each student.

[4 marks]

d) As an application developer, what are the advantages of utilising a DBMS over writing your own storage solution?

[3 marks]

Question THREE – SQL and ER Design [20 marks]

You are asked to design a database for a computer science conference. The conference is organised as follows:

- Several months before the conference is held, authors submit their papers to the conference for review. Each author may submit multiple papers, and each paper may have several authors.
- After submission, the papers are assigned to reviewers. Each paper will have at least 3 reviewers. A reviewer may be reviewing more than 1 paper. As all the reviewers are computer scientists, it is likely that they will submit papers to this conference as well. However, they are not allowed to review their own papers.
- Reviewers will produce a review for each paper they are assigned. Each review represents either a positive or a negative recommendation. A paper will be included in the conference proceedings, if all its reviews are positive. The organisers need to know which papers are accepted.
- Both authors and reviewers are participants of the conference. They should register in the system by providing their names and email addresses, and will be assigned with a unique ID.
- All papers submitted to the conference should also be registered in the system. In addition to the authorship, each paper also has a title and a unique paper ID.

Using the above description, answer the following questions.

Note, it is expected that you make reasonable assumptions, based on your real-life experiences, in the design and implementation of this database. Assumptions should be written down.

a) Draw the Entity Relationship Diagram (ERD) for the computer science conference. Please draw all entities, attributes in entities, and the cardinalities between entities. Reduce all Many to Many relationships in the diagram to 1 to Many relationships.

[8 marks]

b) Write the necessary SQL code to represent your database design in a modern DBMS system. Be certain to indicate primary keys and referential integrity constraints. Sensible referential integrity constraints should be assumed if they are not clearly described in the problem description.

[8 marks]

c) Please write the necessary SQL to list all IDs of papers that are accepted to appear in the conference.

[4 marks]