

The University of Nottingham Ningbo China

SCHOOL OF COMPUTER SCIENCE

A LEVEL 1 MODULE, SPRING SEMESTER 2015–2016

DATABASES 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 THREE questions

Note: Question 1 is worth 35 marks. Questions 2 & 3 are worth 20 marks each.

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 directories are not permitted.

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

DO NOT turn examination paper over until instructed to do so

Question 1- Databases

- (a) Define the terms Candidate key and Primary key. (2)
- (b) With the aid of example relations, explain what Referential Integrity is, and how the options RESTRICT and CASCADE are applied when a referenced tuple is updated or deleted. (6)
- (c) Describe, in the context of a database, what a Transaction is. Your answer should discuss each of the ACID properties and how these properties are ensured by the Database Management system (DBMS). (6)
- (d) Given the 3 relations below (Student, Grade, Module):

Student		Grade			Module	
sID	Name	sID	mCode	Mark	mCode	Title
1	Alex	1	AE1PRG	60	AE1PRG	Programming
2	Ben	1	AE1DBS	65	AE1DBS	Databases
3	Carl	1	AE1FUN	70	AE1UST	Unix
4	Drew	2	AE1DBS	75	AE1FUN	Haskell
		2	AE1PRG	80		
		3	AE1FUN	50		
		3	AE1PRG	50		

Write the results for the following relational algebra expressions.

Note:: The notation used below is as such:

σ :: Selection; π :: Projection; \cup :: Union; \cap :: Intersection;

$-$:: Set Difference; \times :: Cartesian Product.

- (i) $\pi_{mCode}(Grade)$ (1)
- (ii) $\sigma_{sID=1}(Grade)$ (1)
- (iii) $\pi_{sID}(Student) \cup \pi_{sID} \sigma_{Mark \geq 80}(Grade)$ (2)
- (iv) Translate the following SQL query into relational algebra (using only σ, π, \times operators): (4)

```
SELECT Name, Title, Mark
FROM Student
NATURAL JOIN Grade
NATURAL JOIN Module;
```

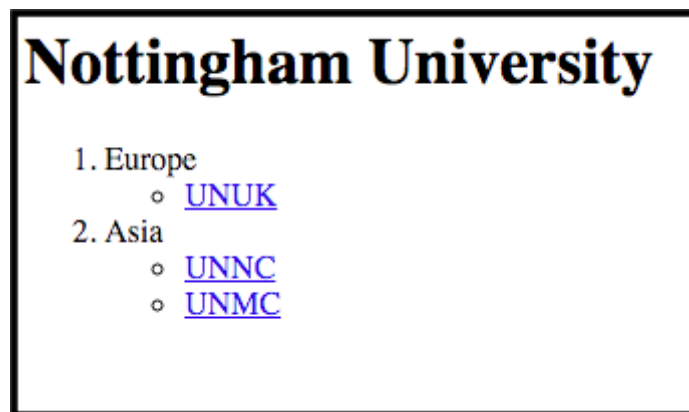
(e) *Alphabet* Inc. is an American multinational conglomerate created as the parent company of Google and several other companies previously owned by Google. You are asked to develop a database system for *Alphabet* to keep track of all their companies, departments, employees and hardware devices. The requirements for the database are provided below:

- There are several departments. Each department belongs to one company.
 - Each department employs one or more employees and each employee works for one department.
 - Each company has a company code and an address.
 - Each department has a department code, a name and the company that the department belongs to.
 - Each employee has an employee number, name, email and the department that he works for.
 - Each device has a Name, Serial Number, Operating System Version and the Employee that it relates to. To clarify, a serial number (e.g. ABC123DEF456) should be stored as a string. Additionally, the "Operating Systems Version" (e.g. Windows-10-X64-Build-12345) should also be stored as a string.
 - Each employee may have one or more device, and each device belongs to one employee.
- (i) Draw an entity relationship diagram for *Alphabet's* database. You should include the attributes (Primary and Foreign keys also) described in the requirements for each relation. (6)
- (ii) Write the necessary SQL code to create the tables with appropriate Primary and Foreign keys for the Alphabet database. (7)

Question 2- Static Web Pages (HTML and CSS)

- (a) What is HTML? (1)
- (b) What is CSS? What is it used for? Write a simple piece of CSS code as an example that demonstrates how CSS is used to affect a HTML element. (3)
- (c) Write an HTML script to create a nested list shown in the image below. The text items {UNUK, UNNC, UNMC} are also hyperlinks which link to the following (respective) pages:
- (i) <http://www.nottingham.ac.uk/>
 - (ii) <http://www.nottingham.edu.cn/>
 - (iii) <http://www.nottingham.edu.my/>

The heading (“Nottingham University”) should be the largest available to the browser. (5)



A render of the web-page you must write the HTML for.

- (d) Show in full, what a web browser will display after processing the following fragment of an HTML document. You should draw your answer. You may use text to support your answer if you wish.

(5)

```
<form>
  <h1>Personal Information</h1>
  First name:
    <input type="text" name="firstname"> <br>

  Last name:
    <input type="text" name="lastname"> <br>

  <input type="radio" name="gender" value="male"
    checked="checked">Male

  <input type="radio" name="gender" value="female">
    Female
  <br>
  <input type="submit" value="Submit">
</form>
```

- (e) This question consists of 2 sub-questions which are designed to test your knowledge of CSS.

- (i) List the 2 different ways we can use to include CSS in a given web page.

(1)

- (ii) Describe the effect of the following three CSS style rules. Your answer should include examples of which HTML elements would be affected by these rules, and when (if appropriate).

(5)

```
#ImportantTitle {
    text-decoration: underline;
}

.ReallyBigText {
    font-size: 72px;
}

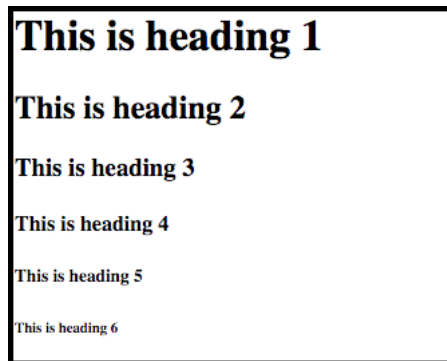
h1:hover {
    color: red;
    font-size: 12px;
}
```

Question 3- Dynamic Web Pages (JavaScript, PHP and AJAX)

- (a) Explain what the difference is between client side and server side scripting. Why do we need both forms of scripting? (3)
- (b) During the module you learnt that HTML provides 6 levels of heading elements ($\langle H1 \rangle, \dots, \langle H6 \rangle$).

Write a HTML document which has an embedded block of JavaScript code.

The JavaScript code should write 6 lines of text into the document. Each line of text should be - "This is heading X" where the value of X corresponds to the level of heading, as shown in the image below. (6)



- (c) Explain, with the aid of an example, what AJAX is. State, in terms of user experience or the technicalities of web development, one advantage of using AJAX over more traditional web development approaches e.g. Information passing between pages via hyper-linking. (4)

- (d) Given the HTML form at the bottom of this page, write a **PHP** script that will create a confirmation page containing an appropriate instance of the text:

Welcome <name>, you are <age> years old.
Your favourite colour is: <color>.

You are required to validate the values submitted via the form. The validation criteria for each input element of the form are provided below:

Name - Should be a string with a length ≥ 2 and length ≤ 20

Age - Should be a number whose value is > 0 and < 120

Color - Should be a string with a length ≥ 2 and length ≤ 15

If validation of any of the fields should fail, the following default values should be assumed.

Name :: "Bob"

Age :: -1

Color :: "No Color"

There is no need to notify the user of invalid input, simply assign and display the default values.

```
<form action = "order.php" method="GET">
  Name:
    <input type="text" name="name" /> <br />
  Age:
    <input type="number" name="age" /> <br />
  Favourite Color:
    <input type="text" name="color" /> <br />

  <input type="submit" value="Submit">
</form>
```

(7)