The University of Nottingham Ningbo China

SCHOOL OF COMPUTER SCIENCE

A LEVEL 1 MODULE, Spring SEMESTER 2020-2021

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 [10 marks]

a) Can the code in Figure 1 produce the output as shown in Figure 2? If it cannot, explain why. **[2 marks]**

```
<!DOCTYPE html>
<html>
    <head>
        <title> My DBI Exam </title>
    </head>
    <body>
        <form>
            <input type = "button" id = "myButton" value = "click" />
        </form>
        <script type = "text/javascript">
            function myButtonHandler()
            {
                confirm('You clicked my button!');
            }

            document.getElementById("myButton").onclick = myButtonHandler;
        </script>

    </body>

</html>
```


Figure 1: Button Handler

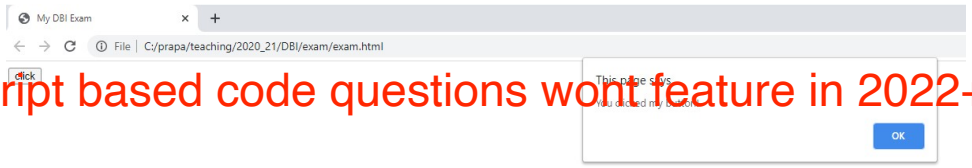

Figure 2: Button - onclick output

b) Given the code in Figure 3, what would be the output of this web page when a user clicks on One on the web page shown in Figure 4? **[1 mark]**


```
<!DOCTYPE html>
<html>
    <head>
        <title> My DBI Exam - radio </title>

        <script type = "text/javascript">
            function numChoice(age)
            {
                switch(age)
                {
                    case "1":
                        alert("You selected One!");
                        break;
                    case "2":
                        alert("You selected Two!");
                        break;
                    default:
                        alert("Error in JavaScript function numChoice");
                        break;
                }
            }
        </script>

    </head>
    <body>
        <form id = "myForm" action ="">
            Select a number:<br />
            <label>
                <input type = "radio" name = "one" value = "1"
                    onclick = "numChoice(1)" /> One.
            </label>

            <label>
                <input type = "radio" name = "two" value = "2"
                    onclick = "numChoice(2)" /> Two.
            </label>
        </form>

    </body>

</html>
```

JavaScript based code questions wont feature in 2022+ exams.

Figure 3: radio button

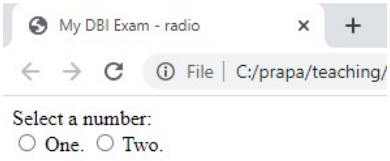

Figure 4: Radio button output

c) With regard to the HTML section, could there be any issue when the form as shown in Figure 3 is used? If there could be, describe explicitly the problematic scenario(s) and explain how to fix the issue(s) on this form. **[3 marks]**

d) Based on the code in Figure 5, how many rows on this web page will be underlined? Specify which row (or rows) they are? **[2 marks]**

```
<!DOCTYPE html>
<html>
    <head>
        <title> My DBI Exam - CSS </title>

        <style type = "text/css">
            li:first-child {
                text-decoration: underline;
            }
        </style>

    </head>
    <body>
        My favourite animals:
        <ol>
            <li>Cat
                <ul>
                    <li>Scottish Fold</li>
                    <li>British Shorthair</li>
                </ul>
            </li>
            <li>Cat</li>
            <li>Cat</li>
            <li>Cat</li>
        </ol>
    </body>

</html>
```

Figure 5: CSS - underline

e) Write the output of the code as shown in Figure 6. **[2 marks]**

```
<!DOCTYPE html>
<html>
    <head>
        <title> My DBI Exam - JS Object</title>
    </head>
    <body>
        <script type = "text/javascript">
            var cat = new Object();
            cat.breed = "Scottish Fold";
            cat.location = "Scotland"
            cat.origin = "Mutation";

            for(var i in cat)
                document.write(i, " ", cat[i], "<br />");

        </script>
    </body>
</html>
```


Figure 6: JavaScript Object

Question TWO – Relational DB Design Theory and DBMS [20 marks]

Consider the following relations:

Student

sId	Name	Year
zy12345	Joe Bloggs	1
zy54321	Adam Smith	2
zy32145	Sherlock Holmes	3

Module

mCode	Title	Credits
COMP1048	Databases and Interfaces	10
COMP3050	Individual Dissertation	40
COMP2044	Human-Computer Interaction	20

Enrolment

sID	mCode	Grade
zy12345	COMP1048	50
zy32145	COMP2044	76
zy54321	COMP2044	34

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

i. $\pi Credits(Student \times Module)$

[1 mark]

ii. $\pi mCode(\sigma Year = 3 \wedge Credits > 10(Module \times Student))$

[2 marks]

iii. $\pi Name, Title, Grade\big(\sigma Year \geq 2(Student \times Module \times Enrollment)\big) - (\sigma Grade \leq 69\ (Student \times Module \times Enrollment))$

[2 marks]

b) Translate the following SQL statement into its equivalent Relational Algebra expression:

```
SELECT Student.Name, Module.Title, Enrolment.Grade from (Enrolment NATURAL JOIN Module
        NATURAL JOIN Student) WHERE Student.Year > 1 and Module.Credits > 10;
```

[5 marks]

c) What is a DBMS? List three advantages of a DBMS over traditional file-based systems.

[4 marks]

d) *RESTRICT*, *CASCADE*, *SET NULL* and *SET DEFAULT* are all examples of strategies a DBMS may use to enforce referential integrity. What is referential integrity? Why is referential integrity important? What are the differences between the four listed strategies for managing referential integrity?

[6 marks]

Question THREE – SQL and ER design [20 marks]

A manufacturing company, iHome, produces a range of modern home furnishing items, such as tables and chairs. iHome have hired you to produce a database capable of storing their product information which should include the products' ID and the quantities of product in stock.
iHome's products are made up of many components. Each component can be supplied by one or more suppliers. The following component information is stored: component ID, name, description, suppliers who supply them, and products in which they are used. You may assume:

- A supplier can exist without providing components.
- A component does not have to be associated with a supplier.
- A component does not have to be associated with a product. Not all components are used in products.
- A product cannot exist without components.

a) Draw the entity relationship diagram (ERD) for the iHome company. Please draw all entities (associative entities are not necessary), attributes in entities, and the cardinalities between entities.

[9 marks]

b) Write the necessary SQL code to represent your ERD in a modern DBMS system.

[8 marks]

c) iHome have asked you to develop a web-based system that allows its workers to interact with the database system you have developed. Outline how you would approach developing such a system, highlighting specific technologies you would use to achieve this.

[3 marks]