

R249/112

DUBLIN INSTITUTE OF TECHNOLOGY
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BSc Information Systems / Information Technology

Stage 1

SUPPLEMENTAL EXAMINATIONS 2008

INFORMATION STORAGE AND MANAGEMENT

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2 HOURS

ATTEMPT **3** QUESTIONS

ALL QUESTIONS CARRY EQUAL MARKS

Examine the following information. It will be needed for questions 1, 2 and 4.

- A snooker tournament has a *name* and a *year*.
- A snooker tournament consists of a set of *matches*.
- Each match involves two *players*.
- Each match takes place at a *round*, between 1 and 6.
- Each player has a *first name*, a *surname*, a *world ranking* and a *nationality*.
- Each player in a match achieves a *score* and is declared *winner* or not.

The XML document below describes the *Celtic Nations tournament* of 2010 according to the above rules.

```
<tournament name="Celtic Nations Championship" year="2010">
  <match round="1">
    <player score="8" winner="false">
      <firstname>Ken</firstname>
      <surname>Doherty</surname>
      <nationality>Ireland</nationality>
      <worldranking>14</worldranking>
    </player>
    <player score="10" winner="true">
      <firstname>Stephen</firstname>
      <surname>Hendry</surname>
      <nationality>Scotland</nationality>
      <worldranking>8</worldranking>
    </player>
  </match>
  <match round="1">
    <player score="4" winner="false">
      <firstname>Mark</firstname>
      <surname>Williams</surname>
      <nationality>Wales</nationality>
      <worldranking>20</worldranking>
    </player>
    <player score="10" winner="true">
      <firstname>Fergal</firstname>
      <surname>O'Brien</surname>
      <nationality>Ireland</nationality>
      <worldranking>38</worldranking>
    </player>
  </match>
  <match round="2">
    <player score="10" winner="true">
      <firstname>Fergal</firstname>
      <surname>O'Brien</surname>
      <nationality>Ireland</nationality>
      <worldranking>38</worldranking>
    </player>
    <player score="0" winner="false">
      <firstname>Stephen</firstname>
      <surname>Hendry</surname>
      <nationality>Scotland</nationality>
      <worldranking>8</worldranking>
    </player>
  </match>
</tournament>
```

Figure 1

1. (a) Explain clearly what is meant by *validity* with respect to XML documents and languages.

(5 marks)

(b) Provide the DTD for the document shown above in Figure 1.

(10 marks)

(c) The following is a partial schema for document shown above in Figure 1. Provide the code to complete this schema, enforcing all relevant types, rules and restrictions. **You do not need to copy the provided code into your answer book.**

```
<?xml version="1.0"?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="tournament">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="match" minOccurs="1" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:attribute ref="name" use="required"/>
      <xs:attribute ref="year" use="required"/>
    </xs:complexType>
  </xs:element>

  <xs:element name="match">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="player"/>
        <xs:element ref="player"/>
      </xs:sequence>
      <xs:attribute ref="round" use="required"/>
    </xs:complexType>
  </xs:element>

  <xs:element name="player">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="firstname"/>
        <xs:element ref="surname"/>
        <xs:element ref="nationality"/>
        <xs:element ref="worldranking"/>
      </xs:sequence>
      <xs:attribute ref="score" use="required"/>
      <xs:attribute ref="winner" use="required"/>
    </xs:complexType>
  </xs:element>

</xs:schema>
```

(18 marks)

2. (a) Explain clearly what is meant by *well-formedness* with respect to XML. **(5 marks)**

(b) Consider that each snooker tournament has, as a prize, a car registered in the Republic of Ireland. It is decided that the language shown in Figure 1 above is to be extended to include the registration number. A regular expression is required to enforce the rules for the registration number format, as given below:

- i. All registration numbers start with a two digit year identifier.
- ii. This is followed by any number of spaces (including none).
- iii. This is followed by an optional dash.
- iv. This is followed by any number of spaces (including none).
- v. This is followed by the county identifier (you can assume that this can only be D, DL or KE).
- vi. This is followed by any number of spaces (including none).
- vii. This is followed by an optional dash.
- viii. This is followed by any number of spaces (including none).
- ix. This is followed by up to 7 digits.

The following are valid registration numbers according to these rules:

- 99-KE-4109
- 03D10934
- 04 DL 1
- 08 - KE1

Provide the regular expression for the registration number format according to the rules provided.

(10 marks)

- (c) Provide the XSL-T and XPath code necessary to answer the following questions with respect to the document shown in Figure 1 above:

- i. Find the names of all players who won matches, to produce the following output:

```
The following players won matches: Hendry, O'Brien, O'Brien
```

- ii. Find the sum of all scores by all players in all matches, to produce the following output:

```
The total scores achieved is: 42
```

- iii. Print a list of all matched opponents, to produce the following output:

```
Doherty -v- Hendry, Williams -v- O'Brien, O'Brien -v- Hendry
```

- iv. Print the names of all players from Ireland who competed in matches in round 1, to produce the following output:

```
The Irish players are Doherty, O'Brien
```

(18 marks)

3. (a) Explain the important differences between a *tree* in general and a *binary tree* in particular. Show how to build a binary parse tree for the following expression

$$(A * (B + C)) - D$$

(10 marks)

- (b) Using the following simple sentence, build a Huffman Tree:

Peter Picked a Pipe

and provide the encoding for the word *keep*.

Demonstrate one method which could be employed to encrypt the encoded version of *keep*.

(14 marks)

- (c) Traverse the Huffman Tree from part (b) above using in-order, pre-order and post-order traversal methods.

(9 marks)

4. (a) Create an ERD for a database to store information on the snooker tournament according to the rules in Figure 1 above. Justify any decisions you make. **(14 marks)**

- (b) Provide the SQL code needed to build the database from part (a).

You do not need to provide the code for entering the data, only the code for creating the tables.

(10 marks)

- (c) Provide SQL statements to perform the following operations on the database from parts (a) and (b):

- i. Insert the details of one of the round 1 matches into the database.
- ii. Provide a list of all match winners.
- iii. Delete all matches where the difference between the winner's score and the loser's score is greater than 5.

(9 marks)