

TRINITY COLLEGE DUBLIN
THE UNIVERSITY OF DUBLIN

Faculty of Engineering, Mathematics and Science
School of Computer Science & Statistics

BA (Mod) Business & Computing
Integrated Computer Science
Year 2 Annual Examinations

Trinity Term 2015

Information Management 1

Prof. Declan O'Sullivan

Thursday 21st May, 2015

Luce Lower

14:00 – 15:30

Instructions to Candidates:

Answer two questions
All questions carry equal marks.
Answer each question in a separate answer book.
Hand up complete question paper.

Materials permitted for this examination:

Calculator

**SOME QUESTIONS REFER TO THE FOLLOWING
FIGURE A:**

```
<?xml version='1.0' encoding='UTF-8'?>

<collection>
  <description>
    Some recipes used in the XML tutorial.
  </description>
  <recipe>
    <title>Beef Parmesan with Garlic Angel Hair Pasta</title>
    <ingredient name='beef cube steak' amount='1.5' unit='pound'/>
    <ingredient name='onion, sliced into thin rings' amount='1'/>
  <preparation>
    <step>
      Preheat oven to 350 degrees F (175 degrees C).
    </step>
    <step>
      Cut cube steak into serving size pieces. Coat meat with the bread crumbs
      and parmesan cheese. Heat olive oil in a large frying pan, and saute 1
      teaspoon of the garlic for 3 minutes. Quick fry (brown quickly on both sides)
      meat. Place meat in a casserole baking dish, slightly overlapping edges.
      Place onion rings and peppers on top of meat, and pour marinara sauce
      over all.
    </step>
  </preparation>
  <comment>
    Make the meat ahead of time, and refrigerate over night. </comment>
  <nutrition calories='1167' fat='23' carbohydrates='45' protein='32'/>
</recipe>

<recipe>
  <title>Ricotta Pie</title>
  <ingredient name='filling'>
    <ingredient name='ricotta cheese' amount='3' unit='kilos'/>
    <ingredient name='eggs' amount='12'/>
  </ingredient>
<nutrition calories='349' fat='18' carbohydrates='64' protein='18'/>
<comment> This is only part of the recipe </comment>
</recipe>
</collection>
```

SEE NEXT PAGE FOR QUESTIONS

Question 1

Using UML, design an information system to support aspects of the operation of a bus company (e.g. Dublin Bus). Include cardinality and other constraint information.

- a) Model at least 6 UML classes (each with at least 2 attributes) representing your information with named associations and roles between the classes. Include at least one subclass and one aggregation association.

(8 marks)

- b) Model 2 UML use cases (diagrams and textual descriptions) that will be supported by these classes.

(6 marks)

- c) Provide a UML sequence diagram for each use case that indicates the sequence of operations involved that will implement the UML use cases designed in part b) above.

(6 marks)

- d) Provide a detailed commentary on the design decisions you took during the modelling task.

(5 marks)

(Total 25 Marks)

Question 2

- a) Explain each of the clauses described by the acronym “FLOWR” in XQuery, and what each is used for. Give example(s) to help your explanations.

(4 Marks)

- b) Use DTD notation to fully describe the XML document shown in Figure A. Provide explanations for your design decisions.

(8 Marks)

Question 2 continues on next page...

...Question 2 continued from previous page

- c) Define and explain XQuery statements for each of the following queries posed over the document in Figure A. Show expected results and explain your design decisions.
- i) Return within a new element called 'Comments', all the comments in the document.
 - ii) Return **just the values of 'amount' attributes** as an **element** called 'Amounts List'.
 - iii) Return only the names of those ingredients who have 'kilos' as a unit.
 - iv) Return the second ingredient of the ingredient named 'filling'.

(13 Marks)

(Total 25 Marks)

Question 3

- a) Name and describe four approaches to adding structure to an information file. Include an example and/or diagram in your explanation.
- b) Describe the algorithm for inserting a key into a B-Tree. Use diagrams with examples to illustrate.

(4 Marks)

(8 Marks)

Question 3 continues on next page...

...Question 3 continued from previous page

- c) Given the B-Tree in Figure B (with $m=5$), show the growth of the B-Tree as you add the keys in the following order:

19, 21, 24, 6, 25, 28, 17, 33, 38, 45, 56, 26, 58, 70, 73

- Show the tree at each stage and provide an explanation for any splits.
- What is the average number of node splits per new key inserted?
- What is the average search time?

(13 Marks)

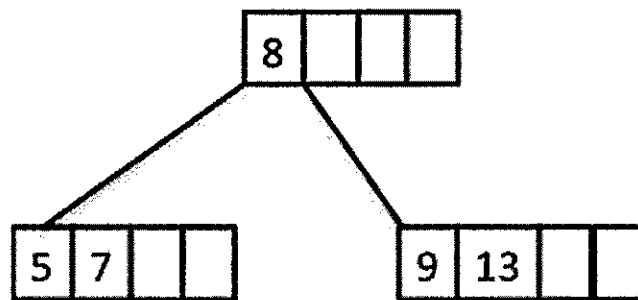


FIGURE B

(Total 25 Marks)

Question 4

The next generation of the web will be based on the Semantic Web for a number of good reasons. Discuss.

Address at least the following points in your answer:

- What is currently a problem with Information Retrieval on the Web;
- The vision of the semantic web with agents and machine readable models and metadata;
- How will the linked data initiative contribute towards realising the vision;
- The advantages of a graph based encoding of knowledge like RDF;
- The fundamentals (with examples) of how RDF works;
- The challenges in making the vision a reality;
- Give your opinion as to whether more semantic metadata about documents might make web crawling process more efficient.

(Total 25 Marks)

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