

**National College of Ireland**

BSc. (Honours) in Computing – Full-time – Year 3 – BSHC3  
BSc. (Honours) in Computing – Part-time – Year 3 – BSHCE3  
BSc. (Honours) in Business Information Systems – Full-time – Year 3 – BSHBIS3  
BSc. (Honours) in Business Information Systems – Part-time – Year 3 – BSHBISE3  
BSc. (Honours) in Technology Management – Full-time – Year 3 – BSHTM3

**Semester One Examinations – 2016/17**

**Wednesday 11<sup>th</sup> January 2017**  
**2.00pm – 3.30pm**

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**Advanced Databases**

Dr. James Doody  
Dr Hugh O'Donnell  
Dr. Paul Hayes  
Mr. Eamon Nolan  
Dr. Kunjan Patel

**Instructions:**

Answer **Question 1** and **TWO** other questions

Use figures and diagrams wherever it is necessary to support your answers

**Duration of exam:** 90 minutes

**Attachments:** None

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**Question 1. Mandatory. Answer ALL parts. 40 Marks**

- (i) Characterise each of the four properties that make transactions ACID-compliant. (8 marks)
- (ii) Demonstate the construction of a multi-level index B-Tree data structure of order 7 containing the following key values:  
5 9 13 55 24 3 8 46 35 34 (8 marks)
- (iii) Distinguish how the *Phantom Read Problem* can manifest itself due to execution of concurrent processes within a DBMS (Database management System). (8 marks)
- (iv) Elucidate the key goal of an *Information Retrieval (IR)* system and identify at least two types of model used. (8 marks)
- (v) Characterise the main activities that occur during the *ETL (Extract-Transform-Load)* process of a Data Warehousing system. (8 marks)

**Answer ANY TWO Questions from the following.**

**Question 2. Answer ALL parts. 30 Marks**

- (i) Characterise how the *Deferred Update Protocol* works. Critique one advantage and one disadvantage of the *Deferred Update Protocol*. (10 marks)
- (ii) Distinguish the actions that are carried out by a DBMS during a checkpoint operation. (10 marks)
- (iii) Delineate how data is physically stored for each of the following *File Organisation Types*:
  - a) Heap
  - b) Ordered(10 marks)

**Question 3. Answer ALL parts. 30 Marks**

*Doc1*

Never seen before.

*Doc2*

Before night day.

*Doc3*

Never during the day.

- (i) Formulate the *term-document incidence matrix* associated with the contents of the three documents above, *Doc1*, *Doc2* and *Doc3*. (10 marks)
- (ii) Evaluate the term vectors associated with the following terms:  
a. never  
b. night  
c. day (10 marks)
- (iii) Demonstrate how bitwise operations are performed on term vectors to return a result vector for the query:  
*night AND day*  
Interpret the result vector. (10 marks)

**Question 4. Answer ALL parts. 30 Marks**

- (i) Delineate 4 challenges that an organisation faces when implementing a data warehouse solution. (10 marks)
- (ii) Distinguish what is meant by the term *Data Mart*. Evaluate two reasons for creating *Data Marts* within an organisation. (10 marks)
- (iii) Analyse and contrast the activities associated with the following data flows within a data warehouse:  
a. Upflow  
b. Downflow (10 marks)