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University Examinations 2018/2019

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATIONS FOR BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, BACHELOR OF SCIENCE IN COMPUTER SCIENCE, BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY, BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND FORENSICS, BACHELOR OF EDUCATION SCIENCE, BACHELOR OF SCIENCE IN COMPUTER SECURITY AND FORENSICS AND BACHELOR OF BUSINESS INFORMATION TECHNOLOGY

CIT 3302: ADVANCED DATABASE SYSTEMS

DATE: SEPTEMBER 2019

TIME: 2 HOURS

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- a) What do you understand from the following terms: (4 marks)
- (i) Concurrency control
 - (ii) Deadlock
- b) The interface between the front-end and the back-end of database functionality is through SQL or through an application program interface. Describe FOUR front-end Components. (4 marks)
- c) While describing what a data warehouse is, give TWO benefits an organization can benefit from implementing a data Warehouse. (4 marks)
- d) Differentiate between
- (i) Local and global transactions in a distributed database. (4 marks)
 - (ii) Centralized and Client-Server Systems. (4 marks)
- e) Query processing in a database is implemented in FOUR main steps. Describe the role played by each of these steps. (4 marks)
- f) The diagram below illustrates transactions failure. DBMS starts at time t_f . Assume data for transactions T_2 and T_3 have been written to secondary storage and checkpoint took place time t_c .

- (i) Based on the above scenario, explain what happens to transactions T_1 , T_6 , T_4 and T_5 . (4 marks)
- (ii) What is the role played by checkpoint feature. (2 marks)

QUESTION TWO (20 MARKS)

- a) Describe THREE main recovery techniques employed by DBMSs. (6 marks)
- b) Describe TWO techniques for managing concurrency. (4 marks)
- c) Based on a transaction T with timestamp $ts(T)$, describe what would happen under the following circumstances. (6 marks)
 - (i) $ts(T) < \text{write-timestamp}(x)$
 - (ii) $ts(T) > \text{write-timestamp}(x)$
 - (iii) $ts(T) > \text{Read-timestamp}(x)$
- d) Differentiate between Fragmentation and Replication in relation to distributed databases. (4 marks)

QUESTION THREE (20 MARKS)

- a) Transactions in a DBMS can have two outcomes. While giving the two outcomes briefly explain what happens after each of the outcomes. (6 marks)
- b) Briefly describe FOUR facilities that DBMS should provide in order to assist with recovery. (4 marks)
- c) Data is a valuable resource that must be strictly protected as with any corporate resource. Describe THREE threats to data stored in a database and give ONE mechanisms employed by database management systems to protect data from each of the threats identified. (6 marks)
- d) SQL injection is a major threat to database security. How can an organization protect its database from SQL injection attack. (4 marks)

QUESTION FOUR (20 MARKS)

- a) Compare RAID level 1 and RAID level 5 technologies in terms of capabilities and preference. (6 marks)

- b) Differentiate between Software RAID and Hardware RAID. (4 marks)
- c) A certain international business based in Kenya has branches in Lagos-Nigeria where 200,000 customer records are held, Scotland where 150,000 customer records are held and Johannesburg –South Africa where 1,000,000 records are held. The company uses a distributed database.
 - (i) Assuming the records in the three branches are randomly distributed, describe THREE problems that are likely to affect this company. (6 marks)
 - (ii) Give FOUR benefits of implementing a distributed database. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Access control is concerned with which database users can access what data (object). Describe the following concepts in relation to access control.
 - (i) Subject (2 marks)
 - (ii) Object (2 marks)
 - (iii) Access right/privileges (2 marks)
- b) While describing TWO phase locking give the significance of the two phases. (4 marks)
- c) Internet communication relies on TCP/IP as the underlying protocol. However, TCP/IP and HTTP were not designed with security in mind. Without special software, all Internet traffic travels 'in the clear' and anyone who monitors traffic can read it. What conditions should anyone sending database content over the Internet ensure. (10 marks)