Review Test Submission: Initial Examination

User	
Course	COS 326 S2 2023
Test	Initial Examination
Started	11/16/23 7:32 AM
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Instructions	

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment & Information Technology

Department of Computer Science

COS326 - Database Systems

Online Initial Examination

Total Marks: 100

16 November 2023

Time/Duration: 7:30am - 10:30am (3 Hours 0 Minutes)

Examiner: Mr. S.M. Makura

External Moderator: Mr. F. Elegbeleye

Instructions

1. Read the question paper carefully and answer all the questions.

2. This examination comprises of **34** questions. It consists of three sections namely Section A (Multiple Choice & Fill in the blank questions) – 20 marks ← **OK**

Section B (Application and Theory - Based Questions) – 40 Marks, Section C (Scenario-Based questions) - 40 Marks.

3. You have **180** minutes to complete this examination.

4. This is a **closed book** examination: you may therefore **not** have any study material with you.

5. Please switch off your smartphone/tablet and keep it off for the duration of the examination.

6. The examination will automatically submit your answers when the time (3 hours) expires. You can also submit the examination yourself if you are done ahead of time.

7. All examination regulations and 'code of conduct' of the University of Pretoria are applicable during this examination.

Integrity Statement:

The University of Pretoria commits itself to produce academic work of integrity. I affirm that I am aware of and have read the Rules and Policies of the University, more specifically the Disciplinary Procedure and the Tests and Examinations Rules, which prohibit any unethical, dishonest or improper conduct during tests, assignments, examinations and/or any other forms of assessment. I am aware that no student or any other person may assist or attempt to assist another student, or obtain help, or attempt to obtain help from another student or any other person during tests, assessments, assignments, examinations and/or any other forms of assessment.

Question 1

1 out of 1 points

In ObjectDB, the object identifier (OID) needs to be immutable. What does this mean?

Question 2

1 out of 1 points

Study the following SQL Statements and answer the question that follows:

```
CREATE SEQUENCE venueSeq START 101;
CREATE TYPE BuildingCodeType AS ENUM ('IT',
'LAW', 'CHM',
'PHY');
CREATE TYPE RoomCodeType AS (building
BuildingCodeType, floor int, room int);
CREATE TYPE EquipmentType AS ENUM
('projector', 'PAsystem',
'safe', 'PC', 'phone');
CREATE TABLE Venue (
venueKey integer DEFAULT nextval('venSeq')
PRIMARY KEY,
venueCode    RoomCodeType, seats  int  );
CREATE TABLE LectureRoom  ( equipmentList
text [ ] ) INHERITS (VENUE);
```

Assuming that the above SQL statement shave been executed in a PostgreSQL database, which one of the SQL statements below will insert the data shown below in to the LectureRoom table?

VenueKey: auto-generated
venue code: IT 4-2
seats: 120
equipment: projector, PAsystem, safe

Question 3

1 out of 1 points

Study the following XML document and answer the question that follows:

```
<CUSTOMERLIST>
     <CUSTOMER branchNo = "B105">
          <ACCOUNTNO>105001</ACCOUNTNO>
          <NAME>
               <FNAME>James</FNAME>
               <LNAME>Brown</LNAME>
          </NAME>
          <CREDLIMIT>30000</CREDLIMIT >
     </CUSTOMER>
     <CUSTOMER branchNo = "B103">
          <ACCOUNTNO>103002</ACCOUNTNO>
          <NAME>
               <FNAME>Kagiso</FNAME>
               <LNAME>Tshabalala</LNAME>
          </NAME>< CREDLIMIT>12000</CREDLIMIT>
    </CUSTOMER>
</CUSTOMERLIST>
```

Which one of the following FLWOR queries will show the customer account number, customer name and credit limit for customers with a credit limit greater than 10,000?

Question 4

1 out of 1 points

Study the following MongoDB collection called "products" and the given aggregation query:

```
{ _id: ObjectId(1), name: "Laptop", category:
"Electronics", price: 1200 }
{ _id: ObjectId(2), name: "Smartphone",
category: "Electronics", price: 800 }
{ _id: ObjectId(3), name: "Toaster", category:
"Appliances", price: 50 }
```

Query

```
mydb.products.aggregate([
    {
        $match: { category: "Electronics" }
    },
    {
        $group: {
            _id: "$category",
            total_price: { $sum: "$price" }
        }
    }
])
```

When the above query is executed in Mongoshell, what will be the output?

Question 5

1 out of 1 points

Aggregation operations in MongoDB ___ values from multiple documents.

Question 6

1 out of 1 points

Given that the following Cypher query has been executed in a Neo4j graph database:

```
CREATE
    (nandi:Person { name: "nandi", city:
"Mbombela", hobby: "reading" }),
    (ayanda:Person { name: "ayanda", city:
"Gqeberha", hobby: "surfing" }),
    (dineo:Person { name: "dineo", city:
"Polokwane", hobby: "painting" }),
    (nandi)-[:FRIENDS]->(ayanda),
    (nandi)-[:FRIENDS]->(dineo),
    (ayanda)-[:FRIENDS]->(dineo);
```

Which of the following Cypher queries will retrieve the names of the friends that Nandi is connected to through the "FRIENDS" relationship?

Question 7

1 out of 1 points

In Neo4j, which one of the following clauses is used to add new properties to an existing node or relationship?

Question 8

0 out of 1 points

Which one of the following technologies bridges the gap between declarative-style interfaces such as SQL, and rigid style required by MapReduce?

Question 9 1 out of 1 points

The process of combining data from multiple sources into a data warehouse is called _____

Question 10 1 out of 1 points

Which one of the following is not a characteristic of a data warehouse?

Question 11 0 out of 1 points

In object-oriented databases, the operation's ability to be applied to different types of objects is called _____

Question 12 0 out of 1 points

To obtain current dimensions of any array value in PostgreSQL you can use the _____ function.

Question 13 1 out of 1 points

To search for a collection in a MongoDB database you use the _____ method.

Question 14 1 out of 1 points

Write out the mongo shell command you would use inoder to see all the collections contained in a particular database in MongoDB.

Question 15 0 out of 1 points

To delete properties and labels from graph elements in Neo4j, you use the _____ clause.

Question 16 0 out of 1 points

Study the following CYPHER query and answer the question that follows:

```
MATCH p   =  (a)-->(b)-->(c)
RETURN a.name, b.name, c.name, length(p);
```

The length() is a type of a _____ function.

Question 17

1 out of 1 points

True/False: NewSQL databases are schema free.

Question 18

0 out of 1 points

YARN stands for _____.

Question 19

1 out of 1 points

In ROLAP, each row of the fact table has a _____ from the dimension tables.

Question 20

1 out of 1 points

True/False: Elementary OLAP operators support a variety of operations such as ranking and window calculations.

Question 21

1 out of 3 points

Object ODBMS

With the aid of examples, differentiate between JPQL / Criteria Variables and JPQL / Criteria Literals in ObjectDB. (3 Marks)

Question 22

4 out of 4 points

Object Relational DBMS

Study the following SQL statements and answer the question which follows.

```
CREATE TABLE Persons (
    id SERIAL PRIMARY KEY,
    first_name VARCHAR(50),
```

```
    last_name VARCHAR(50),
    age INT
);

INSERT INTO Persons (first_name,last_name,age)
VALUES
    ('Marianne','Smit',30),
    ('Lebogang','Bakwena',25),
    ('Sipho','Zulu',40);
```

Write the PL/pgSQL function called `calculate_average` which calculates the average age of the people in the Persons table. (4 Marks)

Question 23

4 out of 5 points

Semi-structured data & XML

Study the following XML document and answer the following question:

```
<store>
    <category>
        <name>Electronics</name>
        <product>
            <name>Laptop</name>
            <price>800</price>
        </product>
        <product>
            <name>Smartphone</name>
            <price>400</price>
        </product>
    </category>
    <category>
        <name>Clothing</name>
        <product>
            <name>T-Shirt</name>
            <price>20</price>
        </product>
        <product>
            <name>Jeans</name>
            <price>50</price>
        </product>
    </category>
</store>
```

Write the FLWOR expression to calculate the average price of products in each category. (5 Marks)

Question 24

3 out of 7 points

MongoDB

Study the following collection (called **salesCollection**) from a MongoDB Database called **mydb** and answer the questions that

follow. The collection shows the number of sales for each product for certain store.

```
{
    order_id: 1,
    product: "Laptop",
    quantity: 3,
    price: 800,
    date: ISODate("2023-11-01T08:00:00Z")
  },
  {
    order_id: 2,
    product: "Smartphone",
    quantity: 5,
    price: 400,
    date: ISODate("2023-11-02T14:30:00Z")
  },
  {
    order_id: 3,
    product: "Tablet",
    quantity: 2,
    price: 300,
    date: ISODate("2023-11-03T10:15:00Z")
  },
  {
    order_id: 4,
    product: "Laptop",
    quantity: 2,
    price: 800,
    date: ISODate("2023-11-04T09:45:00Z")
  }
```

a. Elaborate at least three characteristics of a MongoDB document (3 marks).

b. Write the JavaScript statement for the mongo shell to calculate the total sales value for each product(4 Marks).

Question 25

3 out of 7 points

Neo4j

Study the following CYPHER query and answer the questions that follow:

```
CREATE (braam:User {name: 'braam', age: 30})
CREATE (phathutshedzo:User {name:
'phathutshedzo', age: 28})
CREATE (loyiso:User {name: 'loyiso', age: 35})
CREATE (dave:User {name: 'dave', age: 40})

CREATE (braam)-[:KNOWS]->(phathutshedzo)
CREATE (braam)-[:KNOWS]->(loyiso)
CREATE (phathutshedzo)-[:KNOWS]->(dave)
```

a. What are predicates in the Cypher query language? Give two examples of predicate functions. (3 Marks)

b. Write the CYPHER query to count the number of persons who have an age of 35 or below. Make use of one predicate function. (4 marks)

Question 26

2 out of 7 points

Big Data and Data Mining

a. Mention three advantages of the Hadoop/MapReduce Technology (no one word answers). (3 Marks)

b. Elaborate on at least three ways to describe the knowledge discovered during data mining (no one word answers). (4 Marks)

Question 27

3.5 out of 7 points

Data Warehousing and OLAP

a. What is a datamart, and what is it used for in a data warehousing environment? (2 Marks)

b. Study the following table which shows data extracted from a data mart.

Student Name	Rea	Abel	Rea	Abel	Rea	Abel
Test Number	1	1	2	2	3	3
Test Mark	56	67	99	34	54	72

(i) Differentiate between roll up and a drill down OLAP operations (2 Marks)

(ii) Based on the data in the above table, perform a roll up operation to calculate the average for each test (3 Marks).

Question 28

4 out of 4 points

Object ODBMS

Study the following scenario and the following question:

> You have been called for a software developer interview at ABC software solutions. In the interview you had mentioned that you studied and utilised Object-Oriented databases. The interview panel then decided to test your proficiency in using Object-Oriented databases.
>
> Source: Makura S.M (2023)

Name and describe to the interview panel at least three JPA annotations for relationships you can make use of in ObjectDB. (4 Marks)

Question 29

3.5 out of 4 points

Object RDBMS

Study the following SQL statements and answer the question which follows.

```
CREATE TYPE YearLevelType AS ENUM ('First','Se
cond','Third','Honours','Masters','PhD',);
CREATE TYPE StudentType (title YearLevelType,
firstName CHAR(20), surname CHAR(20));
           CREATE TABLE studentMember (student
         StudentType, degreeofstudy CHAR(50));
```

Source: Makura S.M (2023)

Write the SQL function called `StudentName` which returns a string with the title, first name and last name of a student member. (4 Marks)

Question 30

2 out of 4 points

Semi structured Data & XML

Study the following scenario and the following question:

> Martin is busy with a BaseX practical. In the practical, Martin has been provided with the following XML schema. Assist Martin to answer the following questions.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/
XMLSchema">

  <xs:element name="Person">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="FirstName"
type="xs:string"/>
```

```
        <xs:element name="LastName"
type="xs:string"/>
        <xs:element name="Age"
type="PositiveInteger"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

</xs:schema>
```

Source: Makura S.M (2023)

a. What is the difference between XML schema and XML DTD? (2 Marks)

b. Identify the two types of XML schema elements in the above scenario? (2 Marks).

Question 31

7 out of 7 points

MongoDB

Study the following scenario and the following questions:

Martin then moves to the next practical which involves creation of Java script statements to execute in MongoDB. Martin has shown you the following collection called **books**:

```
{
  "_id": 1,
  "title": "The Great Gatsby",
  "genre": "Fiction",
  "publicationYear": 1925,
  "authors": [
    {
      "name": "F. Scott Fitzgerald",
      "birthYear": 1896
    },
    {
      "name": "Zelda Fitzgerald",
      "birthYear": 1900
    }
  ]
}
{
  "_id": 2,
  "title": "To Kill a Mockingbird",
  "genre": "Fiction",
  "publicationYear": 1960,
  "authors": [
    {
      "name": "Harper Lee",
      "birthYear": 1926
    }
  ]
}
{
```

```
  "_id": 3,
  "title": "The Hobbit",
  "genre": "Fantasy",
  "publicationYear": 1937,
  "authors": [
    {
      "name": "J.R.R. Tolkien",
      "birthYear": 1892
    }
  ]
}
```

The name of the MongoDB database is called **library**. Assist Martin in answering the following questions:

Source: Makura S.M (2023)

Write the JavaScript statement for the mongo shell that does the following:

a. Insert a new book document into the "books" collection with the following information: Title - "The Catcher in the Rye," Genre - "Fiction," Publication Year - 1951, and Author - "J.D. Salinger" (born in 1919). (3 Marks)

b. Update the publication year of "The Great Gatsby" to 1926. (2 Marks)

c. Delete the book document with the title "The Hobbit" from the "books" collection using the MongoDB shell. (2 Marks)

Question 32

6 out of 7 points

Neo4j

Study the following scenario and the following questions:

You have been provided with the following Cypher query:

```
CREATE
      ( psM:Person { name: "Mpho", age: 33}),
      ( psT:Person { name: "Tebatso",  age:
28}),
       ( psA:Person { name: "Aviwe",  age:
24}),
       ( psJ:Person { name: "James",  age:
33}),
      ( dpt1:Department { name: "Accounting"}
),
      ( dpt2:Department { name: "Human
Resources"}),

      ( psJ)-[:MARRIED { since: 2022 }
]->(psM),
       ( psA)-[:WORKS { since: 2019 } ]->(dpt1
),
      ( psT)-[:WORKS { since: 2018 } ]->(dpt2
),
      ( psM)-[:WORKS { since: 2017 } ]->(dpt2
```

```
);
```

Source: Makura S.M (2023)

Assuming that the above query has already been executed in a Neo4j database, write the cypher queries to perform the following operations:

a. Update the age for Aviwe to 25 (2 Marks)

b. Count the number of relationships in the graph. (2 Marks)

c. Calculate the average age of all persons. (1 Mark)

d. Find the persons who work for the Human Resources department and print out their names. (2 Marks)

Question 33

1 out of 7 points

Big Data and Data Mining

Study the following scenario and the following question:

You are working as a data mining specialist at Top Shelf supermarket. You have been given the following dataset:

Transaction ID	Items_purchased
101	Boerewors, Bread, Tomato Sauce
102	Boerewors, Bread
103	Boerewors, Chips, Cold Drink
104	Cold Drink, Chips
105	Chips, Tomato Sauce
106	Boerewors, Chips, Cold Drink

The set of items is {Boerewors, Bread, Tomato Sauce, Cold Drink, Chips}

Source: Makura S.M (2023)

Apply the Apriori algorithm to the above dataset. Use 34% for the minimum support value. Show all your working. (7 Marks)

Question 34

6 out of 7 points

Data warehousing and OLAP

Study the following scenario and the following questions:

You are working as a business analyst at TTech Co. TTech Co is a local company in South Africa with stores in four cities in South Africa. After receiving the profits results for the year 2022 from each of the branch managers of the store, you perform the following operations:

```
CREATE TABLE ttech_profits (
    branch_ID   INTEGER,
```

```
    city        VARCHAR,
    net_profit  NUMERIC(9, 2)
    );

INSERT INTO ttech_profits (branch_ID, city,
net_profit)
    VALUES
    (1, 'Pretoria', 170000),
    (2, 'Mbombela', 140000),
    (3, 'Bloemfontein', 130000),
    (4, 'East London', 155000);
```

Source: Makura S.M (2023)

a. What are ranking functions, and what are they used for in OLAP? (3 Marks)

b. Write the SQL query statement to rank each store based on its net profit. Rank in descending order (4 Marks).

Thursday, November 30, 2023 10:00:27 AM SAST