

University of Pretoria

Department of Computer Science

COS326 Semester Test 2021

Date: 03 November 2021

Total Marks: 40

INSTRUCTIONS

1. Description

COS326 Semester Test 2021

2. Instructions

1. The time limit of this test should be 1 hour 30 minutes. However, because of possible load shedding, the duration will be 2 hours.
2. Click **Begin** to start the test. Click **Cancel** to go back.
3. This test will save and submit automatically when the time period of 2 hours expires.
4. Do not leave the test before clicking **Save and Submit**.
5. This test allows multiple attempts.

3. Timed Test

This test has a time limit of 2 hours. Your remaining time is approximately 1 hour, 50 minutes, 08 seconds.

4. Timer Setting

This test will save and submit automatically when the time expires.

5. Force Completion

This test can be saved and resumed at any point until time has expired. The timer will continue to run if you leave the test.

6. Multiple Attempts

This test allows multiple attempts.

7. Due Date

This Test is due on November 3, 2021 7:50:00 PM SAST.

Click **Continue** to continue: COS326 Semester Test. Click **Cancel** to go back. You'll be previewing this assessment and your results won't be recorded.

QUESTION 1

1. The following CYPHER query has been executed on a Neo4j database:

CREATE

```
( psN:Person { name: "Nandi", from: "Joburg" } ),  
( psJ:Person { name: "Jaco", from: "Pretoria" } ),  
( cb1:Club { name: "Sundowns" } ),  
( cb2:Club { name: "Chiefs" } ),
```

```
( psN)-[:KNOWS { since: 2014 } ]->(psJ ),
( psN)-[:SUPPORTS { since: 2015 } ]->(cb1 ),
( psJ)-[:SUPPORTS { since: 2014 } ]->(cb2 );
```

Which one of the following CYPHER queries will display the names of the 'Persons' who support the Sundowns Club as well as the club name?

- ☐ A. `MATCH (psn)-[:SUPPORTS]->(clb)`
`WHERE clb.name = "Sundowns"`
`RETURN psn, clb;`
- ☐ B. `MATCH (psn: Person)-[R]->(clb:Club)`
`WHERE (R = SUPPORTS) AND (clb.name = "Sundowns")`
`RETURN psn.name, clb.name`
- ☐ C. `MATCH (psn: Person)-[:SUPPORTS]->(clb:Club)`
`WHERE clb.name = "Sundowns"`
`RETURN psn.name, clb.name`

3 points

QUESTION 2

- One limitation that is associated with relational database systems is that, due to normalization, information is obtained from the database through performing expensive joins of 2 or more tables.

Explain how the Neo4j database system avoids this limitation.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

100%

Paragraph

Arial

10pt

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3 points

QUESTION 3

- Given the following XML document:

```
<STAFFLIST>
<STAFF branchNo = "B005">
  <STAFFNO>SL21</STAFFNO>
  <NAME>
    <FNAME>John</FNAME><LNAME>Green</LNAME>
  </NAME>
  <SALARY>30000</SALARY>
</STAFF>
<STAFF branchNo = "B003">
  <STAFFNO>SG37</STAFFNO>
  <NAME>
    <FNAME>Ann</FNAME><LNAME>Brown</LNAME>
  </NAME>
  <SALARY>12000</SALARY>
</STAFF>
</STAFFLIST>
```

Which one of the following FLWOR queries will list the staff numbers of all staff at branch B005 with salary greater than R15,000?

Please note that the dollar character does not work in the ClickUP question editors. I have therefore used the word 'dollar' in the answers shown below. **

- ☐ A. for dollarS in //STAFF
where dollarS/SALARY > 15000 and dollarS/@branchNo = "B005"
return dollarS/STAFFNO
- ☐ B. for dollarS in STAFF
where dollarS/SALARY > 15000 and dollarS/@branchNo = "B005"
return dollarS/STAFFNO
- ☐ C. for dollarS in //STAFF
where dollarS.SALARY > 15000 and dollarS.@branchNo = "B005"
return dollarS.STAFFNO

3 points

QUESTION 4

1. State whether the following statement is TRUE or FALSE.

XML data can be stored in Relational and Object-Relational databases.

- ☐ True
- ☐ False

1 points

QUESTION 5

1. State whether the following statement about developing an OODBMS is TRUE or FALSE.

Develop a brand new database programming language which supports OOP and object persistence.

- ☐ True
- ☐ False

1 points

QUESTION 6

1. State whether the following statement about developing an OODBMS is TRUE or FALSE.

Provide an extensible off-the-shelf OODBMS library which provides persistence and database capabilities.

- ☐ True
- ☐ False

1 points

QUESTION 7

1. State whether the following statement about the relational database is TRUE or FALSE.

The RDBMS uses a homogeneous data structure which means that the intersection of a row and column must be atomic and cannot store an object that can be decomposed into its components.

- ☐ True
- ☐ False

1 points

QUESTION 8

1. State whether the following statement about the relational database is TRUE or FALSE.

The RDBMS has a fixed set of operations (on sets of tuples) which cannot be extended.

- ☐ True
- ☐ False

1 points

QUESTION 9

1. State whether the following statement is TRUE or FALSE.

BaseX is an XML database system which supports XPath and FLWOR queries.

- ☐ True
- ☐ False

1 points

QUESTION 10

1. Given the following XML document:

```
<STAFFLIST>
<STAFF branchNo = "B005">
  <STAFFNO>SL21</STAFFNO>
  <NAME>
    <FNAME>John</FNAME><LNAME>Green</LNAME>
  </NAME>
  <SALARY>30000</SALARY>
</STAFF>
<STAFF branchNo = "B003">
  <STAFFNO>SG37</STAFFNO>
  <NAME>
    <FNAME>Ann</FNAME><LNAME>Brown</LNAME>
  </NAME>
  <SALARY>12000</SALARY>
</STAFF>
</STAFFLIST>
```

Which one of the following FLWOR queries will list the staff numbers of all staff at branch B005 with salary greater than R15,000?

- ☐ A. for \$\$ in //STAFF
where \$\$/SALARY > 15000 and
 \$\$/@branchNo = "B005"
return \$\$/STAFFNO
- ☐ B. for \$\$ in STAFF
where \$\$/SALARY > 15000 and
 \$\$/@branchNo = "B005"
return \$\$/STAFFNO
- ☐ C. for \$\$ in //STAFF

```

where $$SALARY > 15000 and
      $$@branchNo = "B005"
return $$STAFFNO

```

3 points

QUESTION 11

1. Suppose the following SQL statements have been executed on a PostgreSQL database:

```

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('venueSeq') PRIMARY KEY,
    venueCode RoomCodeType,
    seats int );
CREATE TABLE LectureRoom (
    equipmentList text [ ] )
    INHERITS (VENUE);

```

Which one of the SQL statements below will insert the data shown below into the LectureRoom table?

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

- ☐ A. INSERT INTO LectureRoom (venueCode, seats, equipmentList)
VALUES ('IT', 4,2), 120, ['projector', 'PAsystem', 'safe']);
- ☐ B. INSERT INTO LectureRoom (venueCode, seats, equipmentList)
('IT', 4,2, 120, ARRAY['projector', 'PAsystem', 'safe']);
- ☐ C. INSERT INTO LectureRoom (venueCode, seats, equipmentList)
VALUES ('IT', 4,2), 120, ARRAY['projector', 'PAsystem', 'safe']);

3 points

QUESTION 12

1. The PostgreSQL database table below has been created using the following statement:
CREATE TABLE XMLStaff (docNo CHAR(4), staffData XML);

The data shown below has then imported into the table.

docNo	staffData
1	<STAFF branchNo = "B001"> <STAFFNO>S010</STAFFNO> <NAME> <FNAME>James</FNAME> <LNAME>Brown</LNAME> </NAME> </STAFF>
2	<STAFF branchNo = "B002"> <STAFFNO>S011</STAFFNO> <NAME> <FNAME>Thabo</FNAME> <LNAME>Mashaba</LNAME> </NAME> </STAFF>
3	<STAFF branchNo = "B002"> <STAFFNO>S012</STAFFNO> <NAME> <FNAME>Johan</FNAME> <LNAME>van Wyk</LNAME>

	</NAME>
</STAFF>	

Which one of the following PostgreSQL statements will display the staff number and name of all staff, in the following format?

StaffNumber	FirstName	Surname
S010	James	Brown
S011	Thabo	Mashaba
S012	Johan	van Wyk

- ☐ A. `SELECT xpath('/STAFF/STAFFNO/text()', staffData) AS StaffNumber,
xpath('/STAFF/NAME/FNAME/text()', staffData) AS
FirstName,
xpath('/STAFF/NAME/LNAME/text()', staffData) AS Surname
FROM XMLStaff;`
- ☐ B. `SELECT unnest(xpath('/STAFF/STAFFNO/text()', staffData)) AS
StaffNumber,
unnest(xpath('/STAFF/NAME/FNAME/text()', staffData)) AS
FirstName,
unnest(xpath('/STAFF/NAME/LNAME/text()', staffData)) AS
Surname,
FROM XMLStaff`
- ☐ C. `SELECT xpath('/STAFF/STAFFNO', staffData) AS StaffNumber,
xpath('/STAFF/NAME/FNAME', staffData) AS FirstName,
xpath('/STAFF/NAME/LNAME', staffData) AS Surname,
FROM XMLStaff`

3 points

QUESTION 13

1. State whether the following statement about developing an OODBMS is TRUE or FALSE.

OODBMS extends an existing object-oriented programming language by adding traditional database capabilities to the OOP language.

- ☐ True
- ☐ False

1 points

QUESTION 14

1. State whether the following statement about object-relational databases is TRUE or FALSE.

Object-relational databases resolve many limitations of relational databases.

- ☐ True
- ☐ False

1 points

QUESTION 15

1. State whether the following statement about the relational database is TRUE or FALSE.

Join operations which involve tables of objects require recursive execution, which is very expensive.

- ☐ True

☐ False

1 points

QUESTION 16

1. Another limitation that is associated with relational database systems is semantic overloading. This means that there is no mechanism to distinguish between relations and relationships or between different types of relationships.

Explain how the Neo4j database system avoids this limitation.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

100%

Paragraph

Arial

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3 points

QUESTION 17

1. State whether the following statement about object-relational databases is TRUE or FALSE.

The object-relational database system has resulted in a much simpler version of **SQL**.

☐ True

☐ False

1 points

QUESTION 18

1. Yet another limitation that is associated with relational database systems is that, schema changes are difficult. Database schema changes require program changes.

Explain how the Neo4j database system avoids this limitation.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

100%

Paragraph

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3 points

QUESTION 19

1. State whether the following statement about the relational database is TRUE or FALSE.

Normalisation leads to a poor representation of real world entities and relations that do not correspond to entities in the real world.

☐ True

☐ False

1 points

QUESTION 20

1. State whether the following statement is TRUE or FALSE.

XQuery is a query language for XML data. It uses XPath and FLWOR expressions.

- ☐ True
- ☐ False

1 points

QUESTION 21

1. State whether the following statement about object-relational databases is TRUE or FALSE.

Object-relational databases preserve a significant body of knowledge and experience that has gone into the development of relational databases and applications.

- ☐ True
- ☐ False

1 points

QUESTION 22

1. State whether the following statement about object-relational databases is TRUE or FALSE.

Provide a feasible approach for organisations to migrate from using the RDBMS to using the ORDBMS

- ☐ True
- ☐ False

1 points

QUESTION 23

1. State whether the following statement is TRUE or FALSE.

Semi-structured data is data that conforms to a semi-relational data model.

- ☐ True
- ☐ False

1 points

QUESTION 24

1. State whether the following statement about developing an OODBMS is TRUE or FALSE.

Integrate the SQL execution engine into the compiler of an OOP language.

- ☐ True
- ☐ False