University of Pretoria
Department of Computer Science

COS326 Semester Test 2020

Date: 07 October 2020

Total Marks: 40

Instructions	
Timed Test	This test has a time limit of 1 hour and 30 minutes.This test will save and be submitted automatically when the time expires. Warnings appear when **half the time**, **5 minutes**, **1 minute**, and **30 seconds** remain.*[The timer does not appear when previewing this test]*
Multiple Attempts	Not allowed. This Test can only be taken once.
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.
	Your answers are saved automatically.

QUESTION 1

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 2

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 3

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

1 points

QUESTION 4

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 $S in //STAFF
where $S/SALARY > 15000 and
        $S/@branchNo = "B005"
return $S/STAFFNO
```

b.
```
for $S in STAFF
where $S/SALARY > 15000 and
        $S/@branchNo = "B005"
return $S/STAFFNO
```

c.
```
for $S in //STAFF
where $S.SALARY > 15000 and
        $S.@branchNo = "B005"
 return $S.STAFFNO
```

3 points

QUESTION 5

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 6

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 7

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 8

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('venSeq') 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 9

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 10

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 11

1. 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).
Paragraph
Open Sans,arial,helvetica,sans-serif
10pt
P
0 WORDSPOWERED BY TINY

2 points

QUESTION 12

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 13

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 14

1. Given the following SQL statements for the PostgreSQL database:

```
CREATE TYPE TitleType AS ENUM ('Prof','Dr','Ms', 'Mev', 'Miss', 'Mr', 'Mnr');
CREATE TYPE StaffType AS (title TitleType, firstName CHAR(20), surname
CHAR(20) );
CREATE TABLE staffMember (staff StaffType, department CHAR(20));
```

   Which one of the following functions will return a string with the title, firstname and lastname of a staff member?

a.
```
CREATE FUNCTION staffName( StaffType ) RETURNS text AS
$$
    SELECT CAST($1.title AS text) || ' ' ||
           CAST($1.firstName AS text) || ' ' ||
           CAST($1.surname AS text) AS staffName;
$$ LANGUAGE SQL;
```

b.
```
CREATE FUNCTION staffName( StaffType ) RETURNS text AS
$$
    SELECT CAST($1.title AS text) +
           CAST($1.firstName AS text) +
           CAST($1.surname AS text) AS staffName;
$$ LANGUAGE SQL;
```

c.
```
CREATE FUNCTION staffName( StaffType ) RETURNS text AS
$$
    SELECT $1.title + $1.firstName + $1.surname AS staffName;
$$ LANGUAGE SQL;
```

3 points

QUESTION 15

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 16

1. Given the following sample of the contents of the collection *blogs* in the MongoDB database *mydb*:

```
{       _id:            ObjectId(7df78ad8902b)
        title:          'PostgreSQL Overview',
        description:    'PostgreSQL is an Sql database',
        likes:          400
},
{       _id:            ObjectId(7df78ad8902c)
        title:          'Cassandra Overview',
        description:    'Cassandra is a NoSql database',
        likes:          100
},
{       _id:            ObjectId(7df78ad8902d)
        title:          'NoSQL Overview',
        description:    'NoSql database is very fast',
        likes:          200
}
```

Which one of the following queries will compute and display the total number of 'likes' for each 'title'?

a.
```
db.blogs.aggregate(
    [ {  $group:
        {  _id:          "$title",
           total_likes:  { $sum: "$likes"  }
        }
      }
    ]
)
```

b.
```
db.blogs.aggregate(
    [ {  $sum:
        {  _id:          "$title",
           total_likes:  { group: "$likes"  }
         }
      }
    ]
)
```

c.
```
db.blogs.aggregate(
    [ {  $group:
        {  _id:          "title",
           total_likes:  { $sum: "$likes"  }
        }
     }
    ]
```

)

3 points

QUESTION 17

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).
Paragraph
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10pt
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0 WORDSPOWERED BY TINY

2 points

QUESTION 18

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 19

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 20

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

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

True

False

1 points

QUESTION 21

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 22

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

:

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

True

False

1 points

QUESTION 23

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).
Paragraph
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10pt
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0 WORDSPOWERED BY TINY

2 points

QUESTION 24

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 25

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