International Institute of Information Technology Bangalore

DS/SE 603 Data Modeling

SAMPLE QUESTIONS FROM PAST EXAMS

1. (2 marks) What is the main difference between Salami-Slice design and Venetian Blind design of XML schema?

2. (3 marks) A well-formed XML need not necessarily be a valid XML. Explain.

3. (3 marks) What is the role of Dimensions in a dimensional model?

4. (3 marks) Why is mobile_number a bad choice for OID for the MOBILE_PHONE class?

5. (3 marks) What is the limitation of using xs:ID in XML schema?

6. (3 marks) Give one scenario where ObjectStore's memory mapping architecture gives faster response compared to Versant's persistence-by-inheritance approach. (Hint: "Free ride"!)

7. (5 marks) Write about any <u>two</u> Codd rules that were violated by legacy database vendors. Explain the possible way(s) in which those two rules were bypassed. [You need to address specific rules only from Codd's 13 rules here].

8. (5 marks) Explain the role of mapping in the context of data modeling. Why is it important? (Hint: "One size does not fit all")

9. (5 marks) Using an example, explain the difference between navigational access and associative access in a database.

10. (3 marks) Explain the difference between a well-formed XML and a valid XML with the help of one or more examples.

11. (3 marks) Explain in one sentence each and an example each the terms Schema, Mapping, and Data Model.

12. (3 marks) Explain the connection between Data modeling and Enterprise Architecture Framework (as discussed in class in the context of Zachman Framework only).

13. (3 marks) Explain the syntax use and limitations of ID and IDREF attributes in XML? Explain with an example.

14. (3 marks) Write two <u>valid</u> XML instance fragments of complex element <course> as per the following schema declaration. The two instance fragments should have a different number of nodes.

```
<xs:element name="Course">
   <xs:complexType>
     <xs:all>
        <xs:element name="Title" type="xs:string" maxOccurs="unbounded"/>
        <xs:element name="Credits" type="xs:string" fixed="4" minOccurs="1"/>
     </xs:all>
   </xs:complexType>
</xs:element>
```

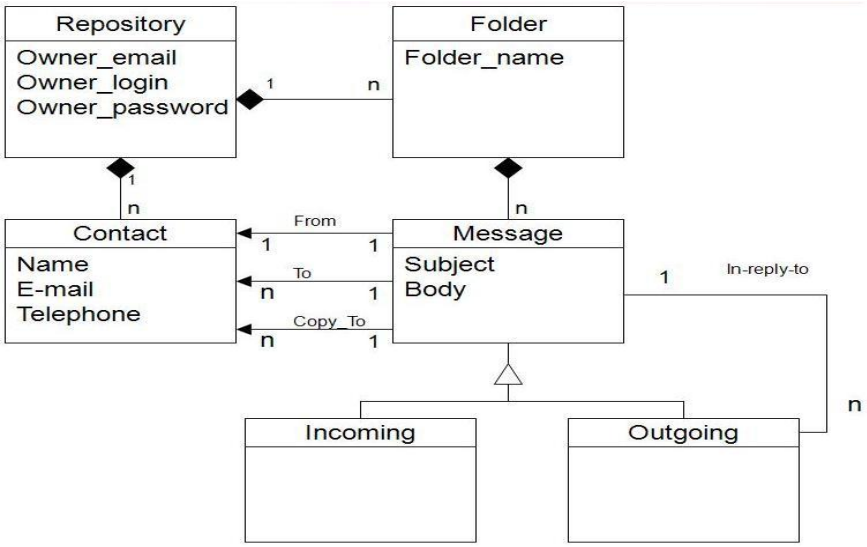
15. (5 marks) A structured database cannot be created without the use of a data model. Explain.

16. (5 marks) Why does splitting a ternary relation into two binary relations lead to a violation of join dependency? Explain with an example.

17. (10 marks) What is the design style of the XML Schema fragment given in Question 5 above? Convert the same into some other design style.

18. (10 marks) Explain fourth normal form and illustrate with an example.

19. (10 marks) Consider the following class diagram of an e-mail repository:



Map the above class diagram into an object oriented program of your choice with the following restrictions:

- All data members should be private

- Every class should have a constructor and necessary getter / setter methods
- No need for any “import” or “include” of libraries etc.
- No need for any other methods

20. (3 marks) Using an example, show how to specify default XML namespace in XML.
21. (3 marks) An XML document can be well-formed, yet not be valid. Explain.
22. (3 marks) List any three desirable characteristics of OID.
23. (3 marks) Given an XML schema file, how do you determine all possible roots of the corresponding instance document?
24. (3 marks) Write xquery to retrieve store elements that have product number 557. Assume xml file to be named catalog.xml.

```
<catalog>
   <store>
         <storename>BLR</storename>
         <product>
               <number>557</number>
         </product>
         <product>
               <number>563</number>
         </product>
   </store>
</catalog>
```

25. (5 marks) In which dimensional model operations do aggregation operators get invoked? Why?
26. (5 marks) While a data warehouse is time-variant in nature, it is still considered to be non-volatile. Explain.
27. (5 marks) What is the role of a dimension table in a dimensional model?
28. (5 marks) XML can be used to store structured, unstructured and semi-structured data. Illustrate with an example of each.
29. (5 marks) What is the meaning of navigational access in a database (hint: compare to associative access in a database).

30. Consider the following relational table

Course	Instructor	Student
DBMS	RC	Student01
DBMS	RC	Student02
OS	JTL	Student02
DBMS	RC	Student03
OS	JTL	Student03
DBMS	SS	Student01
OS	JSN	Student04
DBMS	SS	Student05
OS	JSN	Student05
DBMS	SS	Student06

a. (6 marks) Show all three anomalies (insert, update, delete) in CIS_Table.
b. (6 marks) Show the 5NF design (including data) of the CIS_Table.
c. (6 marks) Show how the three anomalies (insert, update, delete) go away from CIS_Table when a join dependency is converted to 5NF.

31. (10 marks) Consider two class diagrams given in Figure 1 and Figure 2. Draw one object graph each corresponding to each of the class diagrams. The data for the object graph is "John is a student who is a Teaching Assistant for 20 hours for the Data Modeling Course."

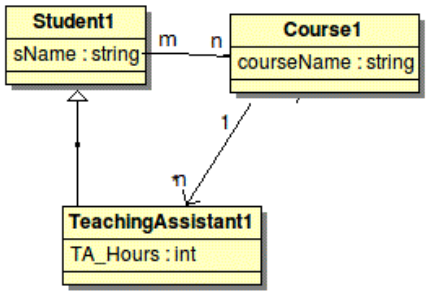


FIGURE 1

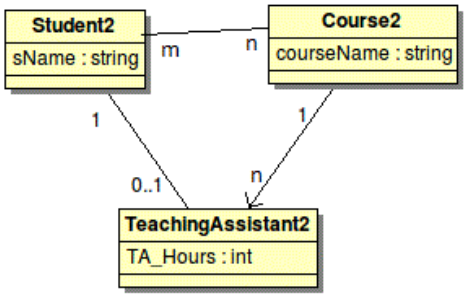
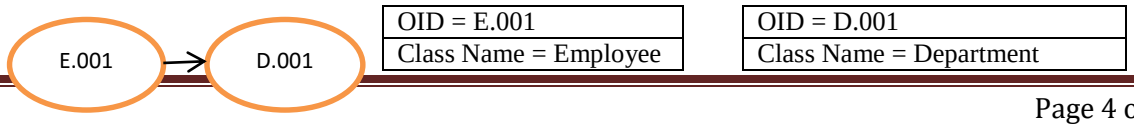


FIGURE 2

Use circles to represent object instances. Assign your own object identifiers (OID) to the instances and use them as labels of the circles. In addition to the object graph, show only the simple attributes of each the object in the following **example format**:



EmpName = John Doe
EmpAge = 25

DeptName = Accounts

32. (10 marks) Consider the following relational tables. Give some **static mapping guidelines** that can be followed on this relational structure to create a meaningful hierarchical XML structure for the given relational data? How will the XML look like?

MOBILE_PLAN

Plan_ID (PK)	Plan_Name	Plan_Description
P01	Buy1get1-SMS	Two SMS can be sent for the price of one

CUSTOMER

Cust_ID	Cust_Name	Plan_ID (FK)
C01	John Doe	P01
C02	Jane Doe	P01

33. Consider the following invoice format for this question:

INVOICE

Order Number	173824
Shipping Date	20-Jan-2013
Number of Items	2
Total Bill	Rs. 1000.00

Billing Address
IIIT Bangalore
26/C Electronics City
Hosur Road
Bangalore 560 100
Karnataka

Contact information
+91 80 2852 7627 (Phone)
+91 80 2852 7636 (Fax)

a. (5 marks) Draw an UML class diagram that can represent the invoice structure given above. Choose only from the following constructs:
   - Class
   - Attribute
   - Association
   - Cardinality

b. (5 marks) Convert the above UML class diagram into Java class definitions using OO→OOPL mapping rules.

1) Select the relevant SAX events that are fired when the parser encounters the following XML fragment: (1)

< book isbn="039843094">

startElement | startAttribute | endElement | endAttribute

2) XML Schema is an example of what type of schema language? (1)

Assertion based | Grammar based | I don't know | Imperative language

3) Select all TRUE statements from the following (2)

Global declarations appear as direct children of the schema element | Global declarations appear as the last element in the schema | There can be only one global element in an XML Schema | Both elements and types can be global in XML schema.

5) Global elements in an XML schema are re-used using which attribute of the declaration? (1)

"type=" attribute | "ref="attribute | Ignore | Ignore

6) Select all CRUD operations that XQuery caters to? (1)

CREATE | RETRIEVE | UPDATE | DELETE

7) (2)

Course Name	IT 708 Data Modeling
Class Room	#132
Instructor	Prof. Chandrashekar R Office No. 116 chandrashekar.ramanathan@iiitb.ac.in
Office Hours	M-F 10:30 AM – 12:00 PM Tue 3:00 PM – 4:00 PM
Course credits	4
Schedule	Monday: 3:15 PM – 5:15 PM Thursday: 9:00 AM – 10:00 AM
Pre-requisite	a) Course IT 502: Principles of Programming Languages (DBMS module) b) Good knowledge of Java or C++

Select items that are good candidates to be complex objects in object-oriented modeling

pre-requisite | class room | instructor | office hours | course credits | schedule

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If course name is chosen as the basis for identity ("key") in the course structure shown above, select all applicable problems associated with the same.

The cascading effect if the value changes | Object is forced to reside at a particular memory address | Object loses identity when the program terminates and reloads the object after restarting | Force fitting values even if none exists

9) Structural description of data is provided by (1)

Data Model | Schema | Database | DBMS

10) Which of the following is/are the right regular expression(s) to represent date in dd-mon-yy (12-Feb-08, 12-feb-08, 12-FEB-08, etc.) (2)

dd-mon-yy | [0-9][0-9]\-[a-zA-Z][a-zA-Z][a-zA-Z]\-[0-9][0-9] | [0-9]{2}\-[a-zA-Z]{3}\-[0-9][0-9] | 99-[aA][aA][aA]-99 | [0-9][0-9]\-[a-zA-Z]*\-[0-9][0-9]

11) DDL for XML is specified using (2)

XQuery | XML Schema | Schematron | XSL

12) (1)

```
<somesample xmlns="http://iiitb.ac.in" xmlns:mydefault="http://iiitb.ac.in/default">
        <name>Product_ID</name>
        <mydefault:value>100</mydefault:value>
</somesample>
```

What is the root element in this XML document?

somesample | name | value | none of the above

13) (2)

```
<somesample xmlns="http://iiitb.ac.in" xmlns:mydefault="http://iiitb.ac.in/default">
        <name>Product_ID</name>
        <mydefault:value>100</mydefault:value>
</somesample>
```

Choose leaf elements in the DOM tree of this XML document

somesample | xmlns | value | 100

14) (1)

```
<somesample xmlns="http://iiitb.ac.in" xmlns:mydefault="http://iiitb.ac.in/default">
        <name>Product_ID</name>
        <mydefault:value>100</mydefault:value>
</somesample>
```

What is the default namespace in the above XML?

xmlns | mydefault | http://www/iiitb.ac.in/default | http://www/iiitb.ac.in

15) (1)

```
<somesample xmlns="http://iiitb.ac.in" xmlns:mydefault="http://iiitb.ac.in/default">
        <name>Product_ID</name>
        <mydefault:value>100</mydefault:value>
</somesample>
```

What is the URI of the only named namespace in the above XML?

mydefault | http://www.iiitb.ac.in/default | http://www.iiitb.ac.in | somesample/name

16) What is the number of global elements in a typical Russian Doll Design in XML? (1)

zero | one | more than one | none

17) Namespace complexity is least in what type of XML schema design? (1)

Russian Doll Design | Salami Slice Design | Venetian Blind Design | Garden of Eden design

18) What is the limitation of xs:ID for implementing keys in XML? (2)

xs:ID is very slow in checking for duplicates | Numbers cannot be used as value of xs:ID attributes | xs:ID values ensure global uniqueness across the entire XML | xs:ID values ensure uniqueness only within sub-elements

19) Identify the two key application areas of XML (1)

Stuctured data management | Data interchange within the application | Data interchange across servers | Semi-structured content management

20) In OR mapping, the mapping rule "map every class to a table" comes under what type of mapping? (1)

static mapping | dynamic mapping | one-to-one mapping | many-to-many mapping

21) In OR mapping, the mapping rule "map an object of a class to a row in the table corresponding to that class" is an example of _____ mapping rule (static or dynamic?) (1)

22) The type of mapping gets invoked when application is executing _____ mapping. Fill in the blank. (1)

23) The mismatch caused when transmitting information from one data model to another data model is called _____ mismatch. Fill in the blank. (2)

24) Match the data model with the software that is capable of managing persistence of data of that data model. (3)

Relational Data Model	-	Not possible to persist data of this data model
Object-oriented data model	-	Native XML Database Management System
ER Data Model	-	RDBMS
	-	OODBMS

25) The Codd's rule that prevents modification of the data directly bypassing the integrity rules of the data is called _____ rule. (2)

Fill in the blank

27) Match the given VIEW definition with the matching statement regarding the ability to update the view. (6)

CREATE VIEW v1 AS (SELECT c.branch_id, COUNT(*) FROM CUSTOMER c GROUP BY c.branch_id);	-	The VIEW v3 IS NOT updateable because it includes a JOIN
CREATE VIEW v2 AS (SELECT c.* FROM CUSTOMER c)	-	The VIEW v2 IS updateable because it includes all rows and all columns from the base table.
CREATE VIEW v3 AS (SELECT c.cust_name, b.branch_name FROM CUSTOMER c, BRANCH b WHERE c.branch_id = b.branch_id	-	The VIEW v2 IS NOT updateable because it does not contain any WHERE clause.
	-	The VIEW V3 IS updateable because it includes a JOIN
	-	The VIEW v1 IS NOT updateable because the VIEW definition includes an aggregate function.
	-	The VIEW v1 IS updateable because the VIEW definition includes an aggregate function.

28) The number of rows _____ in the each of the nodes of the lattice of cuboids as we move from BASE cuboid to APEX cuboid. (2)

Increases | Decreases | Remains the same | Decreases first and then increases

29) In a star schema, where is the meta data available? (2)

ETL | lattice of cuboids | fact table | dimension table

30) One of the four keywords in the definition of Data Warehouse that talks about historic data is _____ (2)

31) One of the four keywords in the definition of Data Warehouse that talks about using data from multiple data souces is _____ (2)

32) What operation gets invoked when navigating the lattice of cuboids from the base cuboid to apex cuboid? (2)

SUBSET UNION AGGREGATION SET DIFFERENCE

PART B

Answer all the questions.

Answer all the questions

1) Give any three differences between using xs:ID/xs:IDREF and xs:key / xs:keyref (4)

a.)

b.) Explain the implication of elementFormDefault attribute in Russian Doll Design versus Salami Slice Design. Illustrate the difference with an example. (4)

c.) (2)

```
< xs:element name="Course">
   < xs:complexType>
   < xs:all>
      < xs:element name="Title" type="xs:string"/>
      < xs:element name="Credits" type="xs:string" fixed="4" minOccurs="0"/>
      < /xs:all>
   < /xs:complexType>
< /xs:element>
```

Write two valid XML instance fragments of complex element < course> as per the above schema declaration. The two instance fragments should have a different number of nodes.

2) Consider the invoice structure given below: (10)

INVOICE

Order Number	309483
Shipping Date	March 8, 2019
Number of items	4
Total bill	200

Billing Address

IIIT Bangalore
26/C Electronics City
Hosur Road
Bangalore 560 100
Karnataka

Contact information

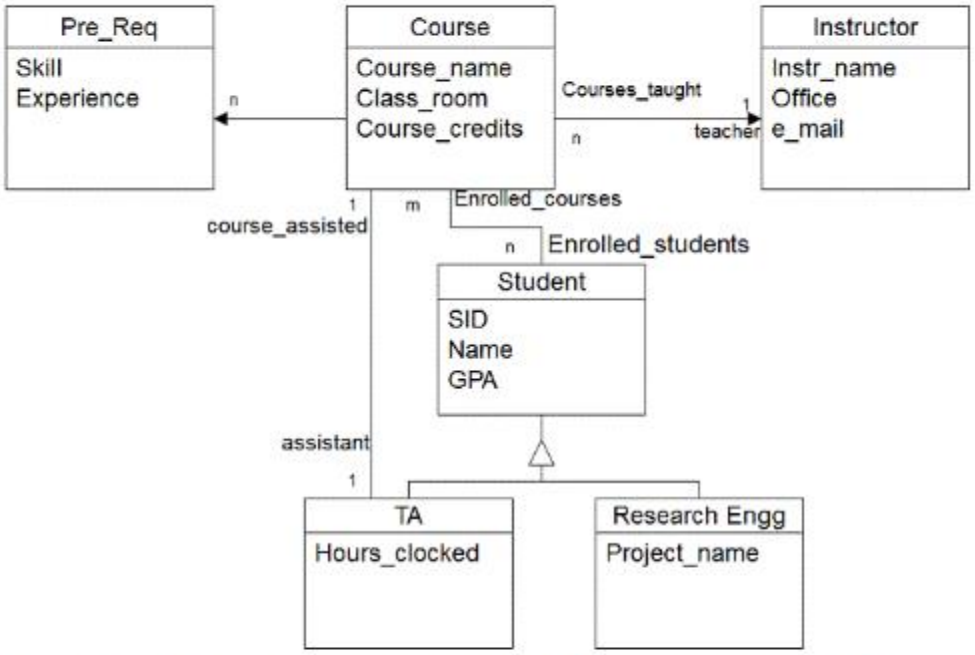
+91 80 2852 7627 (Phone)
+91 80 2852 7636 (Fax)

Draw a class diagram that represents the above invoice structure using ONLY the following classes:

a. Invoice
b. OrderInfo
c. Address
d. BillingAddress
e. ContactNumber
f. TelephoneNumber
g. FaxNumber

State your assumptions, if any.

3) (20)



4) Map the above class diagram to Java classes. Draw the UML comprised of < university, programme, gender>. (10)

- All data members should be private
- Every class should have constructor and necessary getter methods
- No need for "import" statements
- No need for any other methods