# **Multiple Choice Questions**

**Question 1**

Which of the following statements is **CORRECT**?

1. The catalog forms the heart of a database. It can be an integral part of the DBMS or a standalone component.
2. The catalog makes sure the database continues to be correct by, among other measures, specifying all integrity rules.
3. The catalog describes all metadata components that are defined in the metamodel.
4. **All of the above are correct.**

**Question 2**

A data steward notices that part of the database contains values in a different language. Which type of data quality error is this?

1. Intrinsic.
2. Contextual.
3. **Representational.**
4. Accessibility.

**Question 3**

Is the following statement true or false: “The accuracy of a database depends on its representational and contextual characteristics.”

1. **True**
2. False

**Question 4**

Why can data incompleteness prove to be useful information?

1. We can track down faults in the database model, such as updating errors that cause inconsistencies.
2. We can track down the sources of incompleteness and thereby eliminate the cause thereof.
3. We can track down certain patterns in the complete fields, which can lead to more information about a certain user.
4. **All of the above.**

**Question 5**

Which of the following statement is **NOT CORRECT**?

1. Subjectivity can cause data quality issues.
2. Consistency issues can arise due to sharing data across multiple departments.
3. **Data quality issues can always be measured objectively.**
4. All aspects of data quality need to be checked regularly, as every change in the database or even the company can lead to unforeseen issues.

**Question 6**

Given the following relational model (primary keys are underlined, foreign keys in italics):

STUDENT(studentnumber, studentname, street name, street number, zip code, city)

ENROLLED(*student number,course number*)

COURSE(course number, course name)

PROFESSOR(professor number, professor name)

TEACHES(*course number, professor number*)

Which statement is **CORRECT**?

1. The model does not allow a course to be taught by multiple professors.
2. **The model can be further normalized.**
3. The model does not allow a professor to teach multiple courses.
4. The model does not allow a course to be followed by multiple students.

**Question 7**

A foreign key is declared NOT NULL when

1. **the corresponding minimum cardinality in the EER model is 1.**
2. the corresponding maximum cardinality in the EER model is 1.
3. the corresponding minimum and maximum cardinality in the EER model are 1.
4. the corresponding minimum cardinality in the EER model is 0.

**Question 8**

A relation is in 3 NF if it satisfies 2 NF and

1. **no nonprime attribute type of R is transitively dependent on the primary key.**
2. no prime attribute type of R is transitively dependent on the primary key.
3. no primary key of R is transitively dependent on a prime attribute type.
4. no non-primary key of R is transitively dependent on a prime attribute type.

**Question 9**

Which statement is **CORRECT**?

1. The Boyce Codd normal form is more strict than the fourth normal form.
2. **The Boyce Codd normal form is more strict than the third normal form.**
3. The second normal form is more strict than the Boyce Codd normal form
4. The first normal form is more strict than the Boyce Codd normal form.

**Question 10**

Given this relation in 1NF:

Reservation(customerID, roomID, customer name, room name, date, time)

Which of the following statement is **CORRECT**?

* 1. The same room can be booked by the same customer on different dates and/or time.
  2. A customer must have a unique name.
  3. **A customer can book multiple rooms at the same date and time.**
  4. This relation is also in 2NF.

**Question 11**

Given the following relation: Wine(ID, name, grape, region, country)

Assume a wine is associated with one region and country, but can be composed of multiple grapes.

Which statement is **CORRECT**?

* 1. **The relation is not in 1 NF.**
  2. The relation is in 1NF but not in 2NF.
  3. The relations is in 2NF but not in 3NF
  4. The relation is in 3NF but not in BCNF.

**Question 12**

Given the following relations

Cinema(name, street, number, zip code)

Show(movieID*, cinema name*, movie name, date, time), ‘cinema name’ is a foreign key referring to ‘name’ in ‘Cinema’. This value cannot be NULL.

Which of the following statements is **CORRECT**

* 1. This relational model is in 2NF, but not in 3NF.
  2. **A cinema can show multiple movies.**
  3. A movie can only be shown in one cinema.
  4. This relation is in 3NF, but not in BCNF.

**Question 13**

Given the following relations

Artist(ID, name, genre)

Tour(name, year, *artistID*)

‘artistID’ is a foreign key referring to ‘ID’ in ‘Artist’. This value cannot be NULL.

Show(venue*, tour name*, city)

‘tour name’ is a foreign key referring to ‘name’ in ‘Tour’. This value cannot be NULL.

Customer(ID, name, date of birth)

Ticket(*customerID, venue, tour name*)

‘customerID’ is a foreign key referring to ‘ID’ in ‘Customer. This value cannot be NULL.

‘venue’ is a foreign key referring to ‘venue’ in ‘Show’. This value cannot be NULL.

‘tour name’ is a foreign key referring to ‘name’ in ‘Tour’. This value cannot be NULL.

Which statement is **CORRECT**?

* 1. An artist can only have one tour.
  2. All these relations are in 2NF, but not in 3NF.
  3. **A customer can only buy one ticket for a certain show.**
  4. The relations can be further normalised.

**Question 14**

Given the following relation

HospitalRoom(hospitalID, roomNR, street, number, zip code, city, department)

Which statement is **NOT CORRECT?**

* 1. ‘(hospitalID, roomNR)’ is a minimal superkey.
  2. **Every non-prime attribute of this relation is fully functionally dependent on any key of this relation.**
  3. ‘roomNR’ is a prime attribute type.
  4. ‘city’ is transitive dependent on the primary key.

**Question 15**

Which of the following statements is **CORRECT**?

1. A foreign key of a relation A cannot refer to the primary key of the same relation A.
2. A relation cannot have more than 1 foreign key.
3. Every relation must have a foreign key.
4. **A foreign key can be NULL.**

**Question 16**

Consider a data model for the Olympics storing information about countries and athletes. There is a 1-N relationship type between country and athlete and an athlete always has to belong to exactly 1 country. A relational data model containing only 1 table leads to:

1. Unnecessary replication of data about athletes.
2. **Unnecessary replication of data about countries.**
3. Unnecessary replication of data about athletes and countries.
4. No unnecessary replication of data.

**Question 17**

The following relational model represents a HRM system of a consultancy firm. The primary keys are underlined while foreign keys are in italic font.

Consultant(ConsultantID, Date of Birth, Expertise)

Assigned\_to(*ConsultantID*, *ProjectID*) *ConsultantID* refers to ConsultantID in Consultant; *ProjectID* refers to ProjectID in Project

Project(ProjectID, Description, Type, *Company*) *Company* refers to Name in Company

Company(Name, Location)

Suppose a new consultant is hired and immediately assigned to a new training project at a new firm and to 2 other, already existing projects. How many rows (tuples) must be added to the database to reflect this change?

1. 1
2. 3
3. 5
4. **6**

**Question 18**

Which statement is **NOT CORRECT**?

1. A domain specifies the range of admissible values for an attribute type
2. Each attribute type is defined using a corresponding domain
3. **A domain can only be used once in a relation.**
4. The domain constraint states that the value of each attribute type A must be an atomic and single value from the domain dom(A).

**Question 19**

Given the following relational model (primary keys are underlined, foreign keys are in italics).

**EMPLOYEE**(SSN, ENAME, EADDRESS, SEX, DATE\_OF\_BIRTH, *SUPERVISOR*, *DNR*)

SUPERVISOR*: foreign key refers to* SSN in EMPLOYEE, *NULL value allowed*

DNR: *foreign key refers to* DNR in DEPARTMENT, *NULL value not allowed*

**DEPARTMENT**(DNR, DNAME, DLOCATION, *MGNR*)

MGNR: *foreign key refers to* SSN in EMPLOYEE, *NULL value not allowed*

**PROJECT**(PNR, PNAME, PDURATION, *DNR*)

DNR: *foreign key refers to* DNR in DEPARTMENT, *NULL value not allowed*

**WORKS\_ON**(*SSN, PNR*, HOURS)

SSN: *foreign key refers to* SSN in EMPLOYEE, *NULL value not allowed*

PNR: *foreign key refers to* PNR in PROJECT, *NULL value not allowed*

What statement is **CORRECT**?

1. According to the model, a supervisor cannot supervise more than one employee.
2. **According to the model, an employee can manage multiple departments.**
3. According to the model, an employee can work in multiple departments.
4. According to the model, an employee should always work on projects assigned to his/her department.

# **Open Question**

A library database records the authors and the publisher of each book. Normalize the following relation and indicate the primary and foreign key attribute types

R(ISBN, title, author(name, date\_of\_birth), publisher(name, address(streetnr, streetname, zipcode, city)), pages, price)

The assumptions are:

* Each book has a unique ISBN number
* Each author has a unique name
* Each publisher has a unique name
* A book can have multiple authors
* An author can write more than one book
* A publisher can publish more than one book
* A book has only one publisher
* A publisher has only one address

EXTRA QUESTION: Suppose that one book can have multiple publishers. How can you extend your model to accommodate this? Where would you put the attribute type “number\_of\_copies”?

## **Answer:**

**First Normal Form**

The first normal form is violated because Author is a multivalued composite attribute type and Publisher is a composite attribute type. The relation R can be brought in first normal form as follows:

**BOOK**(ISBN, title, publishername, streetnumber, streetname, zipcode, cityname, pages, price)

**AUTHOR**(*ISBN*, authorname, date\_of\_birth)

**Second Normal Form**

The relation AUTHOR is not in second normal form because date\_of\_birth is partially dependent on ISBN and authorname. In fact, it only depends on authorname. The relation AUTHOR can be brought in second normal form as follows:

**BOOK**(ISBN, title, publishername, streetnumber, streetname, zipcode, cityname, pages, price)

**AUTHOR**(authorname, date\_of\_birth)

**WRITES**(*authorname*, *ISBN*)

**Third Normal Form step 1**

The relation BOOK is not in third normal form since we have a transitive functional dependence from ISBN to streetnumber via publishername, from ISBN to streetname via publishername, from ISBN to zipcode via publishername and from ISBN to cityname via publishername. The relation BOOK can be brought in third normal form as follows:

**BOOK**(ISBN, title, pages, price, *publishername*)

**AUTHOR**(authorname, date\_of\_birth)

**WRITES**(*authorname*, *ISBN)*

**PUBLISHER**(publishername, streetnumber, streetname, zipcode, cityname)

**Third Normal Form step 2**

The relation PUBLISHER is still not in third normal form since we have a transitive functional dependency from publishername to cityname via zipcode. The relation BOOK can be brought in third normal form as follows:

**BOOK**(ISBN, title, pages, price, *publishername*)

**AUTHOR**(authorname, date\_of\_birth)

**WRITES**(*authorname*, *ISBN)*

**PUBLISHER**(publishername, streetnumber, streetname, *zipcode*)

**CITY**(zipcode, cityname)

## **Extra Question**

If you want to extend the model by allowing a book to be published by multiple publishers then the relation BOOK is no longer in first normal form since publishername now becomes a multivalued attribute type. The new normalized set of relations then becomes:

**BOOK**(ISBN, title, pages, price)

**AUTHOR**(authorname, date\_of\_birth)

**WRITES**(*authorname*, *ISBN)*

**PUBLISHER**(publishername, streetnumber, streetname, *zipcode*)

**CITY**(zipcode, cityname)

**PUBLISHES**(*ISBN,publishername*)

The attribute type “number\_of\_copies“ can then be stored in the PUBLISHES relation.