Part 1: Multiple Choice (75 points - 3 points per question)

1. Which is true?
   (A) Metadata is the state of data.  (B) XML is a type of semi-structured data.
   (C) Database schema changes every time the database is updated.  (D) none of the above

2. Which is the biggest problem with data redundancy?
   (A) Data dependence  (B) Limited data sharing  (C) Data inconsistencies  (D) none of the above

3. Which of the following is not a cost of the database approach?
   (A) Specialized personnel  (B) Organizational conflict  (C) Cost of conversion  (D) Improved responsiveness

4. Which is an application of data warehouses?
   (A) File updating  (B) Shipping of information.  (C) Order processing  (D) none of the above

5. Which is not a job of a DBA?
   (A) Tuning the DBMS performance  (B) Authorizing access to the database
   (C) Acquiring software and hardware resources  (D) Defining the database constraints

6. Which is a DBMS?  (A) Apache  (B) MySQL  (C) PHP  (D) Microsoft Excel

7. In the three-schema architecture, which schema can have multiple view?
   (A) Internal schema  (B) Conceptual schema  (C) External schema  (D) none of the above

8. Which data model describes how data is stored as files in the computer?
   (A) conceptual  (B) physical  (C) representational  (D) none of the above

9. Who create relational data model?  (A) Steve Jobs  (B) Bill Gates  (C) E. F. Codd  (D) none of the above

10. Which is a rule that cannot be violated by database users?  (A) constraint.  (B) program.  (C) password.  (D) view.

11. Which is true?
    (A) A superkey is a key.  (B) Two tuples can have the same key value.
    (C) A relation can have more than one candidate key.  (D) none of the above

12. Which is not a meaning for null values?
    (A) Attribute value is unknown.  (B) The value is beyond the domain range.
    (C) Attribute does not apply to this tuple.  (D) Value exists but is not available.

13. Which is the rule activated by updates to the table?  (A) constraint (B) business rule (C) trigger  (D) none of the above

14. Which constraint may the delete operation violate?
    (A) Referential constraint  (B) Entity constraint  (C) Key integrity  (D) none of the above

15. Which integrity constraints can trigger a sequence of operations?  (A) restrict  (B) set default  (C) set null  (D) cascade

16. Which is a SQL DML command?  (A) delete  (B) grant  (C) alter  (D) none of the above

17. Which SQL command can remove a table?  (A) delete table  (B) drop table  (C) remove table  (D) none of the above

18. Which SQL command specifies alternate (secondary) keys?  (A) unique  (B) index  (C) distinct  (D) none of the above

19. Which is used to eliminate duplicate rows in a query in SQL?  (A) unique  (B) index  (C) distinct  (D) none of the above

20. Which represents all attributes of a table in a SQL select command?  (A) %  (B) <>  (C) &  (D) *

21. Which is a join condition in the following SQL commands?
    select * from member, borrow where name = 'Amy' and member.id = borrow.id;
    (A) member.id = borrow.id;  (B) name = 'Amy'  (C) select * from member, borrow (D) none of the above

22. What is a virtual table in SQL?  (A) screen  (B) view  (C) vision  (D) none of the above

23. In the like operator of SQL, which can represent any string?  (A) *  (B) ;  (C) _  (D) %

24. Which is used to to sort the result set in SQL?  (A) order by (B) group by (C) sort by (D) having

25. When you post a message on your Facebook account, which SQL command will be used?
    (A) delete (B) query (C) insert (D) none of the above

Part 2: Questions and Answers (89 points)

1. (24 points) Briefly explain these terminologies. If they are acronyms, also write what they stand for.
   (a) data independence (b) XML (c) DBMS (d) ODBC (e) ERP (f) data mining
   (a) Data independence is the capacity to change the lower-level schema without having to change the higher level schema.
   (b) XML (eXtensible Markup Language) is a language for defining markup languages.
   (c) Database management system (DBMS) is software used to create, maintain, and provide controlled access to databases.
   (d) Open Database Connectivity (ODBC) is an API for database access.
   (e) Enterprise resource planning (ERP) is an information technology term referring to an integrated system that serves all departments within an enterprise.
   (f) The data mining can be defined in either one as shown in below:
      i. The discovery of new information in terms of patterns or rules from vast amounts of data.
      ii. The process of finding interesting structure in data.
iii. The process of employing one or more computer learning techniques to automatically analyze and extract knowledge from data.

2. (a) (4 points) What is the data model?
   (b) (4 points) Illustrate the three-tier client-server architecture.
   (c) (6 points) Explain the functions for each tier in the three-tier architecture.

(a) A set of concepts to describe the structure of a database, the operations for manipulating these structures, and certain constraints that the database should obey.

(b) The first tier has the Web browser, which provides the user interface.
• The middle tier has Web server and the applications that require database access.
• The third tier has the database system and the database itself.

3. (a) (3 points) What is integrity constraint?
   (b) (8 points) Explain the key constraint, domain constraint, entity integrity constraint, and referential constraint.

(a) Integrity constraints are the constraints used to ensure accuracy and consistency of data in a relational database.
(b) • The key constraint means there is no duplicate key in any relation.
• The domain constraint indicates every value in a tuple must be from the domain of its attribute.
• The entity integrity indicates the values of primary key attributes in a relation cannot be null.
• The referential integrity constraints indicate any attribute of a foreign key in a table can contain only either values from the corresponding parent table’s primary key or the null value.

4. (a) (4 points) What does SQL stand for? Explain it.
   (b) (6 points) Based on the functions how can SQL be classified into three categories?

(a) Structured Query Language (SQL) is a standard language used to retrieve, update and delete data from relational database management systems (DBMS).
(b) Data Definition Language (DDL) is used to define databases.
Data Manipulation Language (DML) is used to manipulate databases.
Data Control Language (DCL) is used to control databases.

5. (8 points) Consider the following relations for book adoption of a course. Draw the relational schema diagram and indicate the primary keys and the referential constraints.

course (course_no, course_title, credit)
book_adoption(course_no, semester, isbn)
book (isbn, title, author, publisher, year)

6. (22 points) Consider the following database:

<table>
<thead>
<tr>
<th>Artist table</th>
<th>Completion table</th>
<th>Painting table</th>
</tr>
</thead>
<tbody>
<tr>
<td>artist_id</td>
<td>artist_id</td>
<td>painting_id</td>
</tr>
<tr>
<td>first_name</td>
<td>painting_id</td>
<td>completed_year</td>
</tr>
<tr>
<td>last_name</td>
<td>completed_year</td>
<td>title</td>
</tr>
<tr>
<td>A1001</td>
<td>V</td>
<td>P1001</td>
</tr>
<tr>
<td>A2002</td>
<td>C</td>
<td>P2002</td>
</tr>
<tr>
<td>A3003</td>
<td>E</td>
<td>P3003</td>
</tr>
</tbody>
</table>
where primary keys are underlined. artist_id and painting_id in the Completion table are foreign keys referring to the artist and painting table respectively.

(a) (8 points) If the following operations are taken, check if domain constraints, key constraints, entity integrity, or referential integrity is violated. If there is any violation, explain it.

i. Insert ('A4004', 'Pablo', 'Picasso') into the Artist table.
ii. Remove the row with the artist name 'Claude Monet' from the Artist table.
iii. Change the value of completed_year from 1888 to 'one thousand and eight hundred and eighty-eight' in the Completion table.
iv. Change the value of artist_id from A3003 to A5005 in the Artist table.

(b) (14 points) Use SQL to answer the following questions based on the above database:

i. (3 points) Create the Artist table and set artist_id as the primary key.
ii. (2 points) Insert ('A6006', 'Pierre-auguste', 'Renoir') into the Artist table.
iii. (3 points) Update the Artist table and change the value of name from 'Edouard Manet' to 'Alfred Sisley'.
iv. (3 points) List all paintings by Vincent Van Gogh.
v. (3 points) Delete all paintings completed in 2007.

(a) i. It violates no constraint.
ii. It violates the referential integrity because the foreign key, artist_id 'A2002' in the Completion table will have no primary key to refer to in the Artist table.
iii. It violates domain constraint because completed_year should be an integer.
iv. It violates the referential integrity because the foreign key, artist_id 'A3003' in the Completion table will have no primary key to reference to in the Artist table.

(b) i. create table Artist (artist_id char(5) primary key not null, firstname varchar(30), lastname varchar(10));
ii. insert into Artist values ('A6006', 'Pierre-auguste', 'Renoir')
iii. update Artist set firstname = 'Alfred', lastname = 'Sisley' where firstname = 'Edouard' and lastname = 'Manet';
v. delete from Painting where painting_id in (select painting_id from Completion where completed_year = 2007);