Part 1: Multiple Choice (78 points - 3 points per question)

(A) 1. Which is true?
   (A) A database is a collection of related data. (B) Data after processing is knowledge.
   (C) Database schema changes every time the database is updated. (D) None of the above

(D) 2. All of the following are properties of metadata except:
   (A) data definitions. (B) data structures. (C) rules or constraints. (D) processing logic.

(C) 3. Who is responsible to tune the performance of a DBMS?
   (A) application programmer (B) database designers (C) database administrators (D) none of the above

(D) 5. With the database approach, data descriptions are stored in a central location known as a(n):
   (A) index. (B) data warehouse. (C) data server. (D) repository.

(C) 6. Which is a DBMS? (A) Adobe Photoshop (B) Appserv (C) Microsoft Access (D) none of the above

(B) 7. Which is a SQL DCL command? (A) delete (B) grant (C) update (D) none of the above

(A) 9. Which is used to to sort the result set in SQL? (A) order by (B) group by (C) sort by (D) having

(D) 10. In MySQL which command can show the schema of a table? (A) show (B) display (C) present (D) describe

(A) 11. Which of the following represents all attributes of a table in a SQL statement?
   (A) * (B) <> (C) = (D) &

(C) 12. What does the following SQL statement do? select name from student where major = 'Computer Science';
   (A) Retrieves all majors whose name is Computer Science from the student table.
   (B) Retrieves all students who likes Computer Science from the student table.
   (C) Retrieves the name of all students majoring in Computer Science.
   (D) None of the above

(A) 13. Which SQL command can be used to change a table definition?
   (A) alter table (B) drop table (C) truncate table (D) none of the above

(C) 14. In the like operator of SQL, which can represent any string? (A) * (B) ; (C) % (D) _

(A) 15. When you post a message on your Facebook account, which SQL command will be used?
   (A) insert (B) grant (C) select (D) delete

(B) 16. In MySQL which is used to execute a SQL script? (A) use (B) source (C) \\

(C) 17. Which is the rule activated by updates to the table? (A) constraint (B) business rule (C) trigger (D) none of above

(D) 18. Which is not a meaning for null values?
   (A) Attribute does not apply to this tuple. (B) Value exists but is not available.
   (C) Attribute value is unknown. (D) The value is beyond the domain range.

(C) 19. Which is true?
   (A) A super key is a key. (B) A superkey should be minimal.
   (C) Candidate keys can be designated as unique keys. (D) none of the above

(A) 20. The ______ of a relationship type is the number of participating entity instances.
   (A) cardinality (B) degree (C) identification (D) participation

(A) 22. Which constraint may the delete operation violate?
   (A) Referential constraint (B) Entity constraint (C) Key integrity (D) None of the above

(D) 23. Which integrity constraints can trigger a sequence of operations?
   (A) restrict (B) set default (C) set null (D) cascade

(A) 24. Which is used to eliminate duplicate rows in a query in SQL? (A) distinct (B) check (C) alter (D) specific

Part 2: Questions and Answers (106 points)

1. (20 points) Briefly explain these terminologies. If they are acronyms, also write what they stand for.
   (a) DBMS (b) data model (c) XML (d) entity integrity (e) ODBC
      (a) Database management system (DBMS) is software used to create, maintain, and provide controlled access to
         databases.
      (b) 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.
      (c) EXtensible Markup Language (XML) is a language used to specify the data content.
      (d) The entity integrity indicates the values of primary key attributes in a relation cannot be null.
(e) Open Database Connectivity (ODBC) is an API for database access.

2. (a) (4 points) Illustrate the three-tier client-server architecture.
(b) (3 points) Explain the functions for each tier in the three-tier architecture.
(c) (3 points) Give an example of a software for each tier respectively.

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

(c) Client: firefox, Web server: Apache, Database server: MySQL

3. (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.

4. (21 points) Consider the following music store database:

<table>
<thead>
<tr>
<th>employee table</th>
<th>works_on table</th>
</tr>
</thead>
<tbody>
<tr>
<td>employee_no</td>
<td>name</td>
</tr>
<tr>
<td>E99022</td>
<td>Lady Gaga</td>
</tr>
<tr>
<td>E99145</td>
<td>Taylor Swift</td>
</tr>
<tr>
<td>E99262</td>
<td>Amy Winehouse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>works_on table</th>
<th>employee_no</th>
<th>project_no</th>
<th>hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E99022</td>
<td>PJ101</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>E99145</td>
<td>PJ202</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>E99262</td>
<td>PJ311</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>department table</th>
<th>project table</th>
</tr>
</thead>
<tbody>
<tr>
<td>department_no</td>
<td>project_no</td>
</tr>
<tr>
<td>MK100</td>
<td>PJ101</td>
</tr>
<tr>
<td>SL200</td>
<td>PJ202</td>
</tr>
<tr>
<td>HR300</td>
<td>PJ311</td>
</tr>
</tbody>
</table>

where primary keys are underlined. department_no in the employee table is a foreign key referencing to the department table. employee_no and project_no in the works_on table are foreign keys referencing to the employee and project table respectively.

(a) 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. (2 points) Insert ('E99262', 'Ketty Perry', 'Marketing', MK100) into the employee table.
   ii. (2 points) Change the project_no of 'PJ102' in the works_on table from 'PJ102' to 'PJ212'.
   iii. (2 points) Remove the row ('SL200', 'Sales', 'E95022') from the department table.
   iv. (2 points) Change the project name in the project table from 'World Peace' to 'Stop Violence'.

(b) Use SQL to answer the following questions.
   i. (3 points) Create the employee table with the required constraints.
   ii. (2 points) Insert ('RH400', 'Research', 'E93202') into the department table.
   iii. (2 points) Change the position of Taylor Swift from 'clerk' to 'staff'.
   iv. (3 points) Remove all projects Amy Winehouse works on.
   v. (3 points) List the department name and the number of employees in the order of the number of employees.
(a)  
   i. It violates the key constraint because the employee_no 'E95262' already existed.
   ii. It violates the referential integrity because the foreign key, works_on 'PJ212' in the class table will have no primary key to reference to in the project table.
   iii. It violates the referential integrity because the foreign key, department_no 'SL2638' in the employee table will have no primary key to reference to in the department table.
   iv. It violates no constraint.
(b)  
   i. create table employee (  
       employee_no char(6) primary key not null,  
       name varchar(30),  
       position varchar(15),  
       department_no char(6));
   ii. insert into department values ('RH400', 'Research', 'E93202');
   iii. update employee set position = 'staff' where name = 'Taylor Swift';
   iv. delete from project where employee_no = 
       (select employee_no from employee, works_on  
       where project.project_no = works_on.project_no and name = 'Amy Winehouse');

5. (8 points) Consider the following schema for a game competition. Underline the primary key and draw the schema diagram.
   player(player_id, name, team_id)
   team(team_id, name, country) schedule(game_id, team_id, date, time, place)
   game(game_id, name, award)