Part 1: Multiple Choice (81 points - 3 points per question)

(C) 1. Which is true?
   (A) Database system is a collection of related data. (B) Metadata is the state of data.
   (C) Database instance changes every time the database is updated. (D) none of the above

(D) 2. Which is not a function of a DBMS?
   (A) database manipulation (B) database construction (C) database definition (D) data abstraction

(B) 3. Which is a DBMS? (A) Excel (B) Access (C) Apache (D) none of the above

(C) 4. Which is the rule activated by updates to the table? (A) constraint (B) business rule (C) trigger (D) None of above

(A) 5. Which is the data in database at a particular moment in time? (A) database state (B) database constraint (C) database schema (D) database query

(B) 6. Which is a job of a DBA?
   (A) Defining the database constraints (B) Authorizing access to the database (C) Defining the database transactions (D) none of the above

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

(A) 8. Which is in DBMS-independent design process?
   (A) requirement analysis (B) application program design (C) transaction Implementation (D) none of the above

(A) 9. Which represents a real-world object or concept? (A) Entity (B) Attribute (C) Relationship (D) none of above

(C) 10. Which is true?
   (A) A relation has only one key. (B) A superkey must be minimal. (C) Any key is a superkey. (D) none of the above

(A) 11. Which constraint may delete violate?
   (A) referential integrity (B) key constraint (C) domain constraint (D) none of the above

(C) 12. Which integrity constraints can trigger a sequence of operations?
   (A) restrict (B) set default (C) cascade (D) none of the above

(B) 13. Which is not a meaning for null values?
   (A) Attribute does not apply to this tuple. (B) The value is beyond the domain range.
   (C) Attribute value is unknown. (D) Value exists but is not available.

(A) 14. Which SQL command is used to delete a table?
   (A) delete table (B) drop table (C) truncate table (D) none of the above

(A) 15. In an SQL statement, which part states the selection conditions? (A) where (B) select (C) from (D) in case

(B) 16. Which is used to to sort the result set in SQL? (A) group by (B) order by (C) sort by (D) having

(A) 17. Which returns the number of rows in SQL? (A) count() (B) number() (C) num() (D) none of the above

(A) 18. What is a virtual table in SQL? (A) view (B) vision (C) screen (D) none of the above

(C) 19. To eliminate duplicate rows in a query, which can be used? (A) unique (B) index (C) distinct (D) none of the above

(C) 20. Which is a join condition in the following SQL commands?
   ```sql
   select name from employee, department
   where department_name = 'Research' and employee.department_no = department.department_no;
   ```
   (A) select name from employee, department (B) department_name = 'Research'
   (C) employee.department_no = department.department_no (D) none of the above

(D) 21. Which of the following represents all attributes of a table in a SQL statement? (A) % (B) <> (C) & (D) *

(B) 22. Which SQL operator is used to search for a specified pattern in a column? (A) as (B) like (C) match (D) none of the above

(D) 23. In MySQL which command can show the schema of a table? (A) show (B) display (C) present (D) describe

(C) 24. In MySQL which is used to execute a SQL script? (A) use (B) \c (C) \ (D) none of the above

(D) 25. When you log into your Facebook, which SQL command will be used? (A) insert (B) update (C) delete (D) select

(D) 26. A rule that database users should obey is called a: (A) regulation. (B) principle. (C) privilege. (D) constraint.

(A) 27. Which is persistent data? (A) HTML documents (B) SQL statements (C) work queues (D) none of above

Part 2: Questions and Answers (80 points)

1. (20 points) Briefly explain these terminologies. If they are acronyms, also write what they stand for.
   (a) data model (b) data independence (c) XML (d) DBMS (e) data mining
   (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) Data independence is the capacity to change the lower-level schema without having to change the higher level schema.
   (c) EXtensible Markup Language (XML) is a language used to specify the data content.
2. (a) (3 points) Illustrate the three-tier client-server architecture.
(b) (4 points) Explain the function for each tier in the three-tier architecture.
(c) (3 points) Map the software in Xampp server to corresponding tier.

(a)

![Three-tier architecture diagram]

(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.

(c) Client: phpMyAdmin, Web server: Apache, PHP, Database server: MySQL.

3. (8 points) Explain the key constraint, domain constraint, entity integrity constraint, and referential constraint.
- 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. (24 points) Consider the following swimming competition database:

<table>
<thead>
<tr>
<th>player table</th>
<th>competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>player_no</td>
<td>name</td>
</tr>
<tr>
<td>102022</td>
<td>Lady Gaga</td>
</tr>
<tr>
<td>102145</td>
<td>Taylor Swift</td>
</tr>
<tr>
<td>102262</td>
<td>Lily Allen</td>
</tr>
</tbody>
</table>

where primary keys are underlined. player_no and event_no in the competition table are foreign keys referencing to the player and event 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 ('102262', 'Ketty Perry', 'USA', 3) into the player table.
ii. (2 points) Change the event_no of 'E202' in the event table from 'E202' to 'E212'.
iii. (2 points) Remove the row ('E202', '100m Breaststroke') from the event table.
iv. (2 points) Change the event name in the event table from '200m Butterfly' to '100m Backstroke'.
(b) Use SQL to answer the following questions.
   i. (3 points) Create the player table with the required constraints.
   ii. (2 points) Insert an 'USA' player, 'Justin Timberlake' with ID '102168' and 5 medals into the player table.
   iii. (2 points) Change '50m Freestyle' to '100m Butterfly' for the event number E101 in the event table.
   iv. (2 points) Sort the players by the number of their medals.
   v. (3 points) Remove all competitions attended by 'Lady Gaga' from the competition table.
   vi. (3 points) Specify a constraint that restricts time between 9:00 and 21:00 in the competition table.
   vii. (3 points) Specify event_no, player_no as the primary key in the competition table.

(a) i. It violates the key constraint because the player_no '100262' already existed.
   ii. It violates the referential integrity because the foreign key, event_no 'E202' in the perform table will have no primary key to reference to in the event table.
   iii. It violates the referential integrity because the foreign key, event_no 'E202' in the perform table will have no primary key to reference to in the event table.
   iv. It violates no constraint.

(b) i. create table player (  
   player_no char(6) primary key not null,  
   name varchar(30),  
   country varchar(15),  
   medal integer);  
   ii. insert into player values ('101168', 'Justin Timberlake', 'USA', 5)  
   iii. update event set event = '50m Freestyle' where event_no = 'E101'  
   iv. select * from player order by medal  
   v. delete from competition where player_no = (select player_no from player where name = 'Lady Gaga')  
   vi. alter table competition add constraint time_constraint check (time >= '9:00' and time <= '21:00')  
   vii. alter table competition add primary key (event_no, player_no)

6. (8 points) The database of a for a library which can store the information of members, borrow, and books. Please draw the relational schema diagram and indicate the primary keys and the referential constraints. The database schema of the library is shown as follows:

member (member_no, name, address, phone, email)
borrow (isbn, checkout_date, member_no, borrow_period)
book (isbn, book_title, authors)

member:  
  ↓  
borrow:  
  ↓  
book:  