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

(D) 1. Which is true?
   (A) Database system is a collection of related data. (B) Meta-data is the state of data.
   (C) Database schema changes every time the database is updated. (D) None of the above

(B) 2. Which is a DBMS? (A) Excel (B) Access (C) Apache (D) none of the above

(C) 3. Which is not a function of a DBMS?
   (A) database definition (B) database construction (C) data abstraction (D) database manipulation

(A) 4. Which is not a job of a DBA?
   (A) Defining the database constraints (B) Authorizing access to the database
   (C) Acquiring software and hardware resources (D) Tuning the DBMS performance

(A) 5. Which represents a real-world object or concept? (A) Entity (B) Attribute (C) Relationship (D) none of above

(D) 6. Which is not a characteristic of the database approach?
   (A) Sharing of data (B) Reducing data redundancy (C) Data independence (D) Data security

(D) 7. Which specifies restrictions on valid data? (A) Constructs (B) Validity (C) Cardinality ratio (D) none of the above

(A) 8. Which of the following is not a property of relations?
   (A) Every attribute value must be unique. (B) Each table must have a unique name.
   (C) The order of the rows must be irrelevant. (D) Every attribute value must be atomic.

(C) 9. Which is the rule activated by updates to the table? (A) constraint (B) business rule (C) trigger (D) none of above

(B) 10. Which is not an option for the update operation to ensure the referential integrity?
   (A) cascade (B) set constraint (C) set null (D) set default

(C) 11. An identifier that enables a dependent relation to refer to its parent relation is called a:
   (A) unique key (B) candidate key (C) foreign key (D) none of the above

(A) 12. A domain definition consists of the following components except:
   (A) integrity constraints. (B) size. (C) data type. (D) domain name.

(D) 13. Referring to the following figure, which following statement is true?
   ![Diagram]
   (A) Child is a strong entity. (B) An employee can have only one child.
   (C) Employee_ID in Employee is a foreign key. (D) none of the above

(A) 14. Which of the following statement is true?
   (A) Each non-key is functionally dependent on every candidate key. (B) Each primary key must be atomic.
   (C) Each table can have only one candidate key. (D) none of the above

(B) 15. Which SQL command is used to remove a table?
   (A) delete table (B) drop table (C) truncate table (D) none of the above

(B) 16. Which is used to indicate categorization of results in SQL? (A) order by (B) group by (C) sort by (D) having

(C) 17. To eliminate duplicate rows in a query, which qualifier can be used in the SQL Select command?
   (A) unique (B) check (C) distinct (D) specific

(B) 18. Which constraint may delete violate?
   (A) Domain constraint (B) Referential integrity (C) Key constraint (D) All of the above

(D) 19. What result set will the following query return? select ticker from stock where price < 20;
   (A) The stocks of tickers whose price is less than 20. (B) The tickers of stocks whose ticker is less than 20.
   (C) The prices of stocks whose ticker is less than 20. (D) None of the above

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

(B) 21. Which SQL operator is used to search for a specified pattern in a column?
   (A) as (B) like (C) match (D) none of above

(A) 22. Which SQL operator allows you to compare strings using wildcards? (A) like (B) as (C) in (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. When you log into your Facebook account, which SQL command will be used?
   (A)insert (B) update (C) select (D) delete

(B) 25. In MySQL which is used to execute a SQL script? (A) use (B) \ (C) \e (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) DBMS  (c) data model  (d) ODBC  (e) data mining  (f) big data

   (a) Data independence is the capacity to change the lower-level schema without having to change the higher level schema.
   (b) Database management system (DBMS) is software used to create, maintain, and provide controlled access to databases.
   (c) 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.
   (d) Open Database Connectivity (ODBC) is an API for database access.
   (e) 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.
   (f) Big Data refers to datasets whose size are beyond the ability of typical database software tools to capture, store, manage and analyze.

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 Wamp server to corresponding tier.

   (a)

   Client

   Application Server or Web Server

   Database Server

   GUI, Web Interface

   Presentation Layer

   Application Programs, Web Pages

   Business Logic Layer

   Database Management System

   Database Services Layer

   (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. (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. (26 points) Consider the following gymnastics competition database:

<table>
<thead>
<tr>
<th>player table</th>
<th>event table</th>
</tr>
</thead>
<tbody>
<tr>
<td>player_no</td>
<td>event_no</td>
</tr>
<tr>
<td>100022</td>
<td>E101</td>
</tr>
<tr>
<td>Lady Gaga</td>
<td>E202</td>
</tr>
<tr>
<td>USA</td>
<td>E303</td>
</tr>
<tr>
<td>100145</td>
<td>E202</td>
</tr>
<tr>
<td>Taylor Swift</td>
<td>E303</td>
</tr>
<tr>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>100262</td>
<td>E101</td>
</tr>
<tr>
<td>Adele Adkins</td>
<td>E202</td>
</tr>
<tr>
<td>UK</td>
<td>E303</td>
</tr>
</tbody>
</table>

where primary keys are underlined. player_no and event_no in the perform 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 ('100262', 'Ketty Perry', 'USA', 3) into the player table.
ii. (2 points) Change the event_no of 'E202' in the perform table from 'E202' to 'E212'.
iii. (2 points) Remove the row ('E202', 'Balance beam') from the event table.
iv. (2 points) Change the event name in the event table from 'Balance beam' to 'Vault'.

(b) Use SQL to answer the following questions.

i. (3 points) Create the player table with the required constraints.
ii. (3 points) List the names and countries of all players who perform on April 15, 2014.
iii. (3 points) Add a constraint of 10:00 ≤ time ≤ 20:30 in the perform table.
iv. (2 points) Insert ('E404', 'Vault') into the event table.
v. (2 points) Change the event name in the event table from 'Balance beam' to 'Vault'.
vi. (2 points) Sort the players by the number of their medals.
vii. (3 points) Remove all events which 'Taylor Swift' performs.

(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. select name, country from player, perform where player.player_no = perform.player_no and date = '2014-04-15';
iii. alter table event add constraint hour_constraint check ('10:00' <= time and time <= '20:30')
iv. insert into event values ('E404', 'Vault');
v. update event set event = 'Vault' where event = 'Balance beam';
vi. select * from player order by medal 
vii. delete from event where player_no = 
     (select player_no from player, perform 
     where event.event_no = perform.event_no and name = 'Amy Winehouse');

6. (8 points) Consider the following relations for a database that keeps track of business trips of salespersons in a sales office.

Please draw the relational schema diagram and indicate the primary keys and the referential constraints.

salesperson(id_no, name, start_year, department_no)
trip(id_no, from_city, departure_date, return_date, trip_id)
expense(trip_id, account_no, amount)

salesperson: 

<table>
<thead>
<tr>
<th>id_no</th>
<th>name</th>
<th>department_no</th>
<th>start_year</th>
</tr>
</thead>
</table>

trip: 

<table>
<thead>
<tr>
<th>id_no</th>
<th>trip_id</th>
<th>from_city</th>
<th>departure_date</th>
<th>return_date</th>
</tr>
</thead>
</table>

expense: 

| trip_id | account_no | amount |