Part 1: Multiple Choice (108 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

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

(A) 3. Which returns the number of rows in SQL? (A) count() (B) number() (C) num() (D) none of the above

(B) 4. 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

(C) 5. Which is in DBMS-independent design process?
   (A) transaction Implementation (B) application program design (C) requirement analysis (D) none of the above

(C) 6. Which is the application of data warehouses?
   (A) shipping of information. (B) order processing. (C) decision support. (D) file updating.

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

(D) 8. In an SQL statement, which part states the selection conditions? (A) in case (B) select (C) from (D) where

(C) 9. Which can speed up access to database tables? (A) data dictionary (B) data view (C) index (D) none of the above

(A) 10. Which is used to to sort the result set in SQL? (A) order by (B) group by (C) sort by (D) having

(D) 11. In MySQL which command can show the schema of a table? (A) show (B) display (C) present (D) describe

(C) 12. Which is usually to represent a relationship in an ER diagram? (A) adjective (B) noun (C) verb (D) proposition

(C) 13. Which is a DBMS? (A) Adobe Photoshop (B) Appserv (C) Microsoft Access (D) none of the above

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

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

(B) 16. Which constraint may the delete operation violate?
   (A) Entity constraint (B) Referential constraint (C) Key integrity (D) None of the above

(C) 17. Which of the following finds those groups meeting stated conditions?
   (A) group by (B) using by (C) having (D) none of the above

(A) 18. Which is an approach to map a n-ary relationship type in the ER diagram to the relational schema?
   (A) A relationship relation and n foreign keys (B) Merged relation
   (C) A relation set of simple component attributes (D) None of the above

(C) 19. Which of the following is false?
   (A) The EER is a type of conceptual data models. (B) E. F. Codd first proposed the relation model.

(B) 20. Which is an entity in a museum? (A) Open hours (B) Exhibition items (C) Ticket price (D) none of the above

(B) 21. 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

(D) 22. Which is an entity in a museum? (A) Open hours (B) Exhibition items (C) Ticket price (D) none of the above

(D) 23. Which is the process of storing the join of higher normal form relations as a base relation?
   (A) Specialization (B) Generalization (C) Realization (D) Denormalization

(D) 24. An entity whose existence depends on another entity is called:
   (A) codependent entity (B) variant entity (C) strong entity (D) weak entity

(A) 25. The _____ of a relationship type is the number of participating entity instances.
   (A) cardinality (B) degree (C) identification (D) participation

(D) 26. Which type of relationships between a course and a student?
   (A) one-to-many (B) one-to-one (C) many-to-one (D) many-to-many

(B) 27. Which is an approach to map a n-ary relationship type in the ER diagram to the relational schema?
   (A) Merged relation (B) A relationship relation and n foreign keys
   (C) A relation set of simple component attributes (D) None of the above

(D) 28. The relational data model consists of which components?
   (A) Data structure (B) Data manipulation (C) Data integrity (D) All of the above

(A) 29. Which constraint may the delete operation violate?
   (A) Referential constraint (B) Entity constraint (C) Key integrity (D) none of above

(C) 30. Which of the following is false?
   (A) The EER is a type of conceptual data models. (B) E. F. Codd first proposed the relation model.
(C) An entity can exist in the database merely by being a member of a subclass. (D) none of the above

(C) 31. Which is persistent data? (A) SQL statements (B) work queues (C) HTML documents (D) none of above

(A) 32. Which constraint may the delete operation violate?
   (A) Referential constraint (B) Entity constraint (C) Key integrity (D) None of the above

(C) 33. The UNION clause is used to:
   (A) join two tables together to form one table. (B) find all rows that do not match in two tables.
   (C) combine the output from multiple queries into a single result table. (D) none of the above.

(B) 34. Which of the following finds those groups meeting stated conditions?
   (A) group by (B) having (C) using by (D) none of the above

(B) 35. Which is an approach to map a n-ary relationship type in the ER diagram to the relational schema?
   (A) Merged relation (B) A relationship relation and n foreign keys
   (C) A relation set of simple component attributes (D) none of the above

(C) 36. Which is a subset of the database that is presented to one or more users?
   (A) correlated subquery (B) derived table (C) view table (D) None of the above.

Part 2: Questions and Answers (107 points)

1. (28 points) Briefly explain these terminologies. If they are acronyms, also write what they stand for.
   (a) ontology (b) functional dependency (c) data mining (d) XML (e) OMG (f) CASE (g) entity integrity

   (a) Ontology means using conceptual modeling and other tools to develop a specification of a conceptualization.

   (b) Functional dependency specifies that the value of an attribute in a table determine the value of other attribute in the same table.

   (c) The data mining can be defined in either one as shown in below:
   - The discovery of new information in terms of patterns or rules from vast amounts of data.
   - The process of finding interesting structure in data.
   - The process of employing one or more computer learning techniques to automatically analyze and extract knowledge from data.

   (d) EXtensible Markup Language (XML) is a language used to specify the data content.

   (e) Object Management Group (OMG) is an international, open membership, non-profit computer industry standards consortium.

   (f) Computer-aided software engineering (CASE) is a set of tools and methods to assist the software development.

   (g) The entity integrity indicates the values of primary key attributes in a relation cannot be null.

2. (a) (4 points) What is data model?

   (b) (4 points) Illustrate the three-tier client-server architecture.

   (c) (3 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)

   (c) 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) (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. (a) (3 points) Explain normalization for a relational database.
(b) (9 points) Explain the 1NF, 2NF, and 3NF.

(a) The process of structuring relations by decomposing their attributes into smaller relations.
(b) i. 1NF is the relation that has no composite attributes, multivalued attributes, and nested relations.
ii. In 2NF, every non-prime attribute is fully functionally dependent on the primary key in the relation.
Other possible answers:
There are no two keys in the relation.
There is no partial functional dependency in the relation.
iii. Third normal form (3NF) is a normal form in which there is no transitive functional dependency in the relation.

5. (32 points) Consider the following gymnastics competition database:

<table>
<thead>
<tr>
<th>perform</th>
<th>event table</th>
</tr>
</thead>
<tbody>
<tr>
<td>event no</td>
<td>player no</td>
</tr>
<tr>
<td>E101</td>
<td>100022</td>
</tr>
<tr>
<td>E202</td>
<td>100415</td>
</tr>
<tr>
<td>E303</td>
<td>100262</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>player table</th>
</tr>
</thead>
<tbody>
<tr>
<td>player no</td>
</tr>
<tr>
<td>100022</td>
</tr>
<tr>
<td>100415</td>
</tr>
<tr>
<td>100262</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) Add a constraint of 10:00 ≤ time ≤ 20:30 in the perform table.
iii. (2 points) Add an attribute gender into the player 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) For each player, list the event name and the total number of events which each player performs.
viii. (3 points) Remove all events which 'Amy Winehouse' performs.
ix. (4 points) List the event name and the number of players for each event sorted by the number of players.

(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
primay 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
primay 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. alter table event add constraint hour_constraint check ('10:00' <= time and time <= '20:30')
iii. alter table player add gender char(1);
iv. insert into event values ('E404', 'Vault');
v. update event set event = 'Vault' where event = 'Balance beam';
vii. select * from player order by medal
vii. • select player_no, count(*) as number_of_event from perform, event
   where event.event_no = perform.event_no
   group by player_no;
• select name, count(*) as number_of_event from player, perform, event
   where player.player_no = perform.player_no and event.event_no = perform.event_no
   group by name;
viii. delete from event where player_no =
   (select player_no from player, perform
   where event.event_no = perform.event_no and name = 'Amy Winehouse');
ix. select event, count(*) as num_of_player from perform, event
   where perform.event_no = event.event_no
   group by event order by num_of_player;

6. (14 points) Consider the following order table.
order(order_no, date, customer_no, customer_name, item, product_no, product_name, unit, unit_price, amount, price)
where the keys are underlined.
(a) (7 points) Normalize the above table to the 3 NF and draw the relational schema diagram and indicate the primary
keys and the referential constraints.
(b) (7 points) Based on the above schema diagram draw the ER diagram.

(a) customer: customer_no customer_name
doer: order_no customer_no date
detail: order_no item product_no amount
   product: product_no product_name unit price

(b)