Part 1: Multiple Choice (96 points - 3 points per question)

(B) 1. Which is a SQL DCL command? (A) delete (B) grant (C) update (D) none of the above

(A) 2. Which is used to select all the columns from a table in SQL? (A) * (B) % (C) = (D) &

(B) 3. Which SQL command can remove a table? (A) remove table (B) drop table (C) truncate table (D) none of the above

(C) 4. Which is a join condition in the following SQL command?
   ```sql
   select movie_title from professional, movie
   where professional_name = 'Martin Scorsese' and professional.professional_id = movie.director_id;
   ```
   (A) select movie_title from professional, movie (B) professional_name = 'Martin Scorsese'
   (C) professional.professional_id = movie.director_id (D) none of the above

(A) 5. Which is the result of the following SQL command?
   ```sql
   select professional_name from professional, movie
   where movie_title = 'Hugo' and professional.professional_id = movie.director_id;
   ```
   (A) List the director name of the movie 'Hugo'. (B) List the titles of movies directed by Hugo.
   (C) List the names of professionals in the movie 'Hugo'. (D) none of the above

(B) 6. 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

(A) 7. When you post a new message on the Facebook, which SQL command will be used?
   (A) insert (B) delete (C) drop (D) none of the above

(D) 8. Which SQL function returns the number of rows of a table? (A) cal (B) sum (C) avg (D) count

(B) 9. Which SQL keyword is used to identify an attribute is a key in a table? (A) distinct (B) check (C) specific (D) unique

(C) 10. Which SQL function returns the number of rows of a table? (A) cal (B) sum (C) avg (D) count

(C) 11. 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

(C) 12. Which constraint can be specified on referential integrity in SQL?
   (A) set null (B) set rule (C) revoke (D) none of the above

(A) 13. Which is used to sort a table in SQL?
   (A) order by (B) group by (C) sort by (D) having

(A) 14. Which SQL operator is used to specify multiple values in a WHERE clause?
   (A) belong (B) include (C) in (D) none of the above

(D) 15. Which is not a SQL aggregation function? (A) count (B) sum (C) avg (D) max

(B) 16. Which SQL function returns the number of rows of a table? (A) cal (B) sum (C) avg (D) count

(C) 17. Which is used to add, delete, or modify columns in an existing table in SQL?
   (A) modify table (B) alter table (C) revise table (D) none of the above

(C) 18. Which is used to decide if a value is null in SQL?
   (A) value equal null (B) value == null (C) value is null (D) none of the above

(C) 19. Which SQL operator is used to specify multiple values in a WHERE clause?
   (A) belong (B) include (C) in (D) none of the above

(D) 20. Which SQL function returns the number of rows of a table? (A) cal (B) sum (C) avg (D) count

(B) 21. Which relates a weak entity type to its owner?
   (A) identifying relationship (B) associate entity (C) assoicate relationship (D) none of the above

(A) 22. Which type of schema is described in ER models?
   (A) Conceptual Schema (B) External schema (C) Internal Schema (D) None of the above

(B) 23. Which is the number of participating entity types? (A) cardinality (B) constraint (C) degree (D) none of the above

(A) 24. Which phase of the database design will result in a database schema in implementation data model?
   (A) conceptual design (B) logical design (C) physical design (D) none of the above

(D) 25. Which is an entity of a video game? (A) genre (B) platform (C) price (D) weapon

(C) 26. Which is a collection of objects that is a subset of the UNION of distinct entity types?
   (A) category (B) inheritance (C) collection (D) none of the above

(A) 27. Which represents a collection of objects that is a subset of the UNION of distinct entity types?
   (A) category (B) inheritance (C) collection (D) none of the above

(B) 28. Which is the process of defining a set of subtypes of a supertype?
   (A) generalization (B) specialization (C) aggregation (D) identification
30. Referring to the following figure, which of the following is true?

(A) An item is a part of a component. (B) A component can be used in only one item. (C) An item can be be used in multiple components. (D) none of the above

31. In the following EER diagram, which is true?

(A) A person can be a camper and a runner. (B) A person must be a camper, a biker, and a runner. (C) A person must be a camper, a biker, or a runner. (D) none of above

32. Which allows meaningful information exchange and search among machines?

(A) semantic Web (B) Web service (C) XML (D) none of the above

Part 2: Questions and Answers (104 points)

1. (28 points) Briefly explain these terminologies. If they are acronyms, also write what they stand for.
   (a) UML (b) trigger (c) assertion (d) EER model (e) weak entity (f) cardinality ratio (g) ontology
   
   (a) Unified Modeling Language (UML) is a standard language for modeling software systems.
   (b) A trigger is a statement that is automatically executed in response to certain events on a particular table or view in a database.
   (c) An assertion is any condition that the database must always satisfy.
   (d) Enhanced Entity-Relationship (EER) model is a high-level conceptual data model enhanced with superclasses and subclasses to represent an object as an entity and associate these entities using relationships.
   (e) A weak entity is an entity whose existence depends on the other entity.
   (f) The cardinality ratio for a binary relationship specifies the maximum number of relationship instances that an entity can participate in.
   (g) Ontology is a knowledge structure that describes the concepts of the domain and how these concepts are interrelated

2. (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.

3. (12 points) Briefly explain the four constraints on specialization and generalization.

   - The disjointness constraint specifies that the subclasses of the specialization must be disjoint.
   - The overlapping specialization specifies that the subclasses of the specialization can be overlapping.
   - The total specialization specifies that every entity in the superclass must be a member of some subclass.
   - The partial specialization specifies that an entity in the superclass is allowed not to belong to any of the subclasses.
4. (30 points) Consider the following partial tables in a database:

<table>
<thead>
<tr>
<th>Artist table</th>
<th>Release table</th>
<th>Album table</th>
</tr>
</thead>
<tbody>
<tr>
<td>artist_id</td>
<td>artist_id</td>
<td>album_id</td>
</tr>
<tr>
<td>firstname</td>
<td>album_id</td>
<td>title</td>
</tr>
<tr>
<td>lastname</td>
<td>released_year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>quantity</td>
<td></td>
</tr>
</tbody>
</table>

where primary keys are underlined. artist_id and album_id in the release table are foreign keys referencing to the artist and album table respectively.

Use SQL to answer the following questions based on the above database:

(a) (3 points) Create the Artist table and set artist_id as the primary key.
(b) (3 points) Add an attribute genre into the Album table.
(c) (3 points) Specify a constraint release_year > 1900 in the Release table.
(d) (3 points) Insert ('A6006', 'Sarah', 'McLachlan') into the Artist table.
(e) (3 points) Update the Artist table and change the value of name from 'Norah Jones' to 'Lisa Loeb'.
(f) (3 points) Get the titles of albums released more than 1000000 copies.
(g) (3 points) Get all albums released by Amy Winehouse.
(h) (3 points) Delete all albums released in 2011.
(i) (3 points) Count the number of the albums released by each artist.
(j) (3 points) Specify the primary key (artist_id, album_id) in the release table.

(a) create table Artist (artist_id char(5) primary key not null, firstname varchar(30), lastname varchar(10));
(b) alter table Album add genre varchar(20);
(c) alter table Release add constraint year_constraint check (year > 1900)
(d) insert into Artist values ('A6006', 'Sarah', 'McLachlan')
(e) update Artist set firstname = 'Lisa', lastname = 'Loeb' where firstname = 'Norah' and lastname = 'Jones';
(f) select title from Album, Release where Album.album_id = Release.album_id and quantity > 1000000
(g) select title from Album, Release, Artist
   where Album.album_id = Release.album_id and Artist.artist_id = Release.artist_id and firstname = 'Amy' and lastname = 'Winehouse'
(h) delete from album where album_id in (select album_id from Release where released_year = 2011);
(i) select firstname, lastname, count(title) from Artist, Release, Album
   where Artist.artist_id = Release.artist_id and Album.album_id = Release.album_id
   group by artist_id
(j) alter table Release add primary key (artist_id, album_id)

5. (14 points) Consider the following relations for book adoption of a course:

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

(a) (6 points) Please draw the ER diagram.
(b) (8 points) Please draw the relational schema diagram and indicate the primary keys and the referential constraints.

(a)
6. (10 points) Draw an EER diagram for the following bank.

A bank has three types of accounts: checking, savings, and loan. The attributes of each account are shown as follows:

Checking: Account_No, Date_Opened, Balance, Service_Charge
Savings: Account_No, Date_Opened, Balance, Interest_Rate
Loan: Account_No, Date_Opened, Balance, Interest_Rate, Payment

Account_type is used to identify the type of accounts. Assume the account in the bank can be only one of its subclasses.