CSS326: Database Programming Laboratory

Final Mock Exam

curated by The Peanuts

Name.............ID.............Section.............Seat No.............

Conditions: Semi-closed Book

Directions:

1. This exam has 19 pages (including this page).
2. Write your name clearly at the top.
3. All exam queries are guaranteed to run without syntax errors. (We tested them. Probably. Maybe. Maybe not)
4. Show your work where applicable. If your answer appears without steps, you'll get zero.
5. Answers must be written in English. MySQL does not support `LANGUAGE = CHAOTIC_SIIT_SLANG`.
6. No communication is allowed. If you whisper to your friend, they may reply: `"ERROR 1142 (42000): SELECT command denied to user"`.

For solution, ***click here****.*

Part I: Multiple Choice Questions

1. Which of the following is NOT a valid MySQL aggregate function?

a) `COUNT()`

b) `AVG()`

c) `CONCAT()`

d) `SUM()`

2. What does the `DELIMITER` command do in MySQL?

a) It deletes records from a table

b) It changes the statement terminator character

c) It creates a new database delimiter

d) It defines the column separator in a table

3. In a stored procedure, which parameter type allows both input and output?

a) `IN`

b) `OUT`

c) `INOUT`

d) `BOTH`

4. What is the primary purpose of a database trigger?

a) To manually execute SQL statements

b) To automatically execute code in response to certain events on a table

c) To create backup copies of data

d) To improve query performance

5. Which keyword is used to reference the new row values in an `INSERT` trigger?

a) `OLD`

b) `NEW`

c) `CURRENT`

d) `INSERTED`

6. What does `UNION` do in MySQL?

a) Combines the result sets of two or more SELECT statements, removing duplicates

b) Joins two tables based on a common column

c) Creates a union of all table constraints

d) Merges two databases into one

7. Which encryption function in MySQL produces a 128-bit hash value?

a) `SHA1()`

b) `MD5()`

c) `AES_ENCRYPT()`

d) `PASSWORD()`

8. What is the main difference between a view and a table?

a) A view stores data physically, while a table does not

b) A view is a virtual table based on a query result

c) A view cannot be updated

d) There is no difference

9. Which SQL statement is used to grant privileges to a user?

a) `GIVE PRIVILEGES`

b) `SET PRIVILEGES`

c) `GRANT`

d) `ALLOW`

10. What does the `ON DELETE CASCADE` option do in a foreign key constraint?

a) Prevents deletion of referenced records

b) Automatically deletes child records when parent record is deleted

c) Creates a backup before deletion

d) Requires manual confirmation for deletion

11. Which join type returns all records from both tables?

a) `INNER JOIN`

b) `LEFT JOIN`

c) `RIGHT JOIN`

d) `CROSS JOIN`

12. What is SQL injection?

a) A method to speed up database queries

b) A security vulnerability where malicious SQL code is inserted through user input

c) A technique to join multiple tables

d) A way to inject data into a database

13. Which of the following is a characteristic of a stored function in MySQL?

a) It can return multiple values

b) It must return a single value

c) It cannot accept parameters

d) It cannot be used in SELECT statements

14. What does the `GROUP_CONCAT()` function do?

a) Concatenates strings from multiple columns

b) Concatenates values from multiple rows into a single string

c) Groups rows by concatenated values

d) Creates a new group of records

15. In Discretionary Access Control (DAC), who controls access to database objects?

a) Only the database administrator

b) The operating system

c) The owner of the object

d) All users have equal control

16. Which trigger timing executes before the triggering statement?

a) `AFTER`

b) `BEFORE`

c) `INSTEAD OF`

d) `DURING`

17. What is the purpose of `FLUSH PRIVILEGES` in MySQL?

a) To clear all user accounts

b) To reload grant tables and apply privilege changes immediately

c) To flush the database cache

d) To remove all privileges from users

18. In PHP, which method is used to establish a connection to MySQL database?

a) `new mysql()`

b) `new mysqli()`

c) `connect_mysql()`

d) `mysql_connect()`

19. What does the `DETERMINISTIC` keyword mean in a stored function?

a) The function will always return the same result for the same input parameters

b) The function determines the table structure

c) The function can modify data

d) The function is executed automatically

20. Which of the following is NOT a valid flow control structure in MySQL stored procedures?

a) `IF`

b) `CASE`

c) `WHILE`

d) `FOR`

Part II: SQL Programming Problems

Problem 1

Consider the `chinook` database with the following relevant tables:

```
Artist (ArtistId, Name)
Album (AlbumId, Title, ArtistId)
Track (TrackId, Name, AlbumId, MediaTypeId, GenreId,
       Composer, Milliseconds, Bytes, UnitPrice)
```

Part A: Create a stored function called `GetArtistTrackCount` that takes an artist's name as input and returns the total number of tracks by that artist.

Fill in the blanks to complete the function:

```
DELIMITER $$

CREATE FUNCTION GetArtistTrackCount(artist_name VARCHAR(120))
    RETURNS __________(1)__________
    DETERMINISTIC
BEGIN
    DECLARE track_count INT;

    SELECT __________(2)__________
    INTO track_count
    FROM Artist ar
    __________(3)__________ Album al ON ar.ArtistId = al.ArtistId
    __________(4)__________ Track t ON al.AlbumId = t.AlbumId
    WHERE ar.Name = __________(5)__________;

    RETURN track_count;
END $$

DELIMITER ;
```

(1) ______________________ **(2)** ______________________

(3) ______________________ **(4)** ______________________

(5) ______________________

Part B: Create a stored procedure called `GetAlbumsByArtist` that accepts an artist name as an `IN` parameter and returns the total number of albums as an `OUT` parameter. The procedure should also display all album titles by that artist.

Fill in the blanks to complete the procedure:

```
DELIMITER $$

CREATE PROCEDURE GetAlbumsByArtist(
    __________(1)__________ p_artist_name VARCHAR(120),
    __________(2)__________ p_album_count INT
)
BEGIN
    -- Select and display all albums by the artist
    SELECT al.Title AS AlbumTitle
    FROM __________(3)__________ ar
    JOIN __________(4)__________ al ON ar.ArtistId = al.
       ArtistId
    WHERE ar.Name = p_artist_name;

    -- Get the count of albums
    SELECT __________(5)__________
    INTO p_album_count
    FROM Artist ar
    JOIN Album al ON ar.ArtistId = al.ArtistId
    WHERE ar.Name = __________(6)__________;
END $$

DELIMITER ;
```

(1) ______________________ **(2)** ______________________

(3) ______________________ **(4)** ______________________

(5) ______________________ **(6)** ______________________

Problem 2:

Consider a database with the following tables for an employee management system:

```
employees (
    emp_id INT PRIMARY KEY AUTO_INCREMENT,
    first_name VARCHAR(50),
    last_name VARCHAR(50),
    email VARCHAR(100),
    salary DECIMAL(10,2),
    hire_date DATE
)

salary_audit (
    audit_id INT PRIMARY KEY AUTO_INCREMENT,
    emp_id INT,
    old_salary DECIMAL(10,2),
    new_salary DECIMAL(10,2),
    change_date TIMESTAMP,
    change_type VARCHAR(20)
)
```

Part A: Create an `AFTER UPDATE` trigger named `audit_salary_changes` that automatically logs any salary changes to the `salary_audit` table. The trigger should record the employee ID, old salary, new salary, current timestamp, and set change_type to 'UPDATE'.

Fill in the blanks to complete the trigger:

```
DELIMITER $$

CREATE TRIGGER audit_salary_changes
    __________(1)__________ UPDATE ON employees
    FOR EACH ROW
BEGIN
    IF __________(2)__________ <> __________(3)__________
       THEN
        INSERT INTO salary_audit (
            emp_id,
            old_salary,
            new_salary,
            change_date,
            change_type
        )
        VALUES (
            __________(4)__________,
            __________(5)__________,
            NEW.salary,
            __________(6)__________,
            'UPDATE'
        );
    END IF;
END $$

DELIMITER ;
```

(1) ______________________ **(2)** ______________________

(3) ______________________ **(4)** ______________________

(5) ______________________ **(6)** ______________________

Part B: For security purposes, you need to encrypt employee email addresses in the `employees` table using AES encryption with a key derived from SHA1 hashing.

Fill in the blanks to complete the encryption process:

Step 1: Modify the email column to support encrypted data

```sql
ALTER TABLE employees
MODIFY email __________(1)__________;
```

(1) ______________________________

Step 2: Update all existing email addresses to be encrypted

```sql
UPDATE employees
SET email = __________(2)__________(
                email,
                __________(3)__________('email_key')
            );
```

(2) ______________________________

(3) ______________________________

Step 3: Create a view to display decrypted emails for authorized users

```sql
CREATE VIEW employee_emails AS
SELECT
    emp_id,
    first_name,
    last_name,
    __________(4)__________(
        email,
        __________(5)__________('email_key')
    ) AS decrypted_email,
    salary
FROM employees;
```

(4) ______________________________

(5) ______________________________

Problem 3:

Consider the `spotify_2025` database with the following table:

```sql
spotify_data (
    track_name VARCHAR(255),
    artists_name VARCHAR(255),
    artist_count INT,
    released_year INT,
    released_month INT,
    released_day INT,
    in_spotify_playlists INT,
    in_spotify_charts INT,
    streams INT,
    in_apple_playlists INT,
    in_apple_charts INT,
    bpm INT,
    key_ VARCHAR(2),
    mode_ VARCHAR(5),
    danceability_percent INT,
    valence_percent INT,
    energy_percent INT,
    acousticness_percent INT,
    liveness_percent INT,
    speechiness_percent INT
)
```

Part A: Write a query to find the top 5 artists with the highest average danceability across all their tracks. Display the artist name, number of tracks, and average danceability percentage.

Fill in the blanks to complete the query:

```
SELECT
    artists_name,
    __________(1)__________ AS track_count,
    __________(2)__________ AS avg_danceability
FROM spotify_data
__________(3)__________ artists_name
ORDER BY avg_danceability __________(4)__________
__________(5)__________ 5;
```

(1) ______________________ **(2)** ______________________

(3) ______________________ **(4)** ______________________

(5) ______________________

Part B: Create a stored procedure called `GetTrackStatsByYear` that accepts a year as input and displays comprehensive statistics for that year.

Fill in the blanks to complete the procedure:

```
DELIMITER $$

CREATE PROCEDURE GetTrackStatsByYear(
    IN p_year INT
)
BEGIN
    -- Display comprehensive statistics for the given year
    SELECT
        p_year AS year,
        __________(1)__________ AS total_tracks,
        __________(2)__________(bpm) AS avg_bpm,
        __________(3)__________(energy_percent) AS avg_energy,
        __________(4)__________(streams) AS total_streams
    FROM spotify_data
    WHERE released_year = __________(5)__________;

    -- Find the most common key for the year
    SELECT key_ AS most_common_key, __________(6)__________ AS count
    FROM spotify_data
    WHERE released_year = p_year
    __________(7)__________ key_
    ORDER BY count DESC
    __________(8)__________ 1;
END $$

DELIMITER ;
```

(1) ______________________ **(2)** ______________________

(3) ______________________ **(4)** ______________________

(5) ______________________ **(6)** ______________________

(7) ______________________ **(8)** ______________________

Part III: PHP-MySQL Integration

Problem 4

Consider the following `products` table in a database:

product_id	product_name	category	price
1	Laptop	Electronics	45000
2	Mouse	Electronics	500
3	Desk	Furniture	8000
4	Chair	Furniture	3500
5	Monitor	Electronics	12000

The following PHP code connects to the database and executes a query:

```php
<?php
$mysqli = new mysqli('localhost', 'root', 'root', 'shop_db');

$q =  SELECT category, COUNT(*) as item_count, AVG(price) as avg_price
      FROM products
      GROUP BY category
      ORDER BY avg_price DESC ;

$result = $mysqli->query($q);
$data = array();

while($row = $result->fetch_array()) {
    $data[] = $row;
}

$mysqli->close();
?>
```

Question: What will be stored in the `$data` array after the code executes? Write the contents of the array. Show your work by explaining how you calculated the values.

Answer:

`$data[0][‘category’]` = ________________________________
`$data[0][‘item_count’]` = ________________________________
`$data[0][‘avg_price’]` = ________________________________

`$data[1][‘category’]` = ________________________________
`$data[1][‘item_count’]` = ________________________________
`$data[1][‘avg_price’]` = ________________________________

Show your calculations:

Problem 5

Consider the following two tables in a database:
students table:

student_id	name	major
101	Alice	CS
102	Bob	EE
103	Carol	CS
104	David	ME

grades table:

student_id	course	grade
101	CSS326	85
101	CSS324	90
102	CSS326	78
103	CSS326	92
103	CSS324	88
103	CSS322	95

The following PHP code executes a query:

```php
<?php
$mysqli = new mysqli('localhost', 'user', 'pass', 'uni_db');

$q =  SELECT s.name, s.major, COUNT(g.course) as course_count,
             AVG(g.grade) as avg_grade
      FROM students s
      LEFT JOIN grades g ON s.student_id = g.student_id
      GROUP BY s.student_id
      HAVING COUNT(g.course) >= 2
      ORDER BY avg_grade DESC ;

$result = $mysqli->query($q);
$students = array();

while($row = $result->fetch_array()) {
    $students[] = array(
        'name' => $row['name'],
        'major' => $row['major'],
        'courses' => $row['course_count'],
        'average' => $row['avg_grade']
    );
}

$mysqli->close();
?>
```

Question: What will be stored in the `$students` array after the code executes? Fill in the table below and explain your reasoning.

Answer:

Index	name	major	courses	average
`$students[0]`	__________	__________	__________	__________
`$students[1]`	__________	__________	__________	__________
`$students[2]`	__________	__________	__________	__________

Note: If there are fewer than 3 results, write "N/A" in the unused rows.

Explanation (show which students qualify for the result and why):