CSCB20 Final Exam Winter 2024

Duration: 3 hours
Total Points: 85

Do not turn this page until you have received the signal to start.
(Please fill out the identification section above and read the instructions below.)
Good Luck!

- *Please, make sure to **NOT write anything in the QR code areas**.*
- *Please, use a **black or blue pen or a thick in diameter pencil** to answer all questions in this booklet.*
- *Comments are **not** required except where indicated, although they may help us mark your answers.*
- *No error checking is required: **assume all given code runs correctly**.*
- *If you use any space for rough work, indicate clearly what you want marked.*
- *You can use the back of the given sheet for rough work.*

Question 1 (20 marks)

Description: Database Models with SQLAlchemy

Part a [8 marks]

Consider models defined on the first page of 'Flight Management System Models' that define the schema for a simplified system for flight planning and booking in `SQLAlchemy`. It consists of four main tables: `Airports`, `Aircrafts`, `Flights`, `Bookings`

Your task:

Draw all the four tables by filling some random values for each attribute such that all the relationships within and between the table definitions are covered in the example tables. Create at least two rows for each table. DO NOT write the code for inserting rows.

Assumptions: The code for table creation is complete and syntax is correct. The time format is 'YYYY-MM-DD HH:MM:SS'.

Part b [6 marks]

Identify and describe all ***the relationships between the four tables***.

The relationships between the tables can be:

many-to-many, many-to-one, one-to-many or one-to-one.

You may describe the relationships briefly using **foreign key and/or backref**. Use the examples from the sample tables created in **part a** for explanation.

Part c [6 marks]

Suppose you want to enhance the existing flight booking system by adding a table to store information about passengers' luggage. Design a table named `Luggage` to store this information and establish relationship between the `Flights` table and the `Luggage` table.

- What attributes would you include in the `Luggage` table,
- How would you establish the relationship between `Flights` table and the `Luggage` table?
- What kind of relationship do the two tables share?

Question 2 (15 marks)

Description: Web Dev and Databases – Flask and SQLite

Complete the `search_flights` method in Python Flask.
This method lets the user search for flights using `departure_airport_id`, `arrival_airport_id`, and `aircraft_id`. This information is obtained through a page `'search_flights.html'`, which stores a form to get this information from user. Based on this search, `'flight_results.html'` page is rendered, which will display the result of user's search by getting the result from database.
Your task:

1. Complete the following app configurations on this page.
2. Complete the `search_flights` method in Flask application (next page). Create and store each criterion for searching flights in a separate session variable. If all search criteria are found in session, then retrieve the search criteria from session variables and display the flight details for that search.
   If the search is not in session, then display `search_flight.html` page.

Note: Assume that all the imports are complete. You may assume that the `'search_flights.html'` and `'flight_results.html'` templates exist, and you do not need to create them for this question. Also, work only with the `'flights'` table to retrieve information about existing flights. Assume that for every search, there is a flight in the database. You may define helper functions.

```
from flask import Flask, request, render_template, session, redirect, url_for,
flash
from flask_sqlalchemy import SQLAlchemy
from datetime import datetime

app = Flask(__name__)
# Complete the app configurations




# Continue writing the remaining answer on next page
```

```
@app.route('/search_flights', methods=['GET', 'POST'])
def search_flights():
    if request.method == 'GET':
```

```
    else:
        # Handle form submission
        departure_airport_id = request.form['departure_airport_id']
        arrival_airport_id = request.form['arrival_airport_id']
        aircraft_id = request.form['aircraft_id']
        flights = Flight.query.filter_by(
            departure_airport_id=departure_airport_id,
            arrival_airport_id=arrival_airport_id,
            aircraft_id=aircraft_id
        ).all()
```

Question 3 (5 marks)

Suppose `'flight_results.html'` from Question 2 displays the result of user's flight search using the table display in html. Assume that the information about the relevant flights is received by the html page through a variable named `flights`. Complete following partial html code using jinja2 template for `'flight_results.html'`.

```
<html>
<body>
    <h1>Flight Search Results</h1>
    <table>
        <thead>
            <tr>
                <th>Flight ID</th>
                <th>Departure Airport</th>
                <th>Arrival Airport</th>
                <th>Departure Time</th>
                <th>Arrival Time</th>
            </tr>
        </thead>
        <tbody>









        </tbody>
    </table>
</body>
</html>
```

Question 4 (15 marks)

Part a [5 marks]

You have a simple HTML document containing a class container with some text, button, and script tag. Your task is to create a CSS ***media query that creates a responsive grid layout for class `'container'`*** based on screen size.

```
<body>
    <div class="container">
        <div class="item">Item 1</div>
        <div class="item">Item 2</div>
        <div class="item">Item 3</div>
        <div class="item">Item 4</div>
        <div class="item">Item 5</div>
        <div class="item">Item 6</div>
        <div class="item">Item 7</div>
        <div class="item">Item 8</div>
        <div class="item">Item 9</div>
    </div>
    <button id="colorButton">Change Background
Color</button>
    <script src="script.js"></script>
</body>
```

Instructions:

The layout should display *three columns on large screens (more than 1200px), two columns on medium screens (between 768 and 1200 px), and a single column on small screens (smaller than 768 px).* Additionally, each column should have *equal width*. Media query should be written only for class `container`. DO NOT write code for `button` or `script` tags.

Complete the following code and write media query.
Assume HTML code and script.js code are complete and run without errors.

```
.container {
  display: grid;
  /* 1fr is for 1 part of the available space */
  grid-template-columns: repeat(auto-fit, minmax(300px, 1fr));
  grid-gap: 20px;
}

/* Ensure each column has equal width and content is centered */
.item {
  width: 100%;
  text-align: center;
}

/* Media queries for responsiveness */
```

Part b [5 marks]

Write JavaScript code to select the button element from the HTML document from **part a**.
Attach an **event listener to the button element to listen for click events.**
When the button is clicked, **execute a function that changes the background color** of the document's body to a random color.

Relevant HTML part for this question:

```
<body>
    <button id="colorButton">Change Background Color</button>
    <script src="script.js"></script>
</body>
```

Note: Use following variable to generate random color

```
randomColor = 'rgb(${Math.floor(Math.random() * 256)},
                    ${Math.floor(Math.random() * 256)}, ${Math.floor(Math.random() *
                    256)})';
```

Part c [5 marks]

Briefly explain the concept and importance of DOM in web applications for both front and back end.

Question 5 (20 marks)

Description: (RA and SQL queries)

Note: *Following schema is different than one used in Question 1, Question 2, and Question 3*. Consider following schema that keeps track of **airline flight information**. This schema is designed to manage airline flight information, including details about flights, aircraft, certifications, and employees.

```
Flights(flno: integer, from: string, to: string, distance: integer,
            departs: time, arrives: time, price: real)
Aircraft(aid: integer, aname: string, cruisingrange: integer)
Certified(eid: integer, aid: integer)
Employees(eid: integer, ename: string, salary: integer)
```

- `cruisingrange` attribute defines Maximum distance the aircraft can travel without refueling.
- The `Employees` relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.
- The `Certified` table establishes a many-to-many relationship between employees and aircraft, indicating which employees are certified to operate which aircraft.

Part a [5 marks]

Find the `aids` of all aircraft that can be used on routes from Los Angeles to Chicago.

Part b [10 marks]

Find the names of aircraft such that all pilots certified to operate them have salaries more than $80,000.

Part c [5 marks]
Convert following relational algebra queries into English sentences.

1. $R1 \coloneqq \pi_{eid}(\sigma_{cruisingrange>3000}(Aircraft \bowtie Certified))$
   $\pi_{ename}(Employees \bowtie (R1 - \pi_{eid}(\sigma_{name='Boeing'}(Aircraft \bowtie Certified))))$

2. $R1 \coloneqq \rho_{E1} Employees$
   $R2 \coloneqq \rho_{E2} Employees$
   $R3 \coloneqq \rho_{E3}\left(\pi_{E2.eid}\left(E1 \bowtie_{E1.salary>E2.salary} E2\right)\right)$
   $R4 \coloneqq \rho_{E4}\ (E2 \bowtie E3)$
   $R5 \coloneqq \rho_{E5}\ (E2 \bowtie E3)$
   $R6: = \rho_{E6}\ (\pi_{E5.eid}\left(E4 \bowtie_{E1.salary>E5.salary} E5\right))$
   $(\pi_{eid} E3) - E6$

Question 6 (10 marks) Multiple Choice Questions

1. Which of the following is True? Select ALL that apply.

a) All primary keys are superkeys
b) All superkeys are primary keys
c) All candidate keys are primary keys
d) All candidate keys are superkeys
e) All superkeys are candidate keys

2. Consider the following schema for an online store:

```
Customers(customer_id: int, name: varchar(255), email: varchar(255))
Orders(order_id: int, customer_id: int, order_date: date)
Products(product_id: int, name: varchar(255), price: decimal)
OrderDetails(order_detail_id: int, order_id: int, product_id: int, quantity: int)
```

What type of relationship exists between the `Products` and `OrderDetails` tables?

a) One-to-One
b) One-to-Many
c) Many-to-One
d) Many-to-Many
e) None of the above

3. Which of the following command is correct to delete the values in the relation `flights`?

a) Delete from flights;
b) Delete from flights where Id ='Null';
c) Remove table flights;
d) Drop table flights;
e) None of the above

4. Consider the following HTML structure on the left and answer question on the right:

```
<div class="container">
    <div class="intro">
        <p>This is paragraph 1.</p>
        <p>This is paragraph 2.</p>
    </div>
    <p class="intro">
        This is paragraph 3</p>
</div>
```

Which of the following CSS selectors selects only the <p> element containing the text `"This is paragraph 3."`?
Select ALL that apply.

a) `.intro p`
b) `p.intro`
c) `.container p`
d) `.container .intro p`
e) `p > *`

5. Which of the following statements about SQLite is true?

a) SQLite is a serverless, self-contained, zero-configuration, transactional SQL database engine.
b) SQLite is primarily designed for large-scale enterprise-level applications.
c) SQLite requires a separate server process to be running in order to access the database.
d) SQLite is suitable only for the mobile application development.
e) None of the above

6. Consider the following JavaScript code snippet:

```
var element = document.createElement("button");
element.textContent = "Click Me";
element.setAttribute("id", "myButton");
element.addEventListener("click", function() {
    alert("Button clicked!");
});

document.body.appendChild(element);
```

Which of the following *accurately* describes what the code snippet does?

a) Creates a button element with the text "Click Me", sets its id to "myButton", and appends it to the document body.
b) Attaches a click event listener to the existing document body that triggers an alert when clicked.
c) Appends a new button element with the text "Click Me" to the end of the document body.
d) Creates a button element with the text "Click Me" and sets its id to "myButton".
e) Adds a click event listener to the button element that triggers an alert when clicked.

7. What is the primary purpose of the secret key in a Flask application?

a) To encrypt sensitive data stored in the database.
b) To authenticate users during login.
c) To establish a secure connection between the client and the server.
d) To sign session cookies and prevent tampering.
e) To define the routing paths for different views in the application.

8. Which of the following statements accurately describes the role of Jinja2 in web development?

a) Jinja2 is a front-end JavaScript library used for handling user interactions and DOM manipulation.
b) Jinja2 is a back-end Python framework used for routing and handling HTTP requests.
c) Jinja2 is a templating engine that enables the dynamic generation of HTML content by embedding Python-like syntax within HTML templates.
d) Jinja2 is a database management system used for storing and querying structured data.
e) Jinja2 is a styling framework used for creating responsive and visually appealing web pages.

9. Which of the following statements accurately describes "localhost" in web development?

a) Localhost refers to a remote server accessible only via the internet.
b) Localhost is a specific IP address that points to the local machine itself.
c) Localhost is a cloud-based hosting service used for deploying web applications.
d) Localhost is a reserved domain name used exclusively for testing purposes.
e) Localhost refers to a virtual environment created by virtualization software for web development.

10. This mark is Free!