

EE4717 / IM4717

**NANYANG TECHNOLOGICAL UNIVERSITY**

**SEMESTER 1 EXAMINATION 2018-2019**

**EE4717 / IM4717 – WEB APPLICATION DESIGN**

November / December 2018

Time Allowed: 2 hours

**INSTRUCTIONS**

1. This paper contains 1 question and comprises 6 pages.
2. Answer 1 question.
3. This is an open book examination.
4. Unless specifically stated, all symbols have their usual meanings.

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1. *EZcarRentals* is a convenient online portal for booking of rental cars. Figure 1 on page 6 shows the default home page comprising of a top header banner, a navigation bar, and a horizontal display area for advertisement and promotional materials. On the left column of the page, there are two vertical panels for query refinement and search result filtering. The main content area displays photo images of rental cars that are available for leasing.

Guest users may access the system without logging in to the system. They can check the availability of cars for rentals by specifying a pickup date and a return date. However, they will not be allowed to refine their queries and apply filters to their search results. They shall also not have the privilege to view car details or make booking on car rentals.

Registered users, on the other hand, have full functionalities to view, refine, and filter the car rental search results. Guests can sign up as registered users to gain full access privilege to improve on their database search and obtain the best rental deals. They will have access rights to refine their queries based on rental profiles, and filter the search results based on specific car attributes.

Note: Question No. 1 continues on page 2.

EE4717 / IM4717

Registered users, upon successful login, will see a shopping cart icon added to the navigation bar. They will also be able to view the details of each car displayed, and select the car to add to the shopping cart. Upon finalizing the selection process, users can view their shopping cart and confirm their booking(s) before making payment online. A confirmation email will be sent to the user upon successful payment.

The *EZcarRentals* default home page's navigation bar consists of hyperlinks for company's Location Map, FAQs, user's Sign Up and Log In.

- (a) Study the above web application scenarios and design the overall web application software architecture.
- (i) Show the website organization using a site map, and indicate the titles of the web pages you have designed.
  - (ii) Draw the storyboards for all the possible user activities, including user registration and login, browsing and booking of rental car by registered users. Your storyboards should cover both the client-side and server-side activities.

(20 Marks)

- (b) The wireframe of the *EZcarRentals* website home page is shown in Figure 1. The detailed features in the home page layout are as follows:
- The body text uses Verdana font, or Arial, or a font in the Sans-Serif family, with text color code of #8000FF. The background of the page area is in white.
  - The page is centered, with a fixed width of 1000 pixels. There is a border of 3 pixels width, with a color code of #6600CC.
  - The top banner area consists of the company's image logo of size 980×30 pixels, on a background with a color code of #6600CC. The image logo also serves as an alternative hyperlink to the home page.
  - The horizontal navigation bar is located below the banner area, with hyperlinks to other pages of the website, including user sign up and log in.
  - Below the navigation bar, there is a company/sponsor's advertisement area of size 980×80 pixels with an animated image in GIF format.
  - There are two columns below the advertisement area.
  - The left column is used for query refinement and search result filtering, with a column width of 320 pixels. The upper half consists of a query panel, with input fields for Pickup Date, Return Date, Location, Car Type and Car Size. The lower half consists of a filter panel, with input fields for Rating, Price/Day and Car Brand, as shown in Figure 1. Upon submission of this form, the web server will run the *car\_search.php* script.

Note: Question No. 1 continues on page 3.

EE4717 / IM4717

- The right column is the main content area for displaying photo images of available rental cars with a column width of 650 pixels. The 200×160 pixels car images, in PNG format, are tabulated three-in-a-row as shown in Figure 1. The “View Details” hyperlinks are displayed on a light background with a color code of #E6CCFF. The car images also serve as alternative hyperlink to the car’s detail page.
- There is a footer area with a copyright notice in white, centered and in small font size, with a background color code of #6600CC.

You may make further assumptions after studying Figure 1.

- (i) Write the CSS3 codes for an external style sheet *EZcarRentals\_site.css* to ensure that the entire website has a consistent look and feel.
- (ii) Based on the external style sheet *EZcarRentals\_site.css* in part (b)(i), write the HTML5 codes for the *EZcarRentals* home page.

(30 Marks)

- (c) A new user signing up on *EZcarRentals* is required to input his login credentials such as username and password, and contact information such as email address and mobile number. For each input, construct the literal regular expression in JavaScript, and provide a corresponding valid test sample of the user input for validation. Write the necessary test statement(s) in JavaScript to validate the format of the user inputs as described in the following:
  - (i) Username – The username consists of case insensitive word characters and may include digits, character spaces (‘ ’) and underscore characters (‘\_’). It should not begin with a digit nor end with a non-word character.
  - (ii) Password – The password should consist the following:
    - at least 1 upper case character
    - at least 1 numeric digit
    - at least 1 non-word character, such as !@#\$%
    - at least 8 characters in the entire length of the password string
  - (iii) Email Address – The email address should comprise of 3 parts; namely user-name, domain name, and a ‘@’ symbol, which is placed between the user-name and the domain name without any spaces or quotes. The user-name consists of word characters and may include the period (‘.’) symbol. The domain name consists only word characters and has at least two but not more than four extensions; where each extension is separated by a period (‘.’).

Note: Question No. 1 continues on page 4.

EE4717 / IM4717

- (iv) Mobile Number – The mobile number consists of 8 numeral digits and begins with the digit ‘8’, or ‘9’. The string of 8 digits may be separated by a hyphen (‘-’) into two substrings of 4 digits each. The mobile number may be preceded with a country code ‘+(65)’.
- (20 Marks)
- (d) *EZcarRentals* provides efficient search functions for users to find their best cars and book the best rental deals.
- (i) Design a database schema with the relevant tables to maintain records of rental cars and booking information in the database for supporting various searches on cars and rental bookings.
- Records of user login credentials for username and password, and contact information for email address and mobile number.
  - Records of rental bookings of cars made by users. Each booking is made for a time period, commencing on a pickup date and ending on a return date of the car.
  - Records of car rental profiles to allow query refinement of additional attributes on location, type and size of cars. *EZcarRentals* supports the following set of values for the rental profiles:
    - Location of car: Any or North, South, East, West
    - Type of car: Any or Sedan, Sports, MPV
    - Size of car: Any or Compact, Mid-Size, Luxury
  - Records of rental car attributes to allow filtering of search results based on the general preferences of car rating, daily rental rate, and brand of the car. *EZcarRentals* supports the following set of values for the rental car attributes:
    - Rating of car: None or 1 Star, 2 Stars, 3 Stars
    - Daily rental rate of car: None or <\$100, \$100-\$200, >\$200
    - Brand of car: None or Audi, Honda, Toyota

The schema should clearly indicate the primary and foreign keys. Highlight the primary keys with double underline and foreign keys with single underline.

- (ii) Following on from the schema design in part (d)(i), construct a MySQL query in PHP to search all available cars given the following rental dates in PHP variables:
- \$pickupDate = ‘20-11-2018’;
  - \$returnDate = ‘25-11-2018’;

It is assumed that a car is available for rental when there is a new pickup date that is later than the last return date of the car.

Note: Question No. 1 continues on page 5.

EE4717 / IM4717

- (iii) Following on from the query in part (d)(ii), refine the query statement to include the following additional search criteria:
- Type of car: Sedan
  - Size of car: Mid-Size
- (iv) Following on from the query in part (d)(iii), write PHP statements to filter the search results and shortlist only those cars that meet the following daily rental rate, specified in a PHP variable:
- \$rate = ‘<\$100’;

The shortlisted cars may be stored in a list.

(20 Marks)

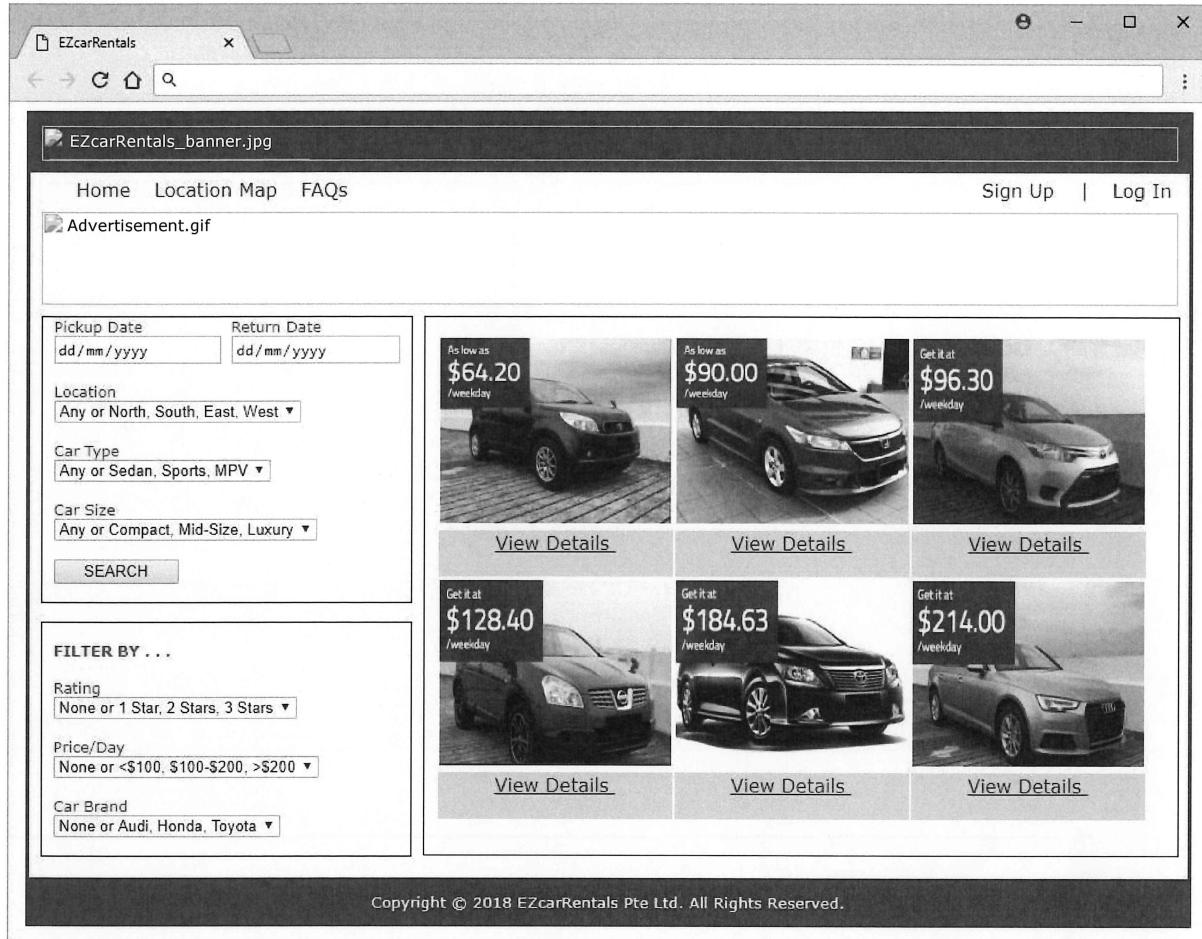
- (e) *EZcarRentals* implements PHP multipurpose page to support context sensitive navigation.
- On successful login at the default home page of Figure 1, the top navigation bar with new context of navigation links are to be updated as shown in Figure 2 on page 6.
  - The navigation bar should display the login username along with a link to allow the user to log out the session.
  - There should also be a shopping cart icon and a counter to count the number of items in the cart on the navigation bar.

Explain the design structure in a multipurpose page for the above implementation and illustrate your answer with appropriate PHP scripts.

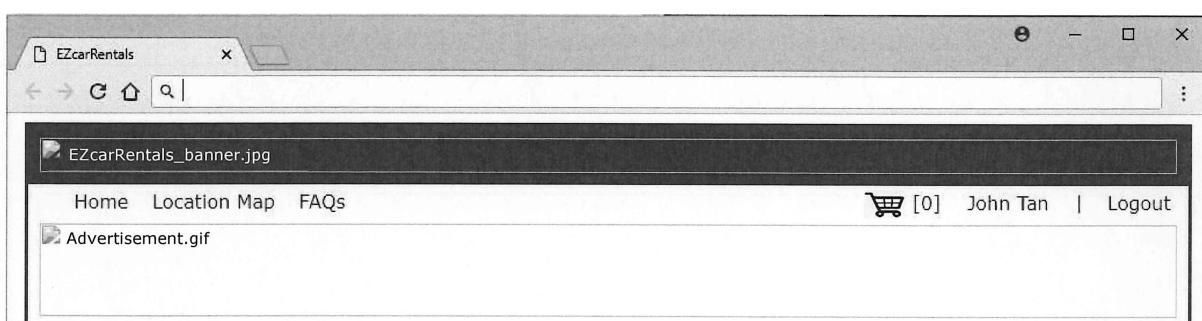
(10 Marks)

Note: Question No. 1 continues on page 6.

EE4717 / IM4717



**Figure 1: EZcarRentals default Home page**



**Figure 2: Updated navigation bar in Home page upon successful login**

END OF PAPER



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Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.