Question 1

Web System and UI Design

(a) Describe a brief architecture of web applications including the interaction between clients and a server, and the use of a protocol for an interaction.

[4 marks]

(b) Explain the difference between HTTP GET and HTTP POST messages and provide examples of when should HTTP GET and HTTP POST messages be used.

[4 marks]

(c) What is a default port number for web applications and how do you specify the port number in URL if the server does not use the default port number?

[2 marks]

(d) Provide two reasons why the User Interface (UI) of web applications is important and provide examples to support the reasons.

[4 marks]

[Total for Question 1: 14 marks]

Question 2

HTML and CSS

(a) An HTML document contains text and tags. Most HTML tags are in the format of `<tagName>....</tagName>`. However, some HTML tags do not necessarily have such format. Provide two HTML tags that have the common format (i.e., `<tagName>....</tagName>`) and two HTML tags that do not have such format.

[2 marks]

(b) Explain what is the role of an HTML attribute and provide three examples of HTML attributes and their roles in HTML tags.

[4 marks]

(c) Explain the difference between the *class* and *id* selectors. Explain a situation when an HTML tag should be assigned an *id* selector and a *class* selector?

[4 marks]

(d) Write HTML code to collect user's email and password. The HTML code should be displayed as shown in figure below. Once a user clicks the login button, it should send an HTTP POST request with user data to "http://localhost/login" without opening a new browser window.

[5 marks]

(e) Two common display types of HTML tags are *block* and *inline*. Explain the difference between these two types and provide one HTML tag that has *block* as a default display type and one HTML tag that have *inline* as a default display type.

[3 marks]

(f) Use the HTML and CSS code below to answer the following questions.

```
<!DOCTYPE html>
<html>
<head>
<style>
.box {
    float: left;
    width: 150px;
    height: 75px;
    margin: 10px;
    border: 3px solid black;
}

.after-box {
    clear: left;
    border: 3px solid red;
}
</style>
</head>
<body>


<div class="box">Box</div>
<div class="box">Box</div>
<div class="box">Box</div>
<div class="box">Box</div>
<div class="box">Box</div>
<div class="box">Box</div>

<div class="after-box">Another box</div>

</body>
</html>
```

i. What is the total width of the `<div class="box">Box</div>` element?

[2 marks]

ii. Draw what would be displayed in the browser window with a dimension of 600px × 600px.

[5 marks]

[Total for Question 2: 25 marks]

Question 3

Dynamic Web Page - Javascript

(a) Using only HTML results in a static web page. Provide three reasons why we might want a web page to be dynamic.

[3 marks]

(b) Use the HTML code below to answer the following four questions.

```
<!DOCTYPE html>
<html>
    <head>
        <title>Exam</title>
    </head>
    <body>
        <script src="script.js"></script>
        <main id="main">
            <h1>We hope this exam is going well!</h1>

            <div id="div1">
                <span class="text">This is a span</span>
                <p class="text">This text is terrible!</p>
            </div>
```

```
            <div id="div2">
                <p class="text">Different text</p>
            </div>

            <p class="text">More different text</p>
        </main>
    </body>
</html>
```

i. Write standard Javascript to change the text of the paragraph `<p class="text">This text is terrible!</p>` to `<p class="text">This text is better</p>`.

[2 marks]

ii. Write jQuery to do the same task.

[2 marks]

iii. Describe how does the following jQuery code change the web page?

```
$('div   .text').append('<strong> Important </strong>');
```

[4 marks]

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iv. The `script.js` file in `<script src="script.js"></script>` contains the following code:

```
var text_span = document.getElementsByClassName('text')[0];
text_span.style.color = "red";
```

However when the page loads, the following error is shown.

```
TypeError: text_span.style is undefined
```

What causes this error, and how is the error fixed?

[4 marks]

[Total for Question 3: 15 marks]

Question 4

Client Server Communication

(a) Describe two advantages and two disadvantages of using AJAX (Asynchronous Javascript and XML) on the client side instead of generating a complete webpage on a server?

[4 marks]

(b) Use the code below to answer the following three questions.

```
function AJAX( ) {

    var xhttp = new XMLHttpRequest();


    /********** THIS SECTION  **********/
    xhttp.onreadystatechange = function() {
        if (xhttp.readyState==4 && xhttp.status == 200) {
            console.log("updated count");
        } else {
            console.log("processing....");
        }
```

```
            console.log("processing....");
        }
    };
    /************************************/


    xhttp.open("POST",/changeCount,true);


     xhttp.setRequestHeader(Content-Type, application/json);
     xhttp.send(JSON.stringify({"newCount":0}));


};
```

i. What does the code written in between `/********** THIS SECTION **********/` comments in the AJAX() function below do, and what is its purpose?

[4 marks]

ii. Describe a sequence of execution when the AJAX() function is called.

[6 marks]

iii. If the server has only the route below, what should be shown in the console when the AJAX() function is called? Justify your answer.

```
router.get(/changeCount, function(req, res) {
    res.send();
});
```

[3 marks]

(c) Given the following route in the server, write the AJAX2() function to send a request with data of `itemCode=1234` to this route.

```
router.get(/item, function(req, res) {
    var i = parseInt(req.query.itemCode);
    res.send(items[i]);
});
```

[3 marks]

[Total for Question 4: 20 marks]

Question 5

Third Party APIs

(a) Describe the benefits of using OpenID, and how it is able to ensure integrity when authenticating a user.

[5 marks]

[Total for Question 5: 5 marks]

Question 6

Databases

(a) Explain the difference between a *primary key*, a *foreign* key, and *a partial key* for a database table in the relational database model.

[4 marks]

(b) SAHome Co., Ltd, a property management service, wants to store the customers and properties information into a database. Use the requirements below to answer the following three questions.

quirements below to answer the following three questions:

- A list of customers and a list of properties under the management of SAHome Co., Ltd. Since a customer can be both a landlord and a tenant, the information of landlords and tenants should be stored in the same table.
- The database should store the unique customer number (CID), customer name (first and last), and phone number(s).
- The database should store the unique property number (PID), property description, property address, the number of bedrooms, the number of car parking lots, and the rental price which is computed from (the number of bedrooms$\times$\$100)+(the number of car parking lots$\times$\$50).
- One customer (i.e., a landlord) can own many properties. All properties must have one landlord.
- One customer (i.e., a tenant) can rent many properties and one property can have many tenants. The start date and end date of the rent contract must be stored.

i. Construct an Entity-Relationship (ER) model for the above requirements.

[10 marks]

ii. Derive the constructed ER model to a relation schema.

iii. Write an SQL command to query a list of landlords which include first name, last name, the number of owned properties, and the total price of the owned properties.

[5 marks]

[Total for Question 6: 27 marks]

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Question 7

Security

(a) Considering the following server code.

```
router.get('/search.json', function(req, res) {

    var location = req.query.location
    req.pool.getConnection( function(err,connection) {
    //Connect to the database
        if (err) { // If there's a problem connecting
            res.sendStatus(500);
        }
        // Query
        var query = "SELECT hotel_name
            FROM hotels WHERE location='"+location+"'";

        //Run query
        connection.query(query, function(err, rows, fields) {
         //Release connection
            connection.release();
            //Send a query response as a JSON object
            res.json(rows);
        });
    });
});
```

i. Discuss whether this server code is vulnerable to XSS and/or SQL Injection attacks and how the attacks will work or not work.

[6 marks]

ii. Provide an example of input that could be used in an attack that would work on this server code and an example of the approach to prevent such an attack.

[8 marks]

[Total for Question 7: 14 marks]