Web Security I

Question 1 ***Session Fixation***

A *session cookie* is used by most websites in order to manage user logins. When the user logs in, the server sends a randomly-generated session cookie to the user's browser. The server also stores the cookie value in a database along with the corresponding username. The user's browser sends the session cookie to the server whenever the user loads any page on the site. The server then looks the session cookie up in the database and retrieves the corresponding username. Using this, the server can know which user is logged in.

Some web application frameworks allow cookies to be set by the URL. For example, visiting the URL

`http://foobar.edu/page.html?sessionid=42`.

will result in the server setting the `sessionid` cookie to the value "42".

(a) Can you spot an attack on this scheme?

(b) Suppose the problem you spotted has been fixed as follows: `foobar.edu` now establishes new sessions with session IDs based on a hash of the tuple `(username, time of connection)`. Is this secure? If not, what would be a better approach?

Question 2 ***Second-order linear... err I mean SQL injection***

Alice likes to use a startup, `NotAmazon`, to do her online shopping. Whenever she adds an item to her cart, a POST request containing the field `item` is made. On receiving such a request, `NotAmazon` executes the following statement:

```
cart_add := fmt.Sprintf("INSERT INTO cart (session, item) " +
                            "VALUES ('%s', '%s')", sessionToken, item)
db.Exec(cart_add)
```

Each item in the cart is stored as a separate row in the `cart` table.

(a) Alice is in desperate need of some toilet paper, but the website blocks her from adding more than 72 rolls to her cart ☹ Describe a POST request she can make to cause the `cart_add` statement to add 100 rolls of toilet paper to her cart.

When a user visits their cart, `NotAmazon` populates the webpage with links to the items. If a user only has one item in their cart, `NotAmazon` optimizes the query (avoiding joins) by doing the following:

```
cart_query := fmt.Sprintf("SELECT item FROM cart " +
                             "WHERE session='%s' LIMIT 1", sessionToken)
item := db.Query(cart_query)
link_query = fmt.Sprintf("SELECT link FROM items WHERE item='%s'", item)
db.Query(link_query)
```

After part(a), Alice recognizes a great business opportunity and begins reselling all of `NotAmazon`'s toilet paper at inflated prices. In a panic, `NotAmazon` fixes the vulnerability by parameterizing the `cart_add` statement.

(b) Alice claims that parameterizing the `cart_add` statement won't stop her toilet paper trafficking empire. Describe how she can still add 100 rolls of toilet paper to her cart. Assume that `NotAmazon` checks that `sessionToken` is valid before executing any queries involving it.

Question 3 ***Cross-site not scripting***

Consider a simple web messaging service. You receive messages from other users. The page shows all messages sent to you. Its HTML looks like this:

```
Mallory: Do you have time for a conference call?
Steam: Your account verification code is 86423
Mallory: Where are you? This is <b>important!!!</b>
Steam: Thank you for your purchase
       <img src="https://store.steampowered.com/assets/thankyou.png">
```

The user is off buying video games from Steam, while Mallory is trying to get ahold of them.

Users can include **arbitrary HTML code** messages and it will be concatenated into the page, **unsanitized**. Sounds crazy, doesn't it? However, they have a magical technique that prevents *any* JavaScript code from running. Period.

Discuss what an attacker could do to snoop on another user's messages. What specially crafted messages could Mallory have sent to steal this user's account verification code?