Peyrin Kao
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CS 161
Computer Security

Exam Prep 9

Q1 *SQL Injection* (14 points)

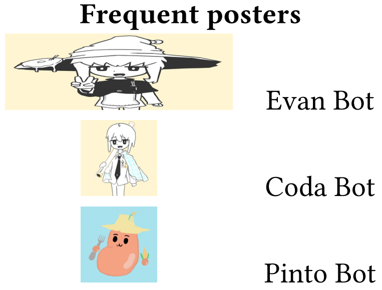
CS 161 students are using a modified version of Piazza to discuss project questions! In this version, the names and profile pictures of the students who answer questions frequently are listed on a side panel on the website.

The server stores a table of users with the following schema:

```
CREATE TABLE users (
    First TEXT,                  -- First name of the user.
    Last TEXT,                   -- Last name of the user.
    ProfilePicture TEXT,         -- URL of the image.
    FrequentPoster BOOLEAN,      -- Are they a frequent poster?
);
```

Q1.1 (3 points) Assume that you are a frequent poster. When playing around with your account, you notice that you can set your profile picture URL to the following, and your image on the frequent poster panel grows wider than everyone else's photos:

ProfilePicture URL: `https://cs161.org/evan.jpg" width="1000`



Frequent posters

Evan Bot

Coda Bot

Pinto Bot

What kind of vulnerability might this indicate on Piazza's website?

○ Stored XSS

○ Path traversal attack

○ Reflected XSS

○ Buffer overflow

○ CSRF

Q1.2 (3 points) Provide a malicious image URL that causes the JavaScript `alert(1)` to run for any browser that loads the frequent poster panel. Assume all relevant defenses are disabled.

Hint: Recall that image tags are typically formatted as `<img src="image.png">`*.*

Q1.3 (4 points) Suppose your account is not a frequent poster, but you still want to conduct an attack through the frequent posters panel!

When a user creates an account on Piazza, the server runs the following code:

```
query := fmt.Sprintf("
    INSERT INTO users (First, Last, ProfilePicture, FrequentPoster)
        VALUES ('%s', '%s', '%s', FALSE);
    ",
    first, last, profilePicture)
db.Exec(query)
```

Provide an input for `profilePicture` that would cause your malicious script to run the next time a user loads the frequent posters panel. You may reference `PAYLOAD` as your malicious image URL from earlier, and you may include `PAYLOAD` as part of a larger input.

Q1.4 (4 points) Instead of injecting a malicious script, you want to conduct a DoS attack on Piazza! Provide an input for `profilePicture` that would cause the SQL statement `DROP TABLE users` to be executed by the server.

Q2 *Web Security: Botgram* **(30 points)**

The website `www.botgram.com` lets users post and view doodles of their Bot friends. Unless otherwise specified, Botgram does not sanitize any inputs.

Botgram stores submitted doodles in their `doodles` database, which has the following schema:

```
CREATE TABLE doodles (
    doodle_url TEXT,
    submission_timestamp INTEGER
    -- Additional fields not shown.
);
```

When a user submits an image URL, Botgram stores the URL with this SQL query (replacing `%s` with the user-provided URL):

```
INSERT INTO doodles (doodle_url, submission_timestamp)
VALUES '%s', CURRENT_TIMESTAMP;
```

Users can visit `www.botgram.com/latest` to view the 100 doodles with the greatest timestamps.

To display the doodles, each URL is inserted into the HTML of the webpage as follows (replacing `%s` with the URL from the database):

```
<img src='%s'>
```

Q2.1 (4 points) Eve is an attacker who wants to post a doodle with the URL `evil.com/a.jpg` to Botgram. Eve wants to make this doodle stay on `www.botgram.com/latest` for a long time by setting its timestamp to 999.

Provide an input for `doodle_url` that posts Eve's doodle with timestamp 999.

For the rest of the question, assume that Eve's doodles always show up on `www.botgram.com/latest`.

`botgram.com` uses session tokens for authentication. Session tokens are stored as cookies with `Secure = False, HttpOnly = False`.

Eve wants any user who views her doodles to send their session token to `evil.com`.

Q2.2 (4 points) Eve uploads a doodle with the URL `evil.com`. She reasons that the `img` tag will send a GET request to `evil.com` originating from `botgram.com`, which will then attach the session token from `botgram.com` to the request.

Briefly explain why this attack does not work.

Q2.3 (4 points) Provide an input for `doodle_url` that sends the session token of any user that views the doodle to `evil.com`.

You may use the JavaScript function `post(URL, data)` which sends a POST request to the given `URL` with the given `data`.

Q2.4 (3 points) Which of the following cookie attributes would stop the attack from the previous subpart? Select all that apply.

□ `Secure=True`, `HttpOnly=False`

□ `Secure=True`, `HttpOnly=True`

□ `Secure=False`, `HttpOnly=True`

□ None of the above

For the rest of the question, Botgram implements an update that **prevents all JavaScript from executing** on Botgram webpages.

Q2.5 (4 points) Alice is a user on Botgram. Alice performs bank transfers by making a GET request to

```
https://www.bank.com/transfer?amount={AMOUNT}&to={RECEIVER}
```

where `{AMOUNT}` and `{RECEIVER}` are values chosen by Alice.

Provide an input to `doodle_url` that sends $100 to the username "Eve" when Alice loads Botgram. Assume Alice is currently logged into `www.bank.com`.

Q2.6 (3 points) What type of attack did Eve execute in the previous subpart?

○ Stored XSS ○ Reflected XSS ○ CSRF ○ Clickjacking

Q2.7 (5 points) Eve wants to force anyone who loads `www.botgram.com/latest` to make 500 GET requests. What `doodle_url` should Eve submit to Botgram? You can describe the input in words or provide the actual input.

Remember that `www.botgram.com/latest` only loads 100 images, and all JavaScript is disabled.

Q2.8 (3 points) Using the strategy from the previous subpart, give the name of one attack from class that Eve could execute. (There may be multiple correct answers.)

Q3 *Phishing* **(0 points)**

A phishing attacker tries to gain sensitive user information by tricking users into going to a fake version of a website they trust. The attacker might convince the user to go to what *appears* to be their bank and to enter their username and password.

i. What are some ways that attackers try to fool users about the site they are going to? How do they convince people to click on links to sites?

ii. What are some defenses you should employ against phishing?