## Questions

Before you work through the questions below, please create a new file and record your answers there. This will be your homework deliverable.

### HTTP Requests and Responses

Answer the following questions about the HTTP request and response process.

1. What type of architecture does the HTTP request and response process occur in?
    a. Client-server architecture

2. What are the different parts of an HTTP request?
    a. Request line
    b. Headers
    c. whitespace

3. Which part of an HTTP request is optional?
    a. The body

4. What are the three parts of an HTTP response?
    a. Status line
    b. Headers
    c. Whitespace
    d. Response body

5. Which number class of status codes represents errors?
    a. 400 codes indicate client errors
    b. 500 codes indicate server errors

6. What are the two most common request methods that a security professional will encounter?
    a. GET
    b. POST

7. Which type of HTTP request method is used for sending data?
    a. POST

8. Which part of an HTTP request contains the data being sent to the server?
    a. Request line using query parameters

9. In which part of an HTTP response does the browser receive the web code to generate and style a web page?

    a. The body

## Using curl

Answer the following questions about curl:

10. What are the advantages of using curl over the browser?
    a. You do not need a UI or a website with navigation links to access a web server

11. Which curl option is used to change the request method?
    a. -X

12. Which curl option is used to set request headers?
    a. -H

13. Which curl option is used to view the response header?
    a. Curl - -head

14. Which request method might an attacker use to figure out which HTTP requests an HTTP server will accept?
    a. GET

## Sessions and Cookies

Recall that HTTP servers need to be able to recognize clients from one another. They do this through sessions and cookies.

Answer the following questions about sessions and cookies:

Which response header sends a cookie to the client?

HTTP/1.1 200 OK
Content-type: text/html

15. Set-Cookie: cart=Bob
    a. POST

Which request header will continue the client's session?

GET /cart HTTP/1.1
Host: www.example.org

16. Cookie: cart=Bob

    a. GET

**Example HTTP Requests and Responses**

Look through the following example HTTP request and response and answer the following questions:

**HTTP Request**

```
POST /login.php HTTP/1.1
Host: example.com
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Content-Type: application/x-www-form-urlencoded
Content-Length: 34
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Linux; Android 6.0; Nexus 5 Build/MRA58N) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/80.0.3987.132 Mobile Safari/537.36

username=Barbara&password=password
```

17. What is the request method?
    a. POST

18. Which header expresses the client's preference for an encrypted response?
    a. Upgrade-Insecure-Requests: 1

19. Does the request have a user session associated with it?
    a. Yes

20. What kind of data is being sent from this request body?
    a. Username and password

**HTTP Response**

```
HTTP/1.1 200 OK
Date: Mon, 16 Mar 2020 17:05:43 GMT
Last-Modified: Sat, 01 Feb 2020 00:00:00 GMT
Content-Encoding: gzip
Expires: Fri, 01 May 2020 00:00:00 GMT
Server: Apache
Set-Cookie: SessionID=5
Content-Type: text/html; charset=UTF-8
```

```
Strict-Transport-Security: max-age=31536000; includeSubDomains
X-Content-Type: NoSniff
X-Frame-Options: DENY
X-XSS-Protection: 1; mode=block

[page content]
```

21. What is the response status code?
    a. 200

22. What web server is handling this HTTP response?
    a. apache

23. Does this response have a user session associated to it?
    a. no

24. What kind of content is likely to be in the [page content] response body?
    a. text

25. If your class covered security headers, what security request headers have been included?
    a. X-Content-Type: NoSniff
    b. X-Frame-Options: DENY
    c. X-XSS-Protection: 1; mode=block

**Monoliths and Microservices**

Answer the following questions about monoliths and microservices:

26. What are the individual components of microservices called?
    a. service

27. What is a service that writes to a database and communicates to other services?
    a. API

28. What type of underlying technology allows for microservices to become scalable and have redundancy?
    a. modularity

**Deploying and Testing a Container Set**

Answer the following questions about multi-container deployment:

29. What tool can be used to deploy multiple containers at once?
    a. docker

30. What kind of file format is required for us to deploy a container set?
    a. YAML

**Databases**

31. Which type of SQL query would we use to see all of the information within a table called customers?
    a. SELECT

32. Which type of SQL query would we use to enter new data into a table? (You don't need a full query, just the first part of the statement.)
    a. INSERT INTO

33. Why would we never run DELETE FROM <table-name>; by itself?
    a. It will delete the entire table

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## Bonus Challenge Overview: The Cookie Jar

For this challenge, you'll once again be using curl, but this time to manage and swap sessions.

⚠ **Heads Up**: You'll need to have WordPress set up from the Swapping Sessions activity from Day 1 of this unit. If you have not done it or it is improperly set up, please refer to the Day 1 student guide and the Swapping Sessions activity file.

If you recall, on Day 1 of this unit you used Google Chrome's Cookie-Editor extension to swap sessions and cookies. For this homework challenge, we'll be using the command-line tool curl to practice swapping cookie and sessions within the WordPress app.

It is important for cybersecurity professionals to know how to manage cookies with curl:

- Web application security engineers need to regularly ensure cookies are both functional and safe from tampering.
    - For example, you might need to request a cookie from a webpage and then test various HTTP responses using that cookie. Doing this over and over through the browser is tedious, but can be automated with scripts.

- The same concept applies for penetration testers and hackers: curl is used to quickly save a cookie in order to test various exploits.
    - For example, an HTTP server may be configured so that, in order to POST data to specific pages, clients need to have cookies or authentication information set in their request headers, which the server will verify.

**Revisiting curl**

Recall that you used curl to craft different kinds of requests for your curl activity, and that you saw how to use the Chrome extension Cookie-Editor to export and import cookies and swap sessions.

There will be many systems in which you will need to test requests and cookies that will not connect to a browser or browser extension.

curl not only allows users to look through headers, send data, and authenticate to servers, but also to save and send cookies through two curl options: --cookie-jar and --cookie.

These two options work exactly like Cookie-Editor, but on the command line.

- --cookie-jar allows a curl user to save the cookies set within a response header into a text file.

- --cookie allows a user to specify a text file where a cookie is saved, in order to send a request with the cookies embedded in the request header.

Let's look at how we can create a curl command that will log into a web page with a supplied username and password, and also save the server's response that should contain a cookie.

**Logging In and Saving Cookies with Curl**

If we want to use the curl command to log into an account, Amanda, with the password password, we use the following curl options:

- curl --cookie-jar ./amandacookies.txt --form "log=Amanda" --form "pwd=password" http://localhost:8080/wp-login.php --verbose

- curl: The tool that we are using.

- --cookie-jar: Specifies where we will save the cookies.

- ./amandacookies.txt: Location and file where the cookies will be saved.

- --form: Lets us pick the login username and password forms that we set in our user info earlier. In this case it's our username.

- log=Amanda: How WordPress understands and accepts usernames.

- --form: Lets us pick the login username and password forms that we set in our user info earlier. In this case it's our password.

- pwd=password: How WordPress understands and accepts passwords.

- http://localhost:8080/wp-login.php: Our WordPress login page.

- --verbose: Outputs more specific description about the actions the command is taking.

Run the command: curl --cookie-jar ./amandacookies.txt --form "log=Amanda" --form "pwd=password" http://localhost:8080/wp-login.php --verbose

If the site confirms our credentials, it will give us a cookie in return, which curl will save in the cookie jar file ./amandacookies.txt.

Now let's look at how to use that saved cookie on a page that requires us to be logged in.

**Using a Saved Cookie**

To use a saved cookie, we use the following curl syntax:

- curl --cookie ./amandacookies.txt http://localhost:8080/wp-admin/users.php
  - curl: The tool that we are using.

  - --cookie: Precedes the location of our saved cookie that we want to use.

  - ./amandacookies.txt: Location and file where the cookies are saved.

  - http://localhost:8080/wp-admin/users.php: A page that requires authentication to see properly. Note that we are not going to the login page, because supplying a cookie in this instance assumes that we are already logged in.

Now that we know how to use the curl cookie jar, let's look at what we need to do for this challenge.

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## Bonus Challenge Instructions: The Cookie Jar

First, using Docker Compose, navigate to the Day 1 WordPress activity directory and bring up the container set:

- /home/sysadmin/Documents/docker_files

Using curl, you will do the following for the Ryan user:

- Log into WordPress and save the user's cookies to a cookie jar.
- Test a WordPress page by using a cookie from the cookie jar.
- Pipe the output from the cookie with grep to check for authenticated page access.
- Attempt to access a privileged WordPress admin page.

**Step 1: Set Up**

Create two new users: Amanda and Ryan.

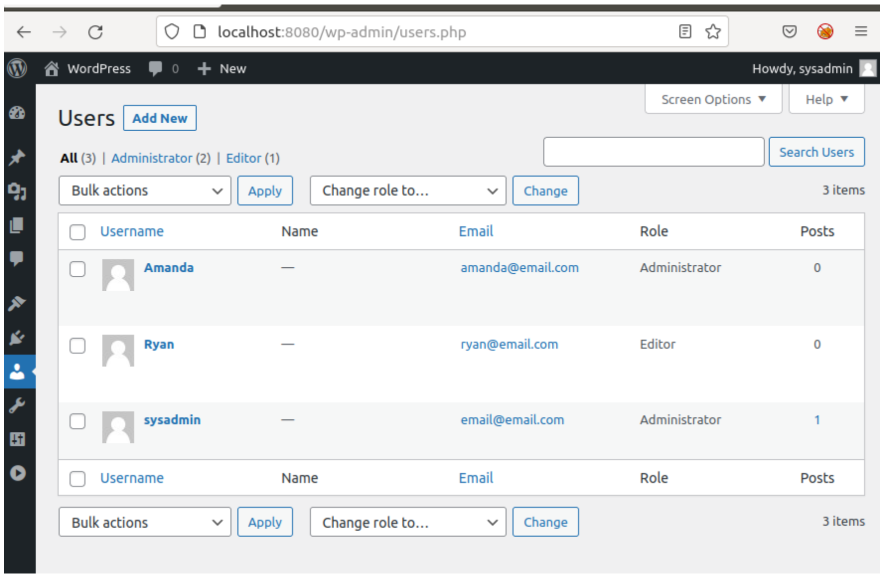
1. Navigate to localhost:8080/wp-admin/
2. On the left-hand toolbar, hover over **Users** and click **Add New**.
3. Enter the following information to create the new user named Amanda.
   - Username: Amanda
   - Email: amanda@email.com
4. Skip down to password:
   - Password: password
   - Confirm Password: Check the box to confirm use of weak password.
   - Role: Administrator
5. Create another user named Ryan.
   - Username: Ryan
   - Email: ryan@email.com
6. Skip down to password:
   - Password: 123456
   - Confirm Password: Check the box to confirm use of weak password.
   - Role: Editor
7. Log out and log in with the following credentials:
   - Username: Amanda

- Password: password

**Step 2: Baselining**

For these "baselining" steps, you'll want to log into two different types of accounts to see how the WordPress site looks at the localhost:8080/wp-admin/users.php page. We want to see how the Users page looks from the perspective of an administrator, vs. a regular user.

1. Using your browser, log into your WordPress site as your sysadmin account and navigate to localhost:8080/wp-admin/users.php, where we previously created the user Ryan. Examine this page briefly. Log out.



Users

All (3) | Administrator (2) | Editor (1)

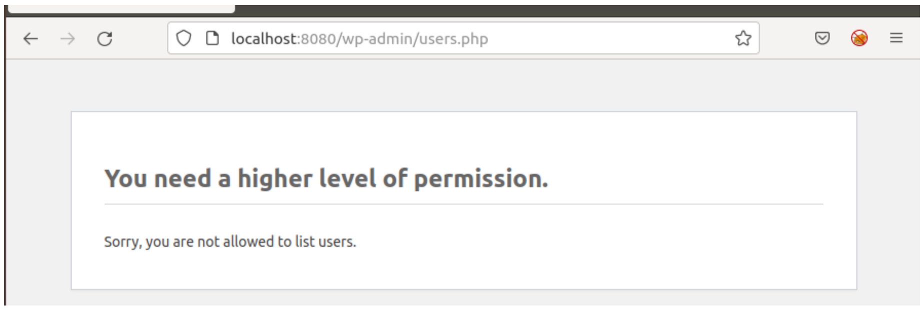
3 items

| Username | Name | Email | Role | Posts |
|---|---|---|---|---|
| Amanda | — | amanda@email.com | Administrator | 0 |
| Ryan | — | ryan@email.com | Editor | 0 |
| sysadmin | — | email@email.com | Administrator | 1 |
| Username | Name | Email | Role | Posts |

3 items

2. Using your browser, log into your Ryan account and attempt to navigate to localhost:8080/wp-admin/index.php. Note the wording on your Dashboard.

3. Attempt to navigate to localhost:8080/wp-admin/users.php. Note what you see now.



You need a higher level of permission.

Sorry, you are not allowed to list users.

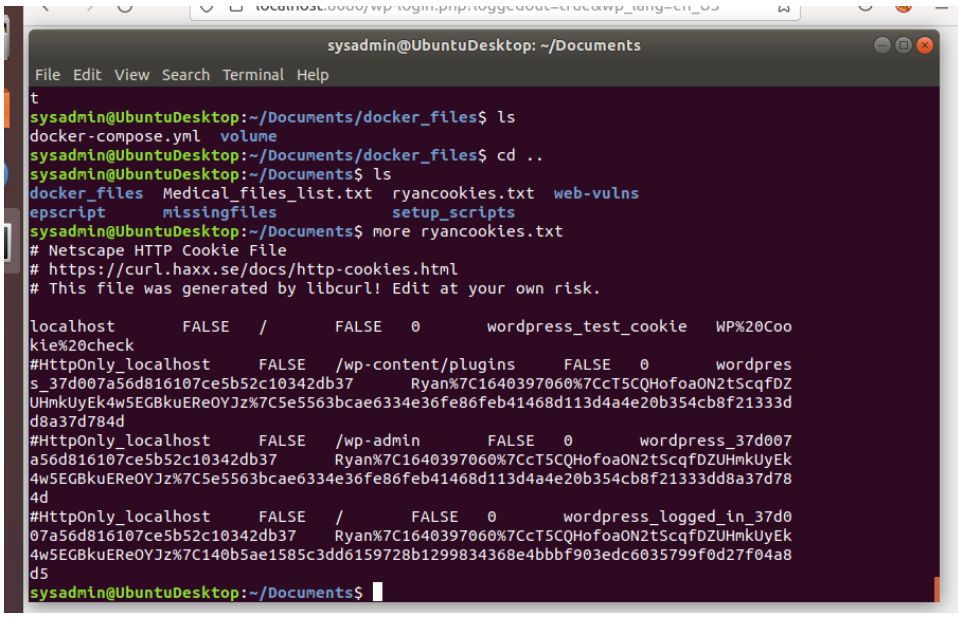
Log out in the browser.

**Step 3: Using Forms and a Cookie Jar**

Navigate to ~/Documents in a terminal to save your cookies.

1. Construct a curl request that enters two forms: "log={username}" and "pwd={password}" and goes to http://localhost:8080/wp-login.php. Enter Ryan's credentials where there are placeholders.
   curl --form "log=Ryan" --form "pwd=123456" http://localhost:8080/wp-login.php
   - **Question:** Did you see any obvious confirmation of a login? (Y/N) N
2. Construct the same curl request, but this time add the option and path to save your cookie: --cookie-jar ./ryancookies.txt. This option tells curl to save the cookies to the ryancookies.txt text file.
   curl --cookie-jar ./ryancookies.txt --form "log=Ryan" --form "pwd=123456" http://localhost:8080/wp-login.php

3. Read the contents of the ryancookies.txt file.



```
sysadmin@UbuntuDesktop: ~/Documents
File  Edit  View  Search  Terminal  Help
t
sysadmin@UbuntuDesktop:~/Documents/docker_files$ ls
docker-compose.yml  volume
sysadmin@UbuntuDesktop:~/Documents/docker_files$ cd ..
sysadmin@UbuntuDesktop:~/Documents$ ls
docker_files  Medical_files_list.txt  ryancookies.txt  web-vulns
epscript      missingfiles            setup_scripts
sysadmin@UbuntuDesktop:~/Documents$ more ryancookies.txt
# Netscape HTTP Cookie File
# https://curl.haxx.se/docs/http-cookies.html
# This file was generated by libcurl! Edit at your own risk.

localhost       FALSE   /       FALSE   0       wordpress_test_cookie   WP%20Coo
kie%20check
#HttpOnly_localhost     FALSE   /wp-content/plugins     FALSE   0       wordpres
s_37d007a56d816107ce5b52c10342db37      Ryan%7C1640397060%7CcT5CQHofoaON2tScqfDZ
UHmkUyEk4w5EGBkuEReOYJz%7C5e5563bcae6334e36fe86feb41468d113d4a4e20b354cb8f21333d
d8a37d784d
#HttpOnly_localhost     FALSE   /wp-admin       FALSE   0       wordpress_37d007
a56d816107ce5b52c10342db37      Ryan%7C1640397060%7CcT5CQHofoaON2tScqfDZUHmkUyEk
4w5EGBkuEReOYJz%7C5e5563bcae6334e36fe86feb41468d113d4a4e20b354cb8f21333dd8a37d78
4d
#HttpOnly_localhost     FALSE   /       FALSE   0       wordpress_logged_in_37d0
07a56d816107ce5b52c10342db37    Ryan%7C1640397060%7CcT5CQHofoaON2tScqfDZUHmkUyEk
4w5EGBkuEReOYJz%7C140b5ae1585c3dd6159728b1299834368e4bbbf903edc6035799f0d27f04a8
d5
sysadmin@UbuntuDesktop:~/Documents$
```

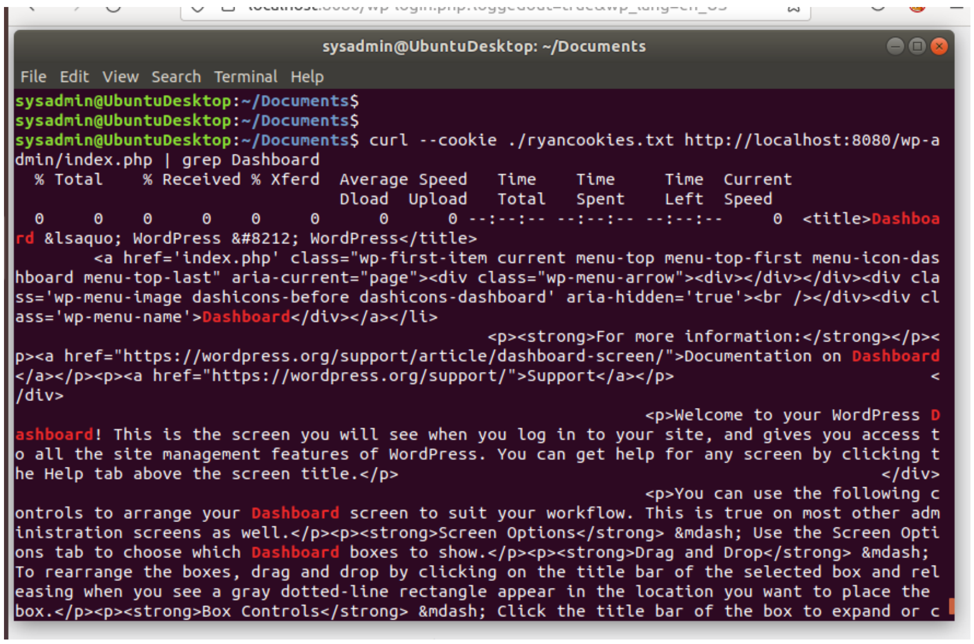
   - **Question:** How many items exist in this file? 4

Note that each one of these is a cookie that was granted to Ryan after logging in.

**Step 4: Log in Using Cookies**

1. Craft a new curl command that now uses the --cookie option, followed by the path to your cookies file. For the URL, use http://localhost:8080/wp-admin/index.php.
   curl --cookie ./ryancookies.txt http://localhost:8080/wp-admin/index.php
   - **Question:** Is it obvious that we can access the Dashboard? (Y/N) No it does not seem obvious

2. Press the up arrow on your keyboard to run the same command, but this time, pipe | grep Dashboard to the end of your command to return all instances of the word Dashboard on the page.
   curl --cookie ./ryancookies.txt http://localhost:8080/wp-admin/index.php | grep Dashboard



```
sysadmin@UbuntuDesktop: ~/Documents
File  Edit  View  Search  Terminal  Help
sysadmin@UbuntuDesktop:~/Documents$
sysadmin@UbuntuDesktop:~/Documents$
sysadmin@UbuntuDesktop:~/Documents$ curl --cookie ./ryancookies.txt http://localhost:8080/wp-a
dmin/index.php | grep Dashboard
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
  0     0    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0  <title>Dashboa
rd &lsaquo; WordPress &#8212; WordPress</title>
        <a href='index.php' class="wp-first-item current menu-top menu-top-first menu-icon-das
hboard menu-top-last" aria-current="page"><div class="wp-menu-arrow"><div></div></div><div cla
ss='wp-menu-image dashicons-before dashicons-dashboard' aria-hidden='true'><br /></div><div cl
ass='wp-menu-name'>Dashboard</div></a></li>
                                                <p><strong>For more information:</strong></p><
p><a href="https://wordpress.org/support/article/dashboard-screen/">Documentation on Dashboard
</a></p><p><a href="https://wordpress.org/support/">Support</a></p>                           <
/div>
                                                                <p>Welcome to your WordPress D
ashboard! This is the screen you will see when you log in to your site, and gives you access t
o all the site management features of WordPress. You can get help for any screen by clicking t
he Help tab above the screen title.</p>                                                 </div>
                                                                <p>You can use the following c
ontrols to arrange your Dashboard screen to suit your workflow. This is true on most other adm
inistration screens as well.</p><p><strong>Screen Options</strong> &mdash; Use the Screen Opti
ons tab to choose which Dashboard boxes to show.</p><p><strong>Drag and Drop</strong> &mdash;
To rearrange the boxes, drag and drop by clicking on the title bar of the selected box and rel
easing when you see a gray dotted-line rectangle appear in the location you want to place the
box.</p><p><strong>Box Controls</strong> &mdash; Click the title bar of the box to expand or c
```

- **Question:** Look through the output where Dashboard is highlighted. Does any of the wording on this page seem familiar? (Y/N) If so, you should be successfully logged in to your Editor's dashboard. Yes, we can see where it says welcome to your WordPress dashboard

### Step 5: Test the Users.php Page

1. Finally, write a curl command using the same --cookie ryancookies.txt option, but attempt to access http://localhost:8080/wp-admin/users.php.
   curl --cookie ./ryancookies.txt http://localhost:8080/wp-users/index.php
   - **Question:** What happens this time? Error 404

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## Submission Guidelines

- Save the file where you documented your solutions and submit it as your homework deliverable.