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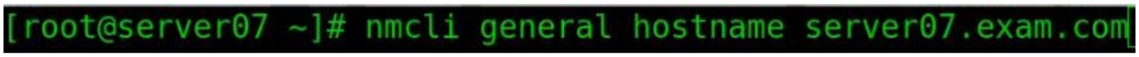
# Final Exam Practical:  420-635-AB

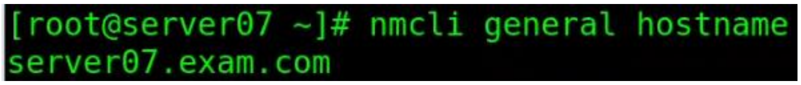
## Server Preparation

### Modify the Hostname

To configure the hostname according to the exam requirements, I used the nmcli tool. then verified the change



```
[root@server07 ~]# nmcli general hostname server07.exam.com
```

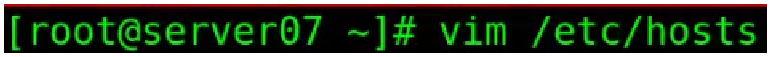


```
[root@server07 ~]# nmcli general hostname
server07.exam.com
```

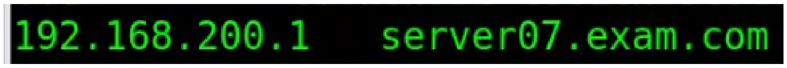
*Figure 1 Hostname successfully changed to server07.exam.com*

### *Update the /etc/hosts File*

To allow correct testing of hyperlink access in the web browser, I modified the /etc/hosts file to map the hostname to the server's LAN IP.



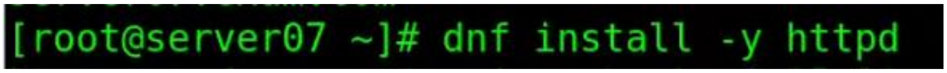
```
[root@server07 ~]# vim /etc/hosts
```



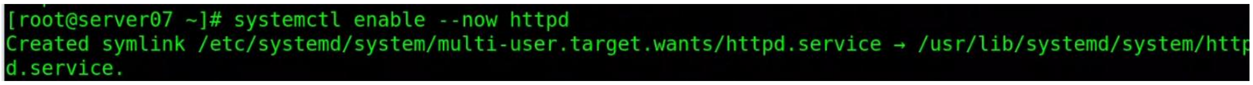
```
192.168.200.1   server07.exam.com
```

### Install and Start Apache Server

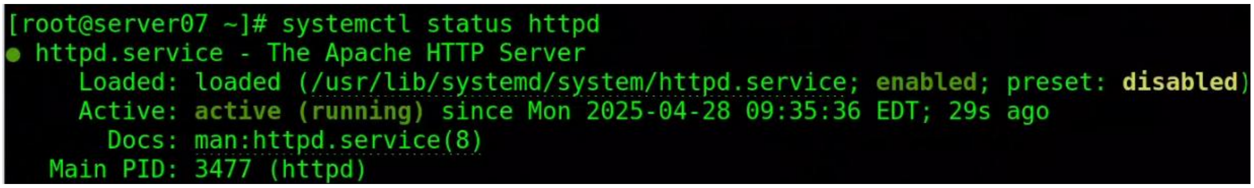
Apache was installed and started using the following commands.



```
[root@server07 ~]# dnf install -y httpd
```



```
[root@server07 ~]# systemctl enable --now httpd
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service → /usr/lib/systemd/system/http
d.service.
```

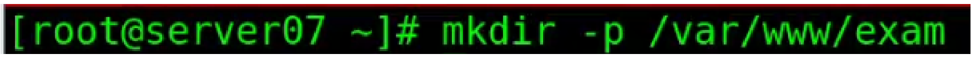


```
[root@server07 ~]# systemctl status httpd
● httpd.service - The Apache HTTP Server
     Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
     Active: active (running) since Mon 2025-04-28 09:35:36 EDT; 29s ago
       Docs: man:httpd.service(8)
   Main PID: 3477 (httpd)
```

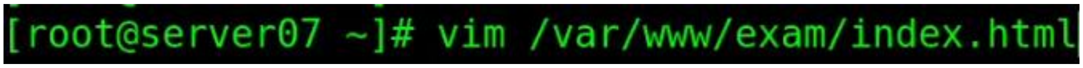
*Figure 2 Apache httpd service active and running*

## Create the /var/www/exam Directory and Homepage

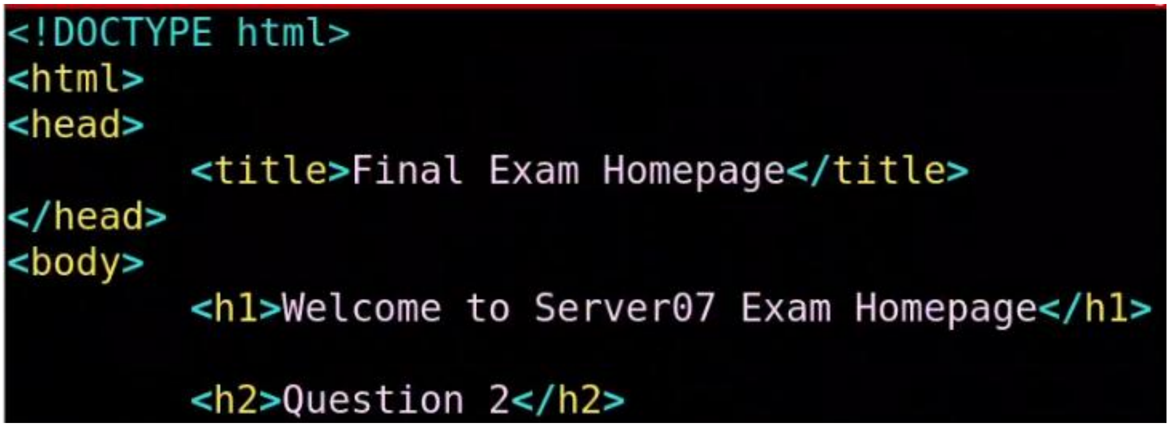
I created the /var/www/exam directory and added the required index.html homepage, containing hyperlinks to test all exam tasks.



```
[root@server07 ~]# mkdir -p /var/www/exam
```



```
[root@server07 ~]# vim /var/www/exam/index.html
```



```
<!DOCTYPE html>
<html>
<head>
        <title>Final Exam Homepage</title>
</head>
<body>
        <h1>Welcome to Server07 Exam Homepage</h1>

        <h2>Question 2</h2>
```

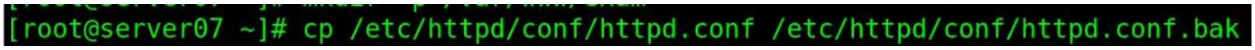
*Figure 3 Homepage with test links*

## Configure Apache to Serve from /var/www/exam

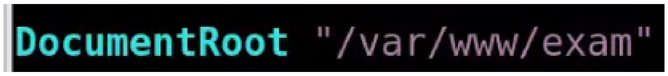
I made a backup of the main apache configuration file before making changes and then I edited the Apache configuration file /etc/httpd/conf/httpd.conf to:

- Change DocumentRoot to /var/www/exam
- Update the <Directory> path accordingly.

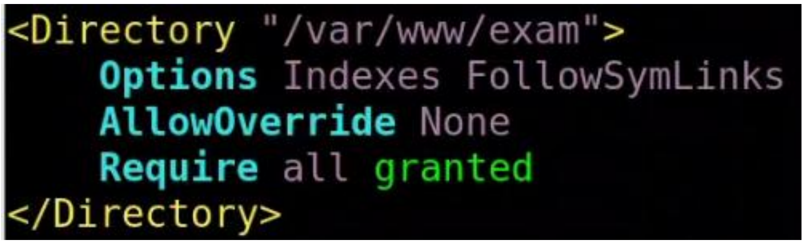
After restarting the Apache service, the homepage became accessible using the server hostname.



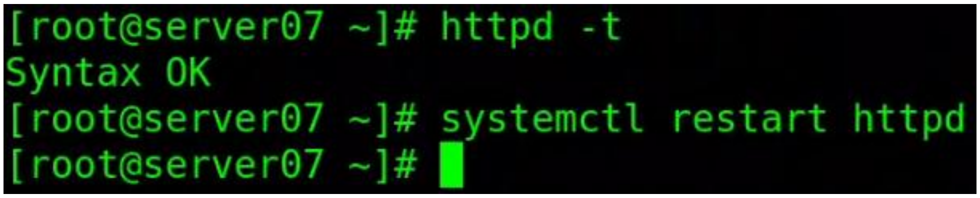
```
[root@server07 ~]# cp /etc/httpd/conf/httpd.conf /etc/httpd/conf/httpd.conf.bak
```



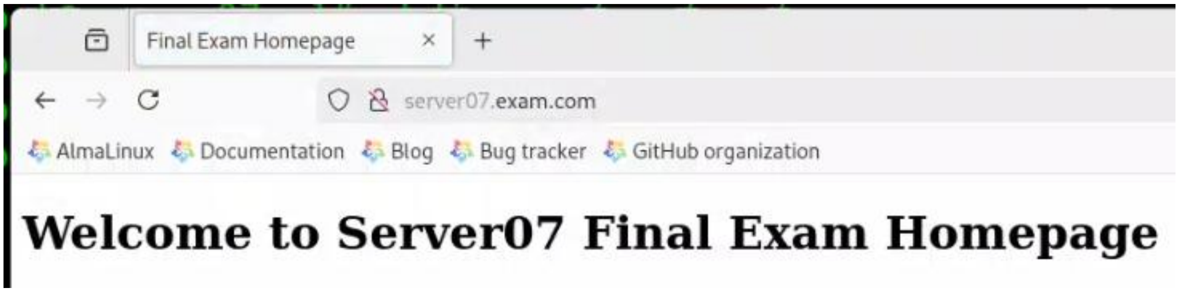
```
DocumentRoot "/var/www/exam"
```



```
<Directory "/var/www/exam">
    Options Indexes FollowSymLinks
    AllowOverride None
    Require all granted
</Directory>
```



```
[root@server07 ~]# httpd -t
Syntax OK
[root@server07 ~]# systemctl restart httpd
[root@server07 ~]# 
```



Welcome to Server07 Final Exam Homepage

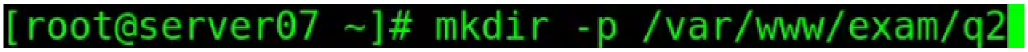
*Figure 4 server07.exam.com succesfully loaded in web browser*

# Website Creation

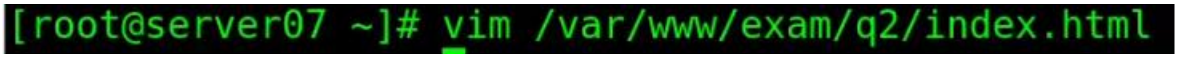
## Create the /var/www/exam/q2 Directory and Web Page

I created the directory /var/www/exam/q2 to host the Question 2 web content.

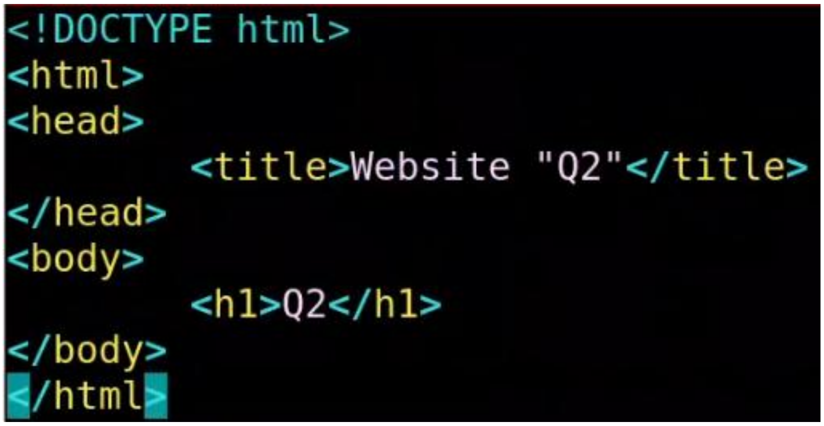
Inside /q2, I placed a simple index.html page displaying the text "**Q2**".



```
[root@server07 ~]# mkdir -p /var/www/exam/q2
```



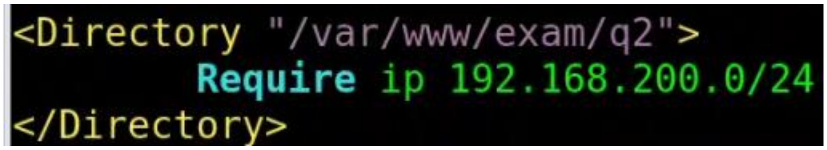
```
[root@server07 ~]# vim /var/www/exam/q2/index.html
```



```
<!DOCTYPE html>
<html>
<head>
        <title>Website "Q2"</title>
</head>
<body>
        <h1>Q2</h1>
</body>
</html>
```

## Configure Access Restriction to 192.168.200.0/24 Subnet

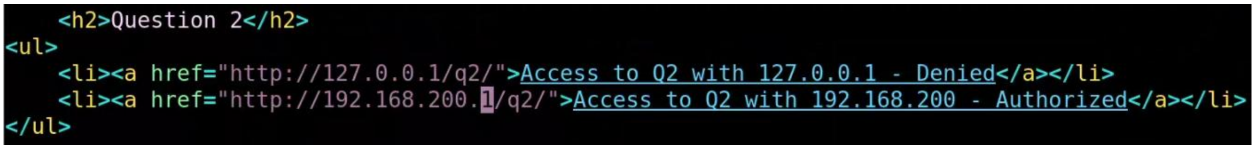
I configured Apache to allow access to /q2 **only** for clients in the 192.168.200.0/24 network by adding the following block inside /etc/httpd/conf/httpd.conf:



```
<Directory "/var/www/exam/q2">
        Require ip 192.168.200.0/24
</Directory>
```

## Update Homepage to Test Access

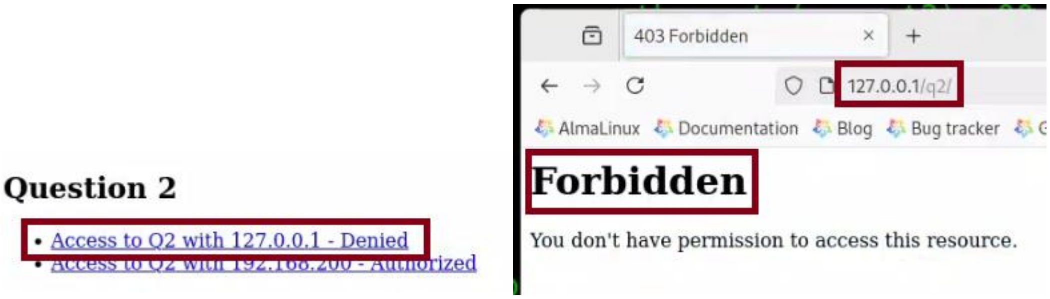
I updated the homepage (index.html) with two hyperlinks for testing. The first link simulates denied access (localhost 127.0.0.1), and the second simulates authorized access (LAN IP 192.168.200.1).



```
    <h2>Question 2</h2>
<ul>
    <li><a href="http://127.0.0.1/q2/">Access to Q2 with 127.0.0.1 - Denied</a></li>
    <li><a href="http://192.168.200.1/q2/">Access to Q2 with 192.168.200 - Authorized</a></li>
</ul>
```

# Validating Question 2

**Access from 127.0.0.1** (localhost) results in a **403 Forbidden** error, as expected.



Question 2

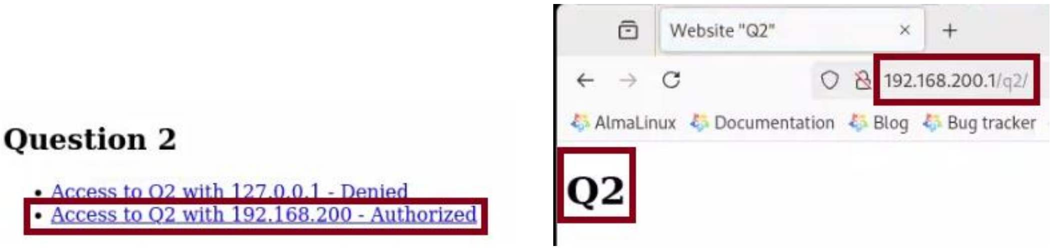
- Access to Q2 with 127.0.0.1 - Denied
- Access to Q2 with 192.168.200 - Authorized

Forbidden

You don't have permission to access this resource.

*Figure 5 Access Denied to /q2 via 127.0.0.1*

**Access from server07.exam.com** (resolving to 192.168.200.1) correctly shows the "**Q2**" web page.



Question 2

- Access to Q2 with 127.0.0.1 - Denied
- Access to Q2 with 192.168.200 - Authorized

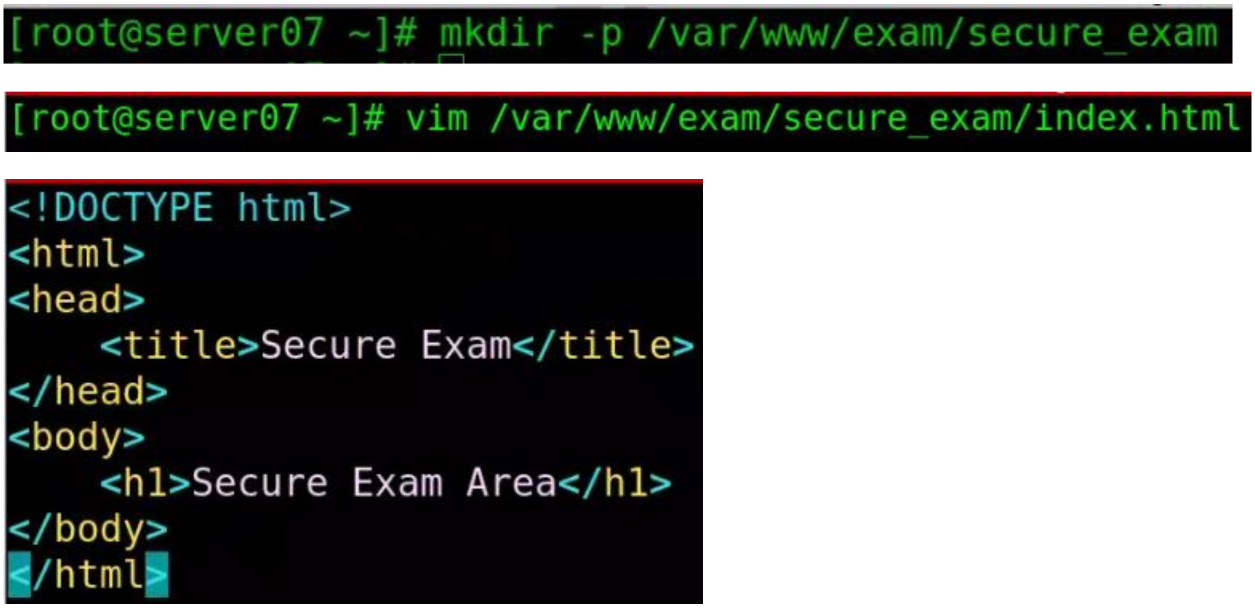
Q2

*Figure 6 Access Authorized to /q2 via server07.exam.com (192.168.200.1)*

# Authentication and Secure Server

## Create the /secure_exam Directory and Web Page

I created the directory /var/www/exam/secure_exam and placed a simple web page for testing.



```
[root@server07 ~]# mkdir -p /var/www/exam/secure_exam
```

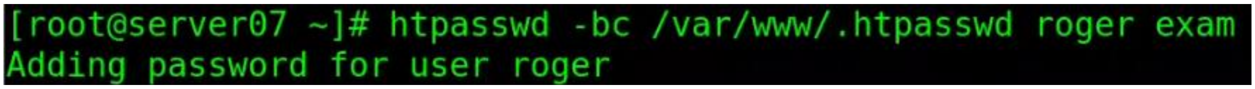
```
[root@server07 ~]# vim /var/www/exam/secure_exam/index.html
```

```
<!DOCTYPE html>
<html>
<head>
    <title>Secure Exam</title>
</head>
<body>
    <h1>Secure Exam Area</h1>
</body>
</html>
```

*Figure 7 /secure_exam directory and index page created*

## Create the Authentication User

I created the authentication user **roger** with password **exam** using the htpasswd command



```
[root@server07 ~]# htpasswd -bc /var/www/.htpasswd roger exam
Adding password for user roger
```

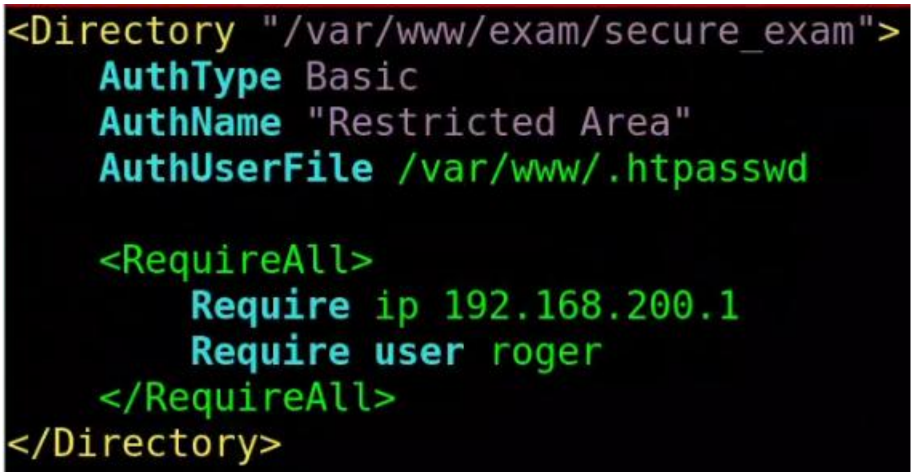
*Figure 8 Creation of authentication user "roger"*

## Configure Apache Authentication for /secure_exam

I edited /etc/httpd/conf/httpd.conf to secure the /secure_exam directory.
The configuration requires users to satisfy **both** conditions:

- The client must have an IP address of 192.168.200.1
- The client must log in with the username **roger** and the correct password.

The configuration block:

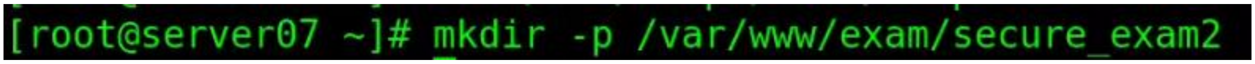


```
<Directory "/var/www/exam/secure_exam">
    AuthType Basic
    AuthName "Restricted Area"
    AuthUserFile /var/www/.htpasswd

    <RequireAll>
        Require ip 192.168.200.1
        Require user roger
    </RequireAll>
</Directory>
```

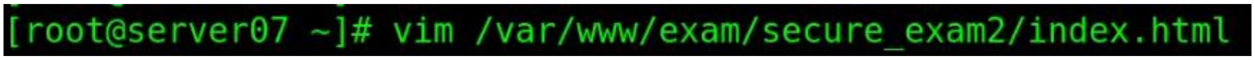
*Figure 9 Apache configuration for /secure_exam requiring IP and authentication*

## Create the /secure_exam2 Directory and Web Page

I created another directory /var/www/exam/secure_exam2 for the second part of Question 3.

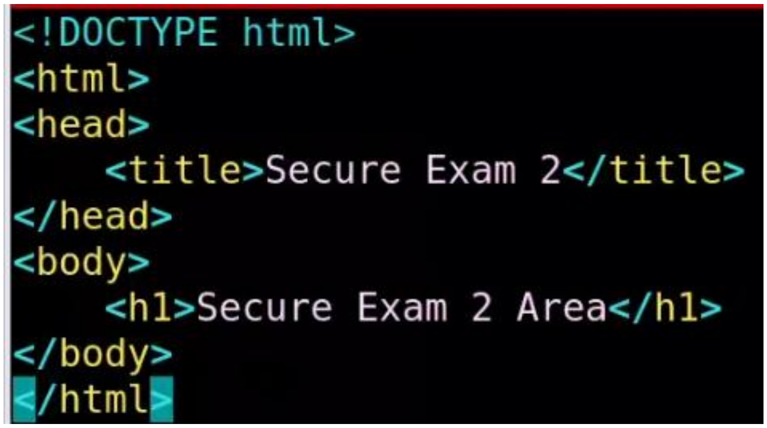


```
[root@server07 ~]# mkdir -p /var/www/exam/secure_exam2
```



```
[root@server07 ~]# vim /var/www/exam/secure_exam2/index.html
```

I placed a basic index.html file for testing inside.



```
<!DOCTYPE html>
<html>
<head>
    <title>Secure Exam 2</title>
</head>
<body>
    <h1>Secure Exam 2 Area</h1>
</body>
</html>
```

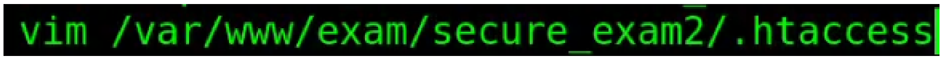
*Figure 10 /secure_exam2 directory and index page created*

## Create a .htaccess File in /secure_exam2

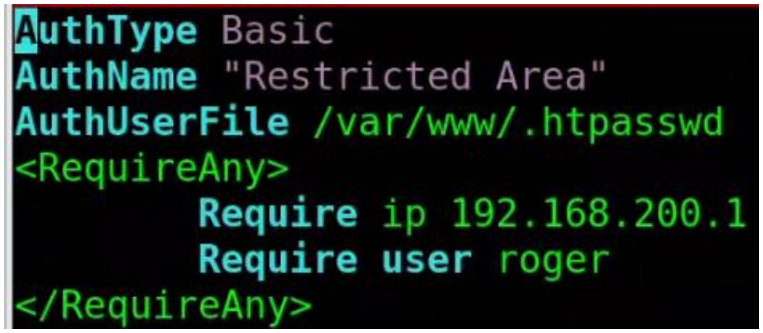
I created a .htaccess file inside /secure_exam2 to allow access using **either** condition:

- he client has IP 192.168.200.1
- OR the client successfully logs in as user **roger**.

The .htaccess content:



```
vim /var/www/exam/secure_exam2/.htaccess
```

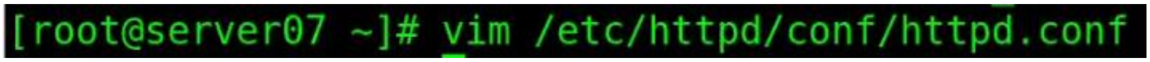


```
AuthType Basic
AuthName "Restricted Area"
AuthUserFile /var/www/.htpasswd
<RequireAny>
        Require ip 192.168.200.1
        Require user roger
</RequireAny>
```

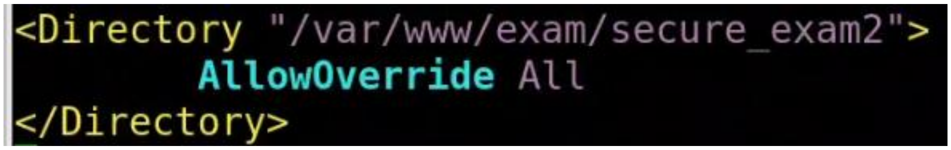
*Figure 11 .htaccess configuration for /secure_exam2*

## Allow Apache to Read .htaccess for /secure_exam2

I updated /etc/httpd/conf/httpd.conf to allow .htaccess overrides for /secure_exam2:



```
[root@server07 ~]# vim /etc/httpd/conf/httpd.conf
```

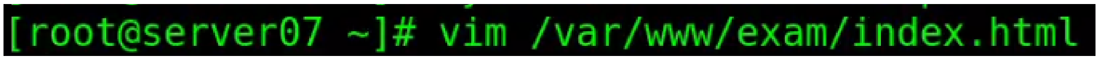


```
<Directory "/var/www/exam/secure_exam2">
        AllowOverride All
</Directory>
```

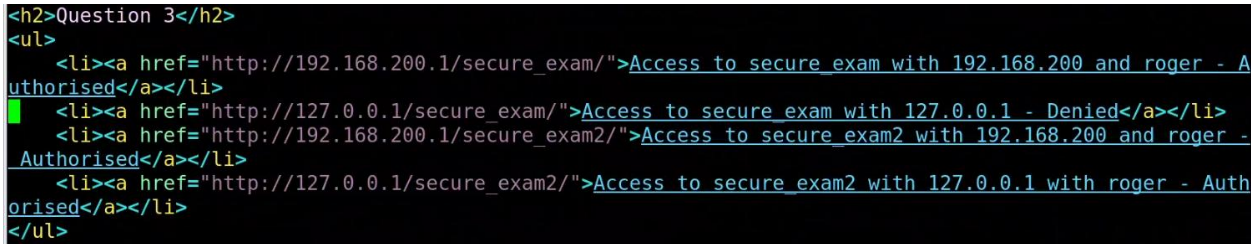
*Figure 12 Apache configuration to allow .htaccess in /secure_exam2*

## Update the Homepage for Question 3 Hyperlinks

To simplify validation, I updated the /var/www/exam/index.html homepage to include hyperlinks for testing all access scenarios in Question 3.



```
[root@server07 ~]# vim /var/www/exam/index.html
```



```
<h2>Question 3</h2>
<ul>
    <li><a href="http://192.168.200.1/secure_exam/">Access to secure_exam with 192.168.200 and roger - A
uthorised</a></li>
    <li><a href="http://127.0.0.1/secure_exam/">Access to secure_exam with 127.0.0.1 - Denied</a></li>
    <li><a href="http://192.168.200.1/secure_exam2/">Access to secure_exam2 with 192.168.200 and roger -
 Authorised</a></li>
    <li><a href="http://127.0.0.1/secure_exam2/">Access to secure_exam2 with 127.0.0.1 with roger - Auth
orised</a></li>
</ul>
```

*Figure 13 Updated index.html homepage hyperlinks for Question 3*

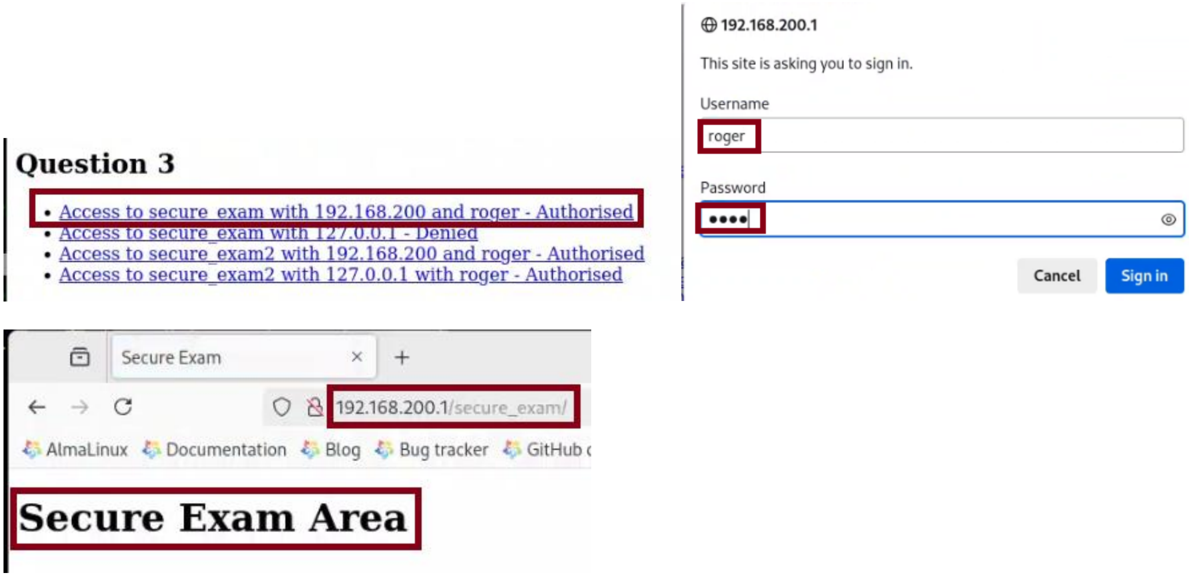
# Validating Question 3

## Validation of /secure_exam Access

### Access /secure_exam from 192.168.200.1 with user roger

I clicked the hyperlink: http://192.168.200.1/secure_exam/

- Apache prompted for username and password.
- After entering username roger and password exam, access was granted.



Question 3

- Access to secure_exam with 192.168.200 and roger - Authorised
- Access to secure_exam with 127.0.0.1 - Denied
- Access to secure_exam2 with 192.168.200 and roger - Authorised
- Access to secure_exam2 with 127.0.0.1 with roger - Authorised

192.168.200.1

This site is asking you to sign in.

Username: roger

Password: ••••

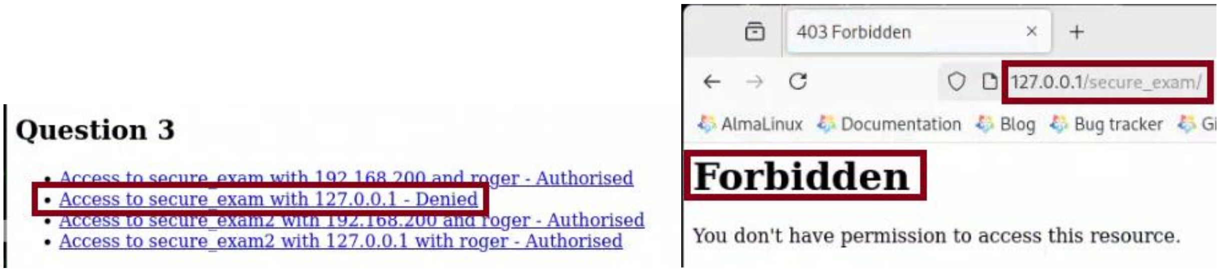
Secure Exam Area

*Figure 14 Access Authorized to /secure_exam with 192.168.200 and roger*

### Access /secure_exam from 127.0.0.1 (localhost)

I clicked the hyperlink: http://127.0.0.1/secure_exam/

- Access was denied because neither IP nor credentials satisfied the access control.



Question 3

- Access to secure_exam with 192.168.200 and roger - Authorised
- Access to secure_exam with 127.0.0.1 - Denied
- Access to secure_exam2 with 192.168.200 and roger - Authorised
- Access to secure_exam2 with 127.0.0.1 with roger - Authorised

Forbidden

You don't have permission to access this resource.

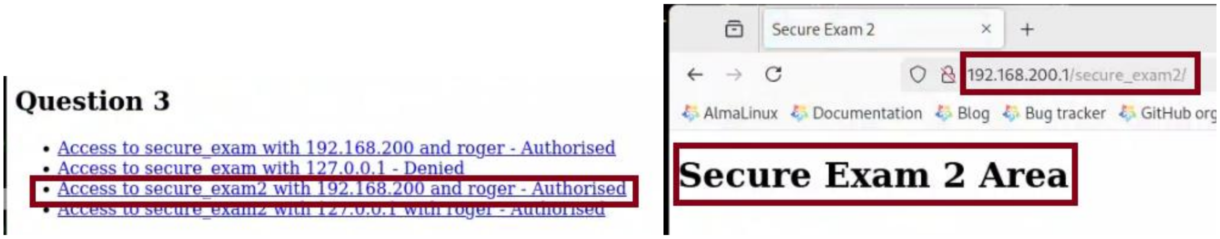
*Figure 15 Access Denied to /secure_exam with 127.0.0.1*

## Validation of /secure_exam2 Access

### Access /secure_exam2 from 192.168.200.1

I clicked the hyperlink: http://192.168.200.1/secure_exam2/

- Access was automatically authorized based on the IP address alone, without prompting for a password.



**Question 3**

- Access to secure_exam with 192.168.200 and roger - Authorised
- Access to secure_exam with 127.0.0.1 - Denied
- Access to secure_exam2 with 192.168.200 and roger - Authorised
- Access to secure_exam2 with 127.0.0.1 with roger - Authorised

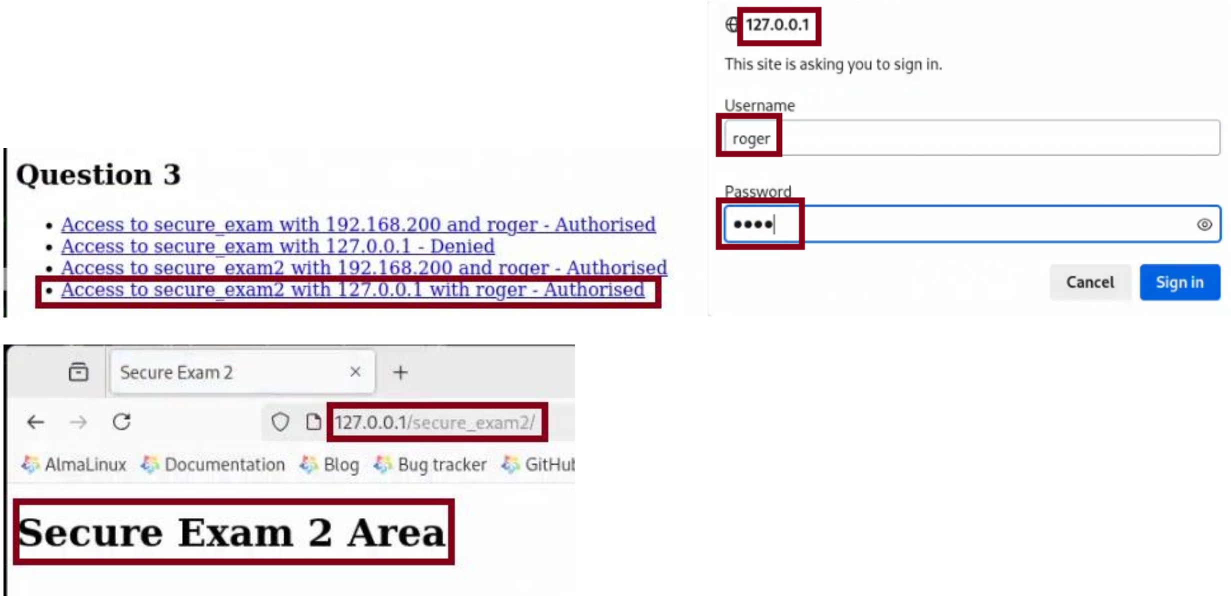
Secure Exam 2 Area

*Figure 16 Access Authorized to /secure_exam2 with 192.168.200.1*

### Access /secure_exam2 from 127.0.0.1 with user roger

We clicked the hyperlink: http://127.0.0.1/secure_exam2/

- Apache prompted for username and password.
- After entering username roger and password exam, access was authorized.



127.0.0.1

This site is asking you to sign in.

Username: roger

Password: ••••

**Question 3**

- Access to secure_exam with 192.168.200 and roger - Authorised
- Access to secure_exam with 127.0.0.1 - Denied
- Access to secure_exam2 with 192.168.200 and roger - Authorised
- Access to secure_exam2 with 127.0.0.1 with roger - Authorised

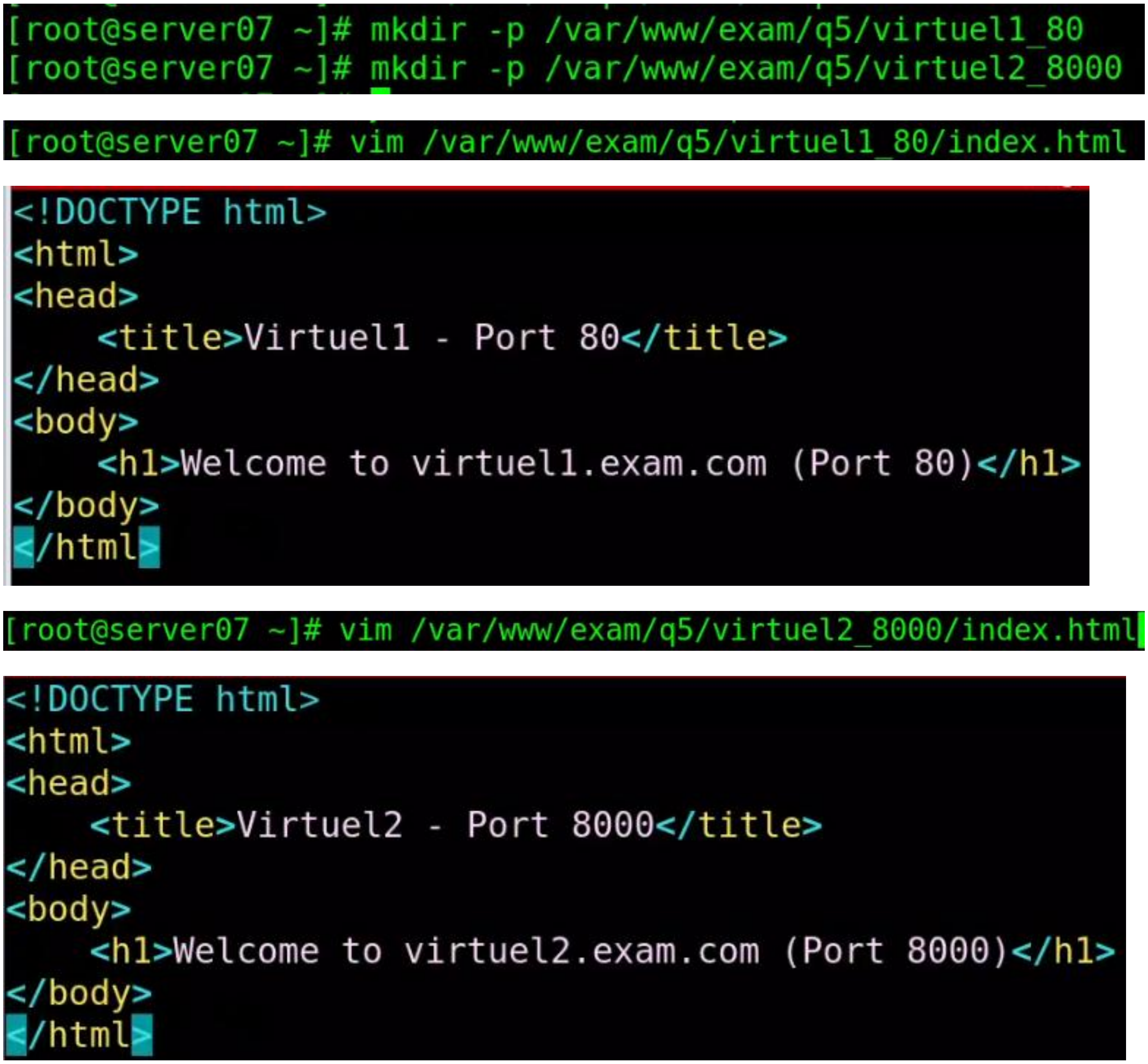
Secure Exam 2 Area

*Figure 17 Access Authorized to /secure_exam2 with 127.0.0.1 and roger*

# DNS and Virtual Hosts

## Creation of Website Directories and Pages

I created two separate directories for the Virtual Hosts. I created a simple index.html file for each site.



```
[root@server07 ~]# mkdir -p /var/www/exam/q5/virtuel1_80
[root@server07 ~]# mkdir -p /var/www/exam/q5/virtuel2_8000
```

```
[root@server07 ~]# vim /var/www/exam/q5/virtuel1_80/index.html
```

```
<!DOCTYPE html>
<html>
<head>
    <title>Virtuel1 - Port 80</title>
</head>
<body>
    <h1>Welcome to virtuel1.exam.com (Port 80)</h1>
</body>
</html>
```

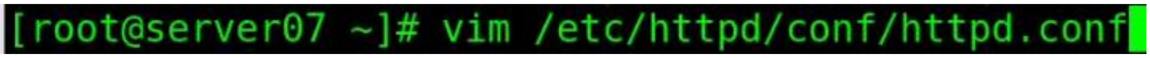
```
[root@server07 ~]# vim /var/www/exam/q5/virtuel2_8000/index.html
```

```
<!DOCTYPE html>
<html>
<head>
    <title>Virtuel2 - Port 8000</title>
</head>
<body>
    <h1>Welcome to virtuel2.exam.com (Port 8000)</h1>
</body>
</html>
```

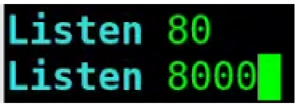
*Figure 18 Creation of VirtualHost directories and sample webpages*

## Configuration of Apache Virtual Hosts

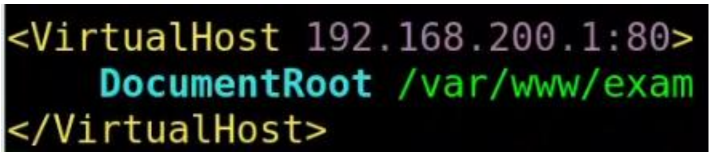
I edited /etc/httpd/conf/httpd.conf and added a **default VirtualHost** to access the exam homepage by typing the IP: 192.168.200.1 and two **exam VirtualHosts**.



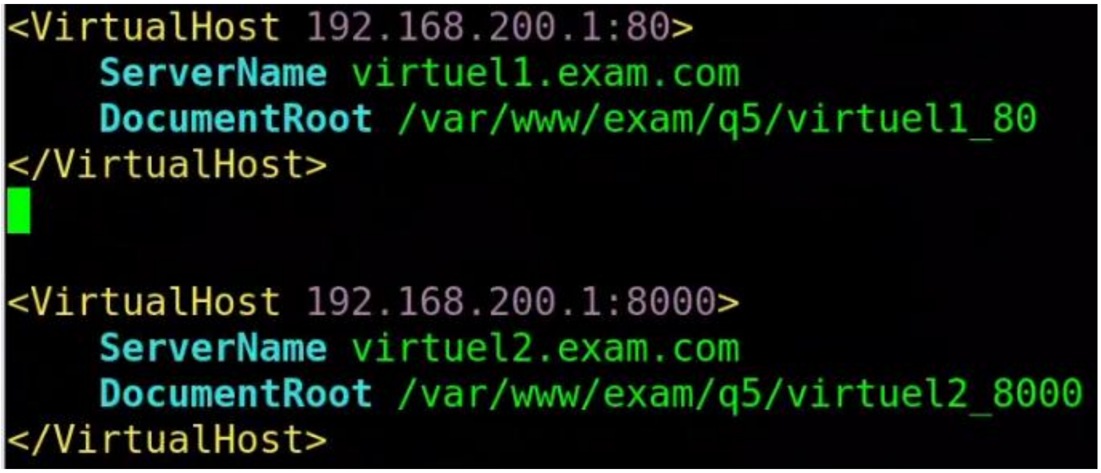
```
[root@server07 ~]# vim /etc/httpd/conf/httpd.conf
```



```
Listen 80
Listen 8000
```



```
<VirtualHost 192.168.200.1:80>
    DocumentRoot /var/www/exam
</VirtualHost>
```

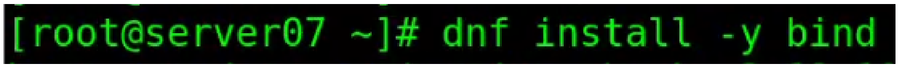


```
<VirtualHost 192.168.200.1:80>
    ServerName virtuel1.exam.com
    DocumentRoot /var/www/exam/q5/virtuel1_80
</VirtualHost>


<VirtualHost 192.168.200.1:8000>
    ServerName virtuel2.exam.com
    DocumentRoot /var/www/exam/q5/virtuel2_8000
</VirtualHost>
```

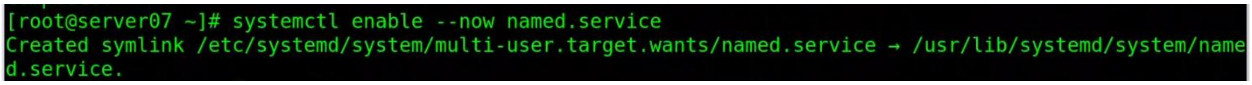
*Figure 19 Apache VirtualHost configuration for Final Exam*

## DNS Server Configuration (BIND)

I installed and started the BIND DNS server

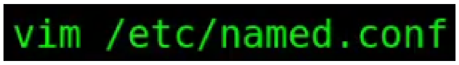


```
[root@server07 ~]# dnf install -y bind
```

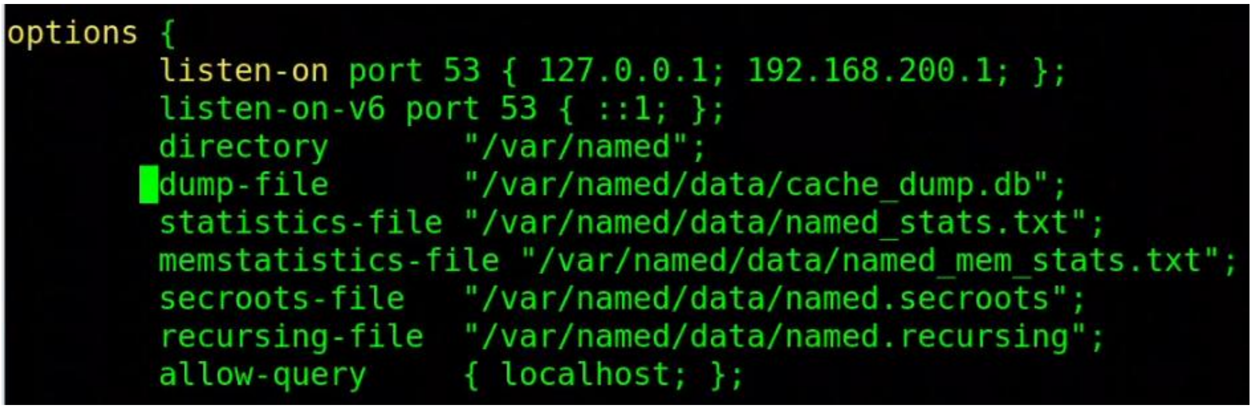


```
[root@server07 ~]# systemctl enable --now named.service
Created symlink /etc/systemd/system/multi-user.target.wants/named.service → /usr/lib/systemd/system/name
d.service.
```

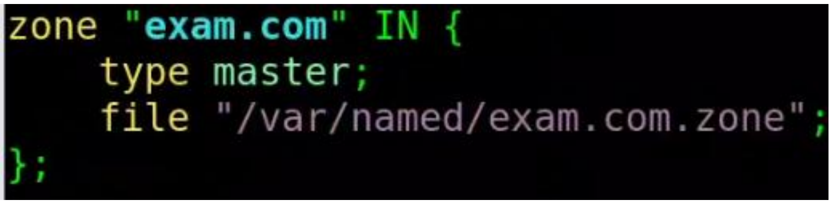
I edited /etc/named.conf:



```
vim /etc/named.conf
```



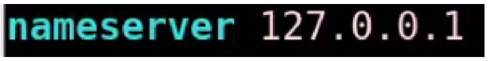
```
options {
        listen-on port 53 { 127.0.0.1; 192.168.200.1; };
        listen-on-v6 port 53 { ::1; };
        directory       "/var/named";
        dump-file       "/var/named/data/cache_dump.db";
        statistics-file "/var/named/data/named_stats.txt";
        memstatistics-file "/var/named/data/named_mem_stats.txt";
        secroots-file   "/var/named/data/named.secroots";
        recursing-file  "/var/named/data/named.recursing";
        allow-query     { localhost; };
```



```
zone "exam.com" IN {
    type master;
    file "/var/named/exam.com.zone";
};
```

*Figure 20 BIND main configuration file named.conf*

I also manually edited /etc/resolv.conf

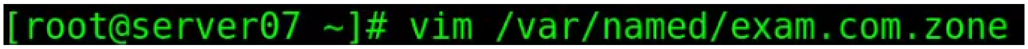


```
nameserver 127.0.0.1
```

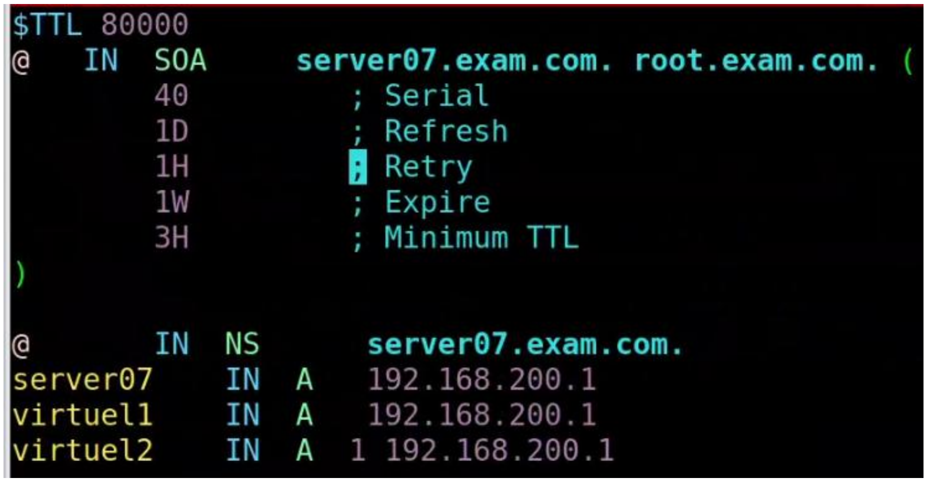
*Figure 21 Updated /etc/resolv.conf pointing to local DNS serv*

## Creation of Zone File /var/named/exam.com.zone

The zone file /var/named/exam.com.zone contains, This points all the required names to the IP 192.168.200.1:



```
[root@server07 ~]# vim /var/named/exam.com.zone
```

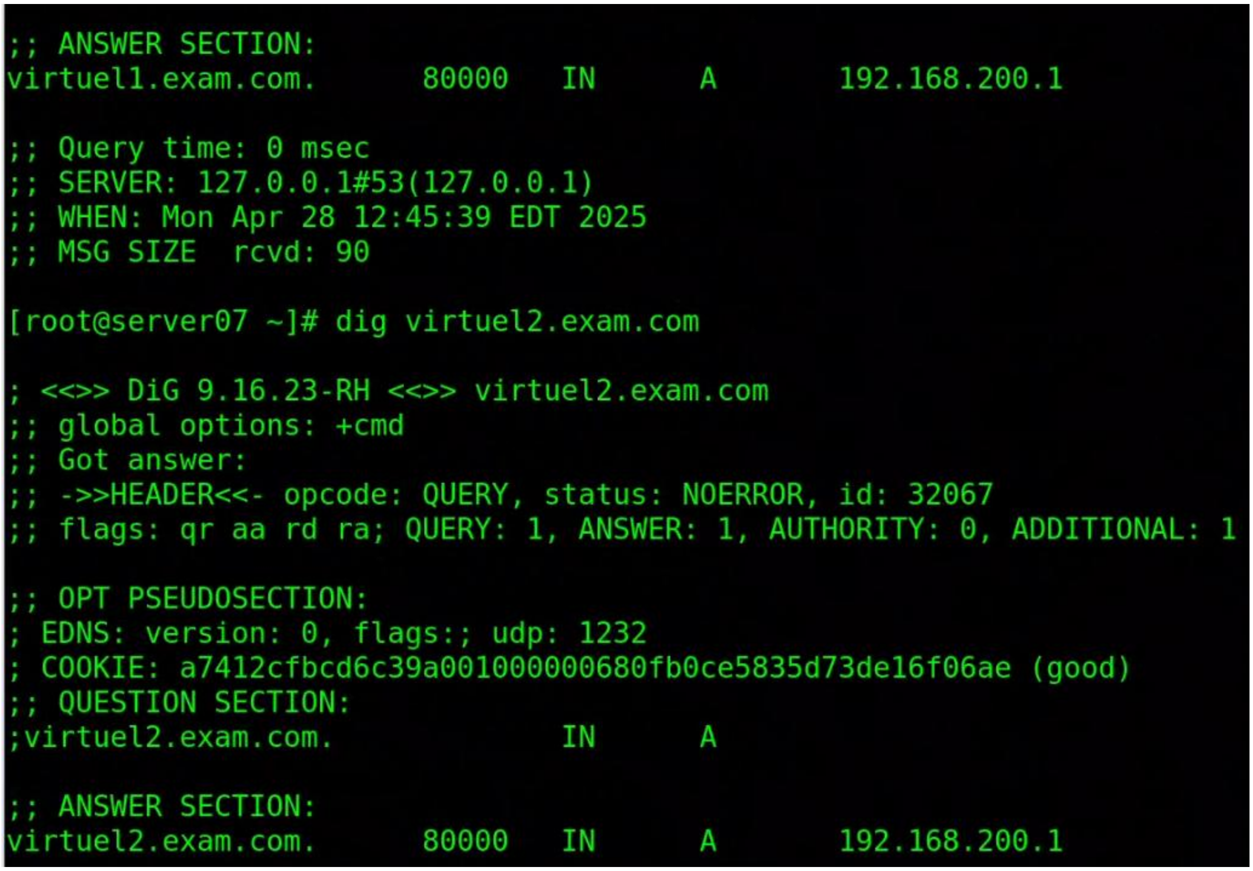


```
$TTL 80000
@   IN  SOA     server07.exam.com. root.exam.com. (
        40          ; Serial
        1D          ; Refresh
        1H          ; Retry
        1W          ; Expire
        3H          ; Minimum TTL
)

@       IN  NS      server07.exam.com.
server07    IN  A    192.168.200.1
virtuel1    IN  A    192.168.200.1
virtuel2    IN  A  1 192.168.200.1
```

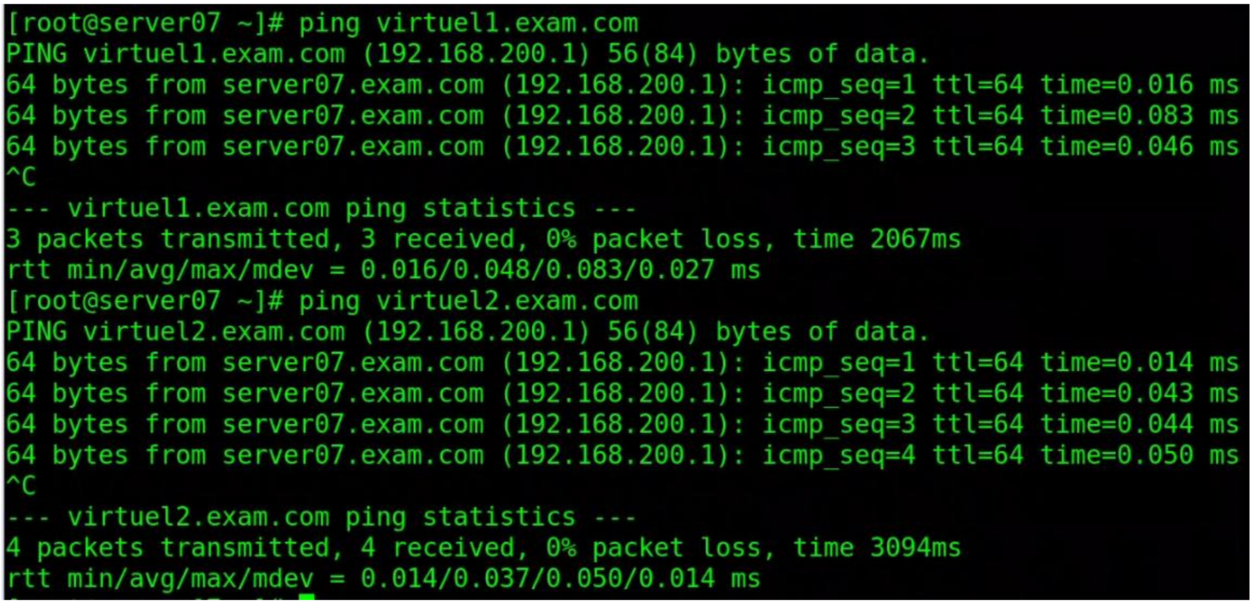
*Figure 22 exam.com.zone file content*

## Validation of DNS Server

I validated the DNS setup, all DNS queries correctly resolved to 192.168.200.1.



```
;; ANSWER SECTION:
virtuel1.exam.com.      80000   IN      A       192.168.200.1

;; Query time: 0 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Mon Apr 28 12:45:39 EDT 2025
;; MSG SIZE  rcvd: 90

[root@server07 ~]# dig virtuel2.exam.com

; <<>> DiG 9.16.23-RH <<>> virtuel2.exam.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 32067
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: a7412cfbcd6c39a001000000680fb0ce5835d73de16f06ae (good)
;; QUESTION SECTION:
;virtuel2.exam.com.             IN      A

;; ANSWER SECTION:
virtuel2.exam.com.      80000   IN      A       192.168.200.1
```

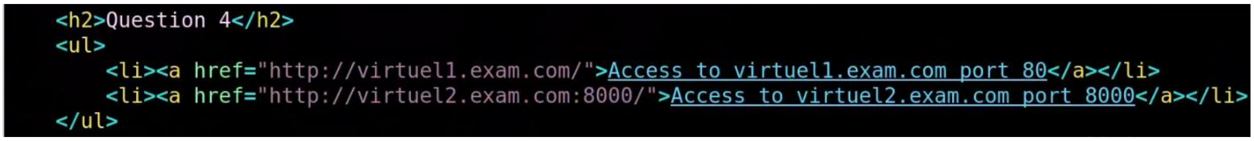


```
[root@server07 ~]# ping virtuel1.exam.com
PING virtuel1.exam.com (192.168.200.1) 56(84) bytes of data.
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=1 ttl=64 time=0.016 ms
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=2 ttl=64 time=0.083 ms
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=3 ttl=64 time=0.046 ms
^C
--- virtuel1.exam.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2067ms
rtt min/avg/max/mdev = 0.016/0.048/0.083/0.027 ms
[root@server07 ~]# ping virtuel2.exam.com
PING virtuel2.exam.com (192.168.200.1) 56(84) bytes of data.
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=1 ttl=64 time=0.014 ms
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=2 ttl=64 time=0.043 ms
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=3 ttl=64 time=0.044 ms
64 bytes from server07.exam.com (192.168.200.1): icmp_seq=4 ttl=64 time=0.050 ms
^C
--- virtuel2.exam.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3094ms
rtt min/avg/max/mdev = 0.014/0.037/0.050/0.014 ms
```

*Figure 23 Successful DNS resolution of Virtual Hosts*

## Update of Exam Homepage Hyperlinks for Question 4

I updated the index.html file located in /var/www/exam/ to create the necessary hyperlinks to validate the Virtual Hosts.

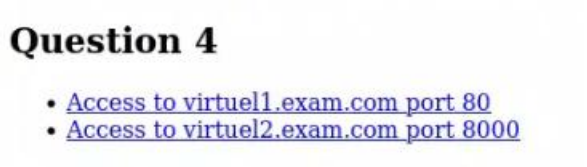


```
    <h2>Question 4</h2>
    <ul>
        <li><a href="http://virtuel1.exam.com/">Access to virtuel1.exam.com port 80</a></li>
        <li><a href="http://virtuel2.exam.com:8000/">Access to virtuel2.exam.com port 8000</a></li>
    </ul>
```

*Figure 24 Updated Final Exam homepage with Question 4 hyperlinks*

# Validating Question 4

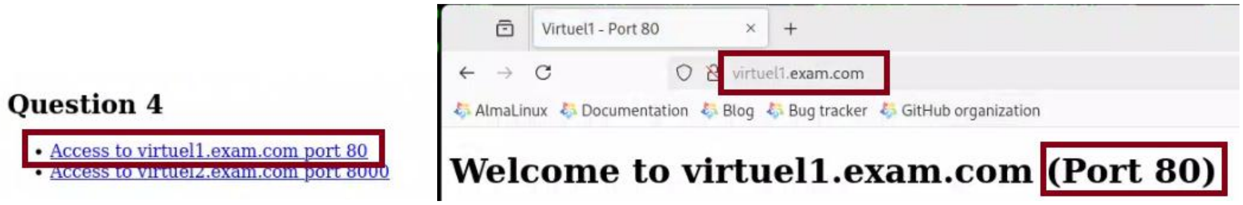
I accessed the servers via the browser



Question 4

- Access to virtuel1.exam.com port 80
- Access to virtuel2.exam.com port 8000

*Figure 25 Final Exam Homepage loaded via 192.168.200.1*

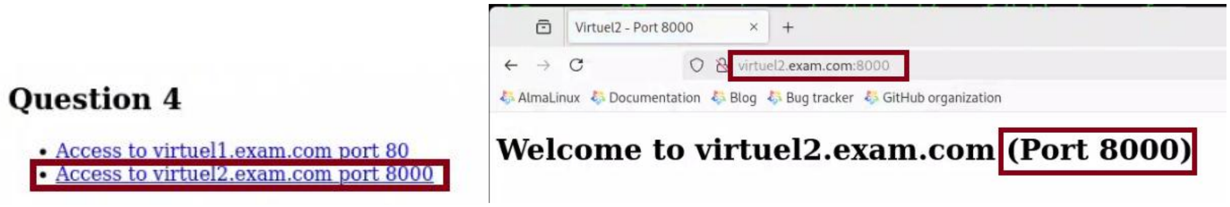


Question 4

- Access to virtuel1.exam.com port 80
- Access to virtuel2.exam.com port 8000

Welcome to virtuel1.exam.com (Port 80)

*Figure 26 Access to Virtuel1 VirtualHost*



Question 4

- Access to virtuel1.exam.com port 80
- Access to virtuel2.exam.com port 8000

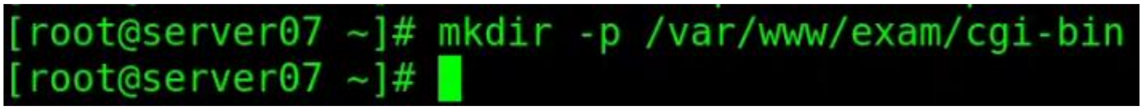
Welcome to virtuel2.exam.com (Port 8000)

*Figure 27 Access to Virtuel2 VirtualHost on Port 8000*

# CGI/Perl Script

## Creation of CGI Directory

I created the directory /var/www/exam/cgi-bin to store the Perl CGI script:

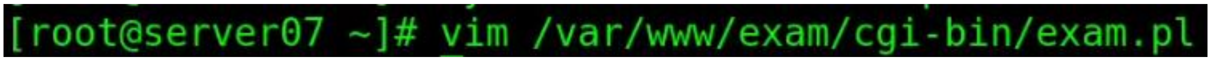


```
[root@server07 ~]# mkdir -p /var/www/exam/cgi-bin
[root@server07 ~]#
```

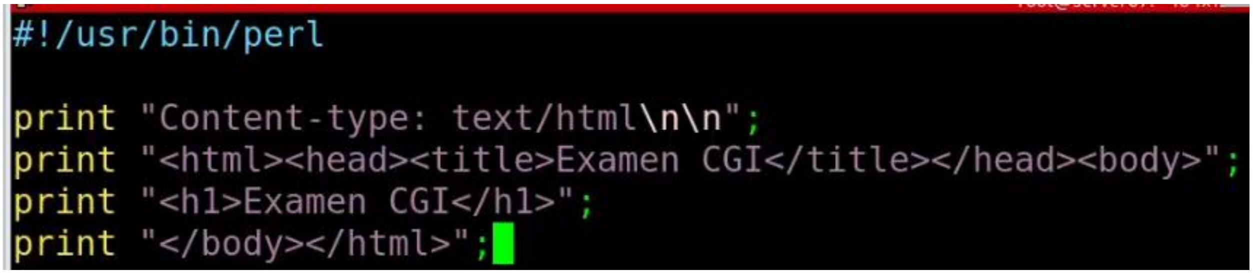
*Figure 28 Creation of the /var/www/exam/cgi-bin directory*

## Creation of Perl CGI Script

I created a Perl script named exam.pl inside /var/www/exam/cgi-bin

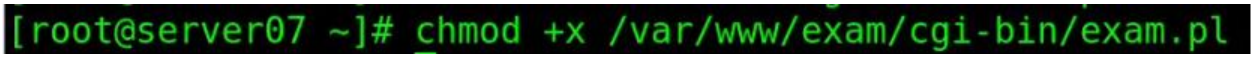


```
[root@server07 ~]# vim /var/www/exam/cgi-bin/exam.pl
```



```
#!/usr/bin/perl

print "Content-type: text/html\n\n";
print "<html><head><title>Examen CGI</title></head><body>";
print "<h1>Examen CGI</h1>";
print "</body></html>";
```

I then made the script executable:

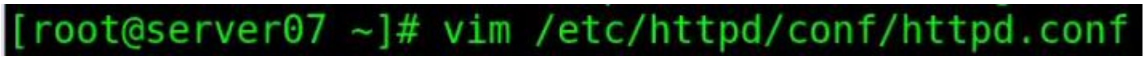


```
[root@server07 ~]# chmod +x /var/www/exam/cgi-bin/exam.pl
```

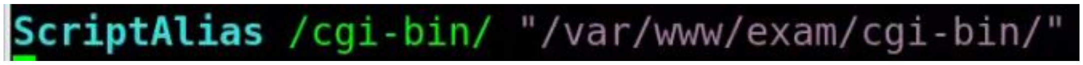
*Figure 29 Creation and permission adjustment of the exam.pl Perl script*

## Apache Configuration for CGI Access

I edited the Apache configuration file /etc/httpd/conf/httpd.conf to enable CGI execution and restrict access. First, I added a ScriptAlias to map /cgi-bin/ to our custom directory:

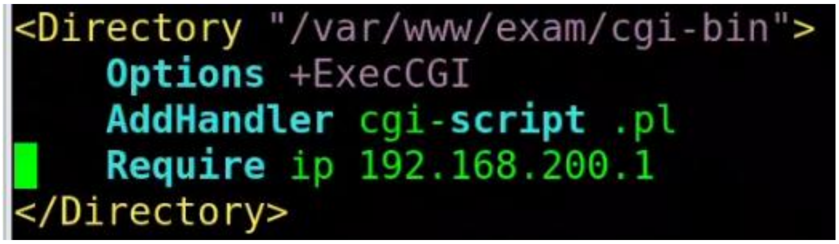


```
[root@server07 ~]# vim /etc/httpd/conf/httpd.conf
```



```
ScriptAlias /cgi-bin/ "/var/www/exam/cgi-bin/"
```

Then I added a <Directory> block to allow CGI execution and restrict it by IP:

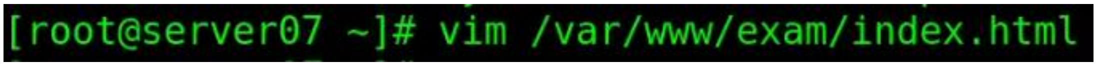


```
<Directory "/var/www/exam/cgi-bin">
    Options +ExecCGI
    AddHandler cgi-script .pl
    Require ip 192.168.200.1
</Directory>
```

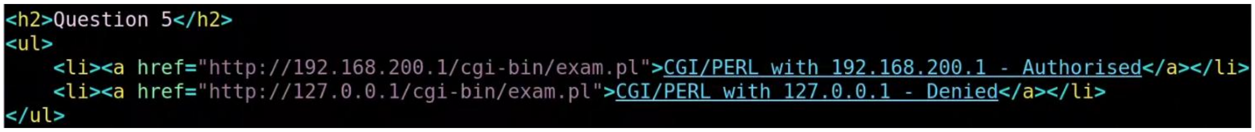
*Figure 30 Apache configuration for enabling CGI access and applying IP restrictions*

## Update of Exam Homepage Hyperlinks

I updated /var/www/exam/index.html to add links for Question 5:



```
[root@server07 ~]# vim /var/www/exam/index.html
```

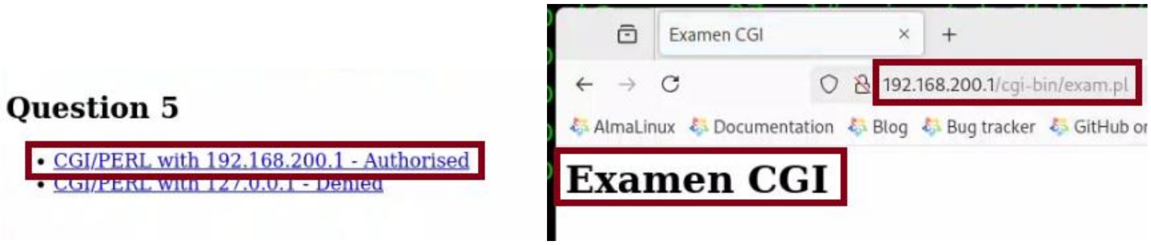


```
<h2>Question 5</h2>
<ul>
    <li><a href="http://192.168.200.1/cgi-bin/exam.pl">CGI/PERL with 192.168.200.1 - Authorised</a></li>
    <li><a href="http://127.0.0.1/cgi-bin/exam.pl">CGI/PERL with 127.0.0.1 - Denied</a></li>
</ul>
```

*Figure 31 Updated Final Exam homepage with Question 5 hyperlinks*

# Validating Question 5

I validated the functionality by accessing the hyperlinks from the "Final Exam" homepage.



**Question 5**

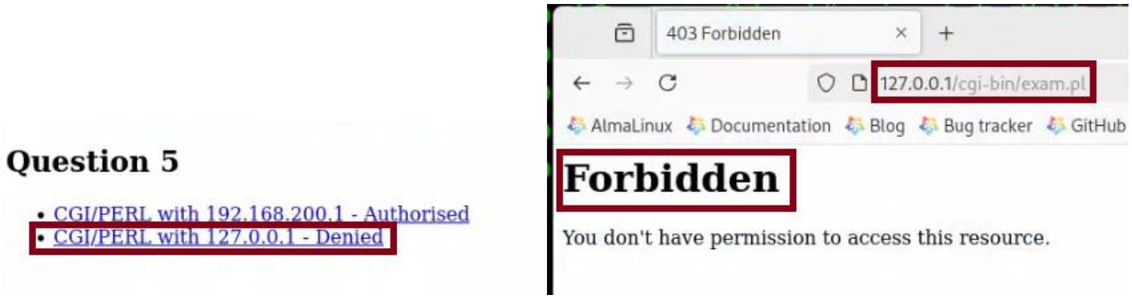
- CGI/PERL with 192.168.200.1 - Authorised
- CGI/PERL with 127.0.0.1 - Denied

Examen CGI

192.168.200.1/cgi-bin/exam.pl

**Examen CGI**

*Figure 32 Successful authorized access from 192.168.200.1*



**Question 5**

- CGI/PERL with 192.168.200.1 - Authorised
- CGI/PERL with 127.0.0.1 - Denied

403 Forbidden

127.0.0.1/cgi-bin/exam.pl

**Forbidden**

You don't have permission to access this resource.

*Figure 33 Denied access from 127.0.0.1*