Lab 2: Securing Apache Web Server

Task : Becoming a CA
Copied the OpenSSL Configuration Template to my directory apachesecure
cp /opt/homebrew/etc/openssl/openssl.cnf ./openssl.cnf

Created Require CA Structure :
mkdir certs crl newcerts private
touch index.txt
echo 1000 > serial

Generated Root CA Certificate (Self Signed):
openssl req -new -x509 -days 365 -keyout private/ca.key -out ca.crt -config openssl.cnf
Common Name: My Root CA
Set a password

It has created ca.crt and private/ca.key

Task : Generating certificates for example.com and webserverlab.com
I will now act as a CA to issue certificates for both sites

example.com:
Generating private key:
openssl genrsa -des3 -out example.key 2048

Generate CSR
openssl req -new -key example.key -out example.csr -config openssl.cnf

Sign CSR with My CA
It will create a signed certificate for the site and a private key

For webserver.com followed the same process

Task Launching HTTPS Test Server :

example.com
Combine Key + Cert for example.com
cp example.key example.pem
cat example.crt >> example.pem

Launch OpenSSL Test Server (Checkpoint 1–2)

openssl s_server -cert example.pem -www
By default, it runs on port 4433.

In browser https://example.com:4433 this shows all details. It means the HTTP server is ready

Task: Deploying HTTPS into Apache (Checkpoint 3, 4)

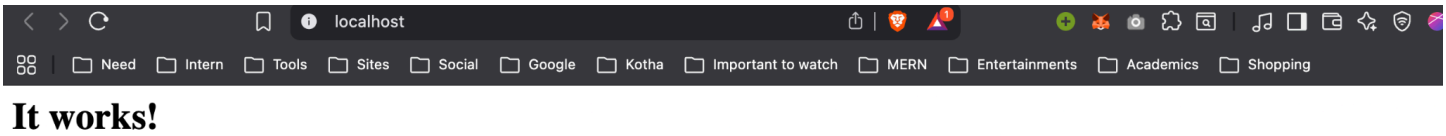
Enabling SSL Module
sudo /opt/homebrew/bin/httpd -M | grep ssl
Restart Apache
sudo apachectl restart

Configuring HTTPS Virtual Hosts

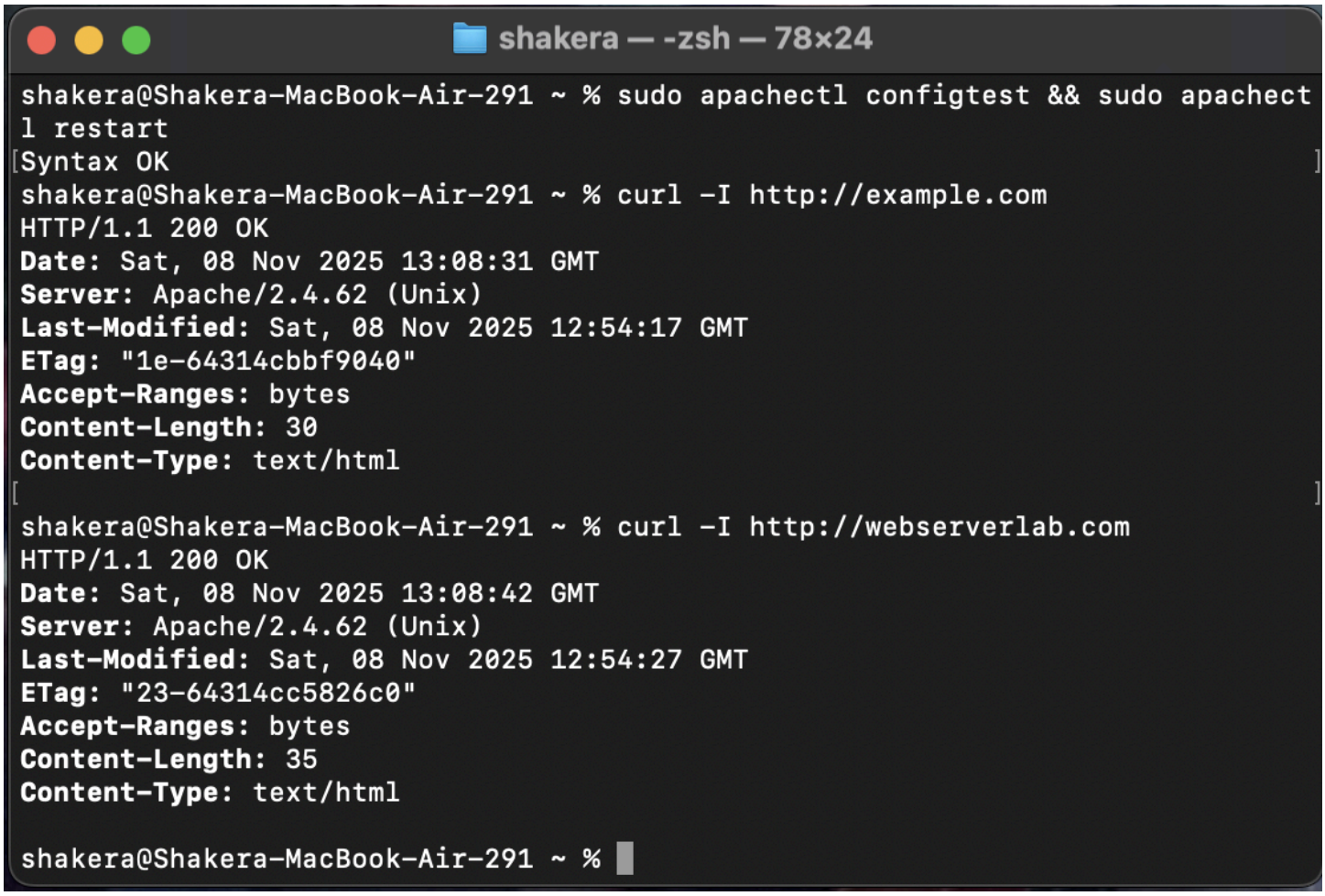
```
# HTTPS for example.com
<IfModule mod_ssl.c>
<VirtualHost *:443>
    ServerName example.com
    DocumentRoot "/opt/homebrew/var/www/example.com"
    ErrorLog "/opt/homebrew/var/logs/example-ssl-error.log"
    CustomLog "/opt/homebrew/var/logs/example-ssl-access.log" common

    SSLEngine on
    SSLCertificateFile "/Users/shakera/apachesecure/example.crt"
    SSLCertificateKeyFile "/Users/shakera/apachesecure/example.key"
</VirtualHost>
</IfModule>

# HTTPS for webserverlab.com
<IfModule mod_ssl.c>
<VirtualHost *:443>
    ServerName webserverlab.com
    DocumentRoot "/opt/homebrew/var/www/webserverlab.com"
    ErrorLog "/opt/homebrew/var/logs/webserverlab-ssl-error.log"
    CustomLog "/opt/homebrew/var/logs/webserverlab-ssl-access.log" common

    SSLEngine on
    SSLCertificateFile "/Users/shakera/apachesecure/webserverlab.crt"
    SSLCertificateKeyFile "/Users/shakera/apachesecure/webserverlab.key"
</VirtualHost>
</IfModule>
```

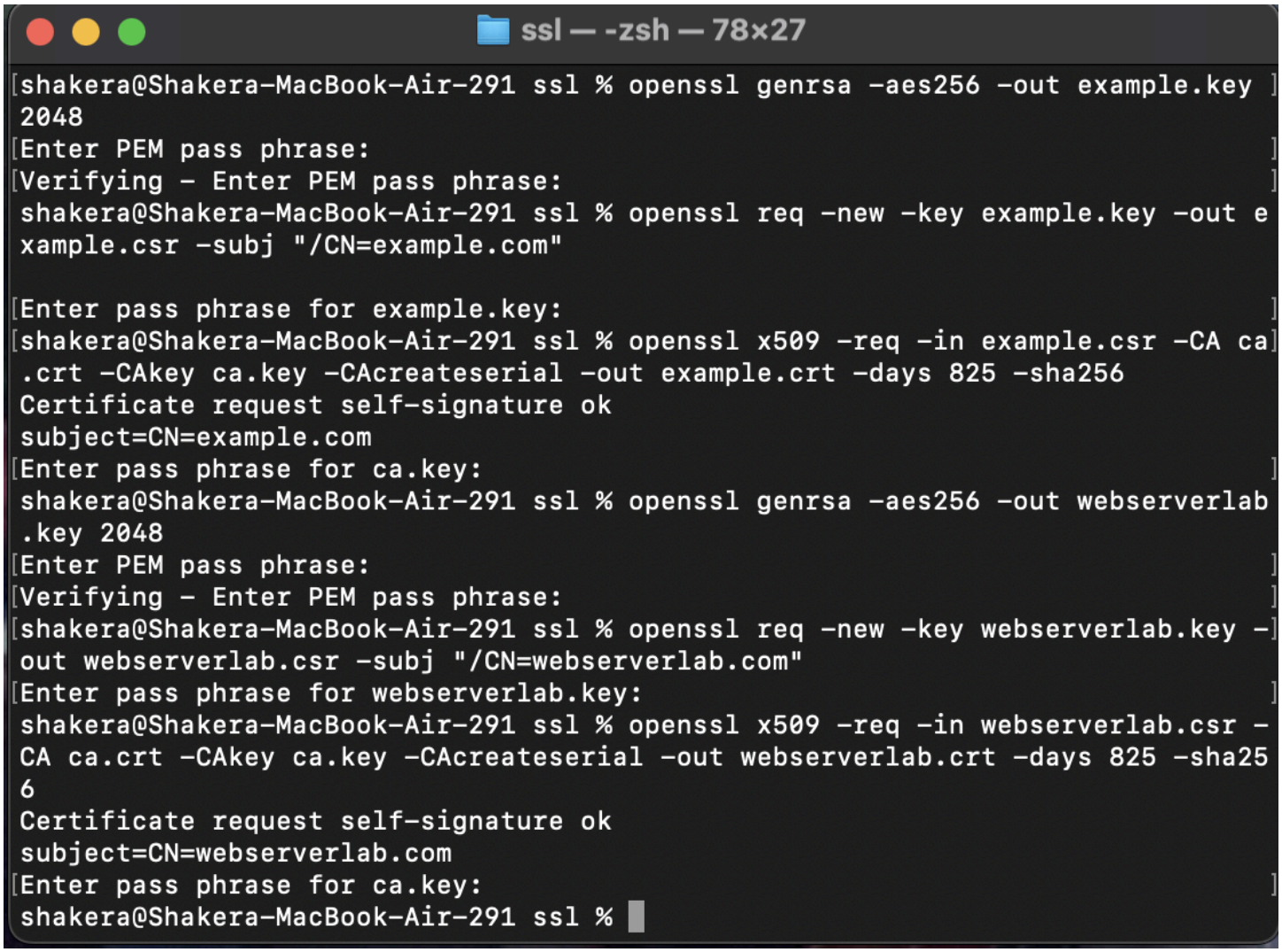
Tested in browser (it works, it loads the previously hosted dynamic website using HTML, JS)

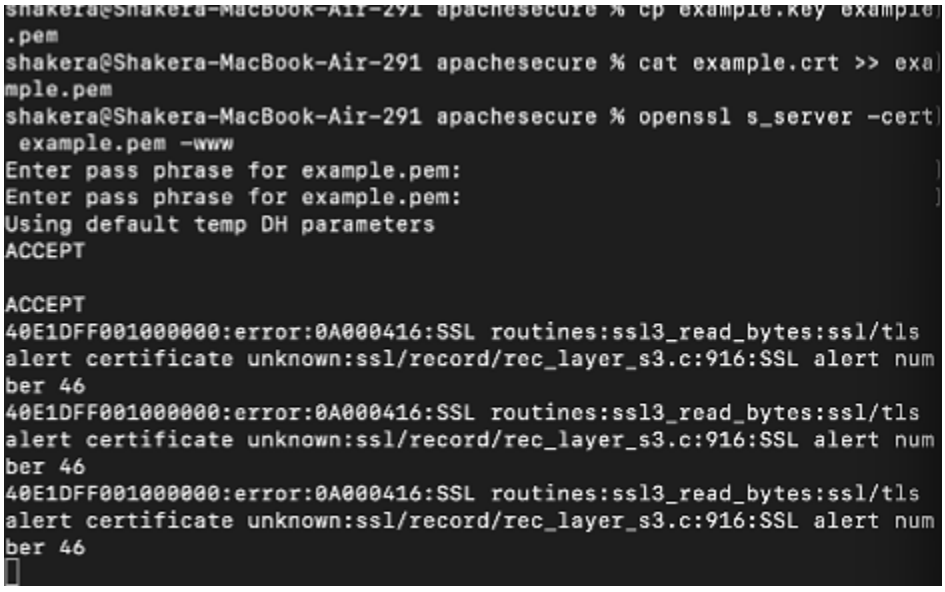
Snapshots:



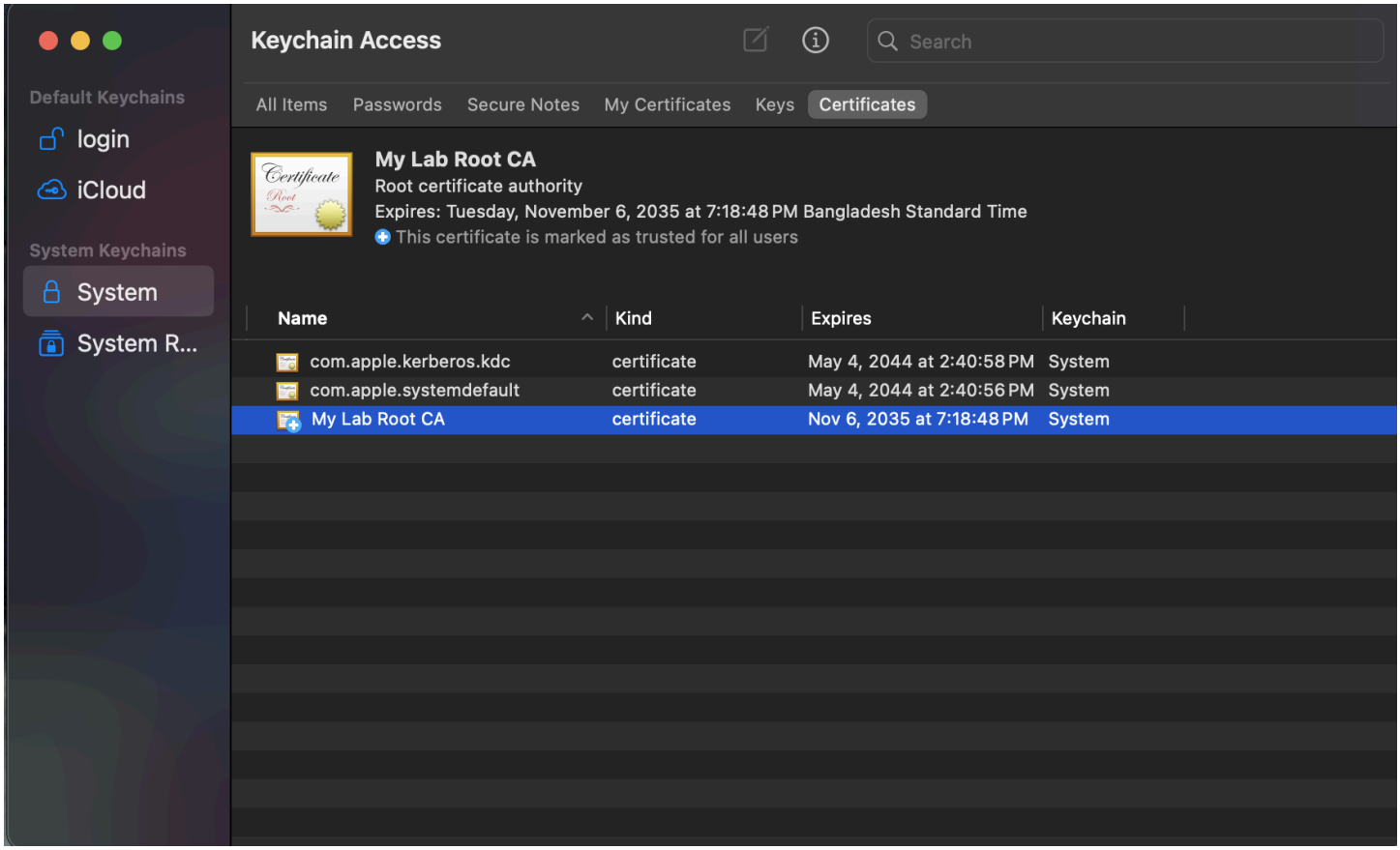
It works!

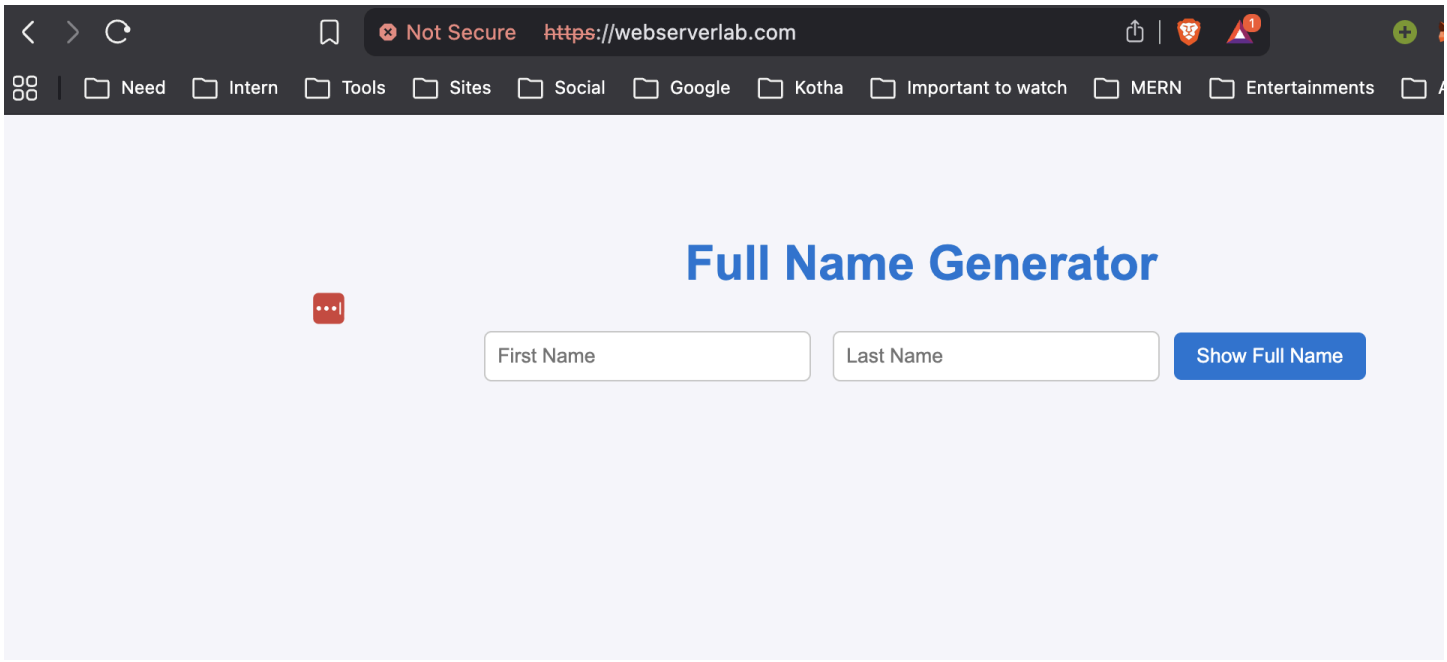


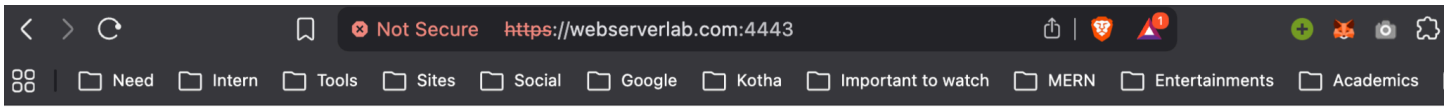

ssl — -zsh — 78×27
shakera@Shakera-MacBook-Air-291 ssl % openssl genrsa -aes256 -out example.key 2048
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:
shakera@Shakera-MacBook-Air-291 ssl % openssl req -new -key example.key -out example.csr -subj "/CN=example.com"
Enter pass phrase for example.key:
shakera@Shakera-MacBook-Air-291 ssl % openssl x509 -req -in example.csr -CA ca.crt -CAkey ca.key -CAcreateserial -out example.crt -days 825 -sha256
Certificate request self-signature ok
subject=CN=example.com
Enter pass phrase for ca.key:
shakera@Shakera-MacBook-Air-291 ssl % openssl genrsa -aes256 -out webserverlab.key 2048
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:
shakera@Shakera-MacBook-Air-291 ssl % openssl req -new -key webserverlab.key -out webserverlab.csr -subj "/CN=webserverlab.com"
Enter pass phrase for webserverlab.key:
shakera@Shakera-MacBook-Air-291 ssl % openssl x509 -req -in webserverlab.csr -CA ca.crt -CAkey ca.key -CAcreateserial -out webserverlab.crt -days 825 -sha256
Certificate request self-signature ok
subject=CN=webserverlab.com
Enter pass phrase for ca.key:
shakera@Shakera-MacBook-Air-291 ssl %


.pem
shakera@Shakera-MacBook-Air-291 apachesecure % cat example.crt >> example.pem
shakera@Shakera-MacBook-Air-291 apachesecure % openssl s_server -cert example.pem -www
Enter pass phrase for example.pem:
Enter pass phrase for example.pem:
Using default temp DH parameters
ACCEPT
ACCEPT
40E1DFF001000000:error:0A000416:SSL routines:ssl3_read_bytes:ssl/tls alert certificate unknown:ssl/record/rec_layer_s3.c:916:SSL alert number 46
40E1DFF001000000:error:0A000416:SSL routines:ssl3_read_bytes:ssl/tls alert certificate unknown:ssl/record/rec_layer_s3.c:916:SSL alert number 46
40E1DFF001000000:error:0A000416:SSL routines:ssl3_read_bytes:ssl/tls alert certificate unknown:ssl/record/rec_layer_s3.c:916:SSL alert number 46

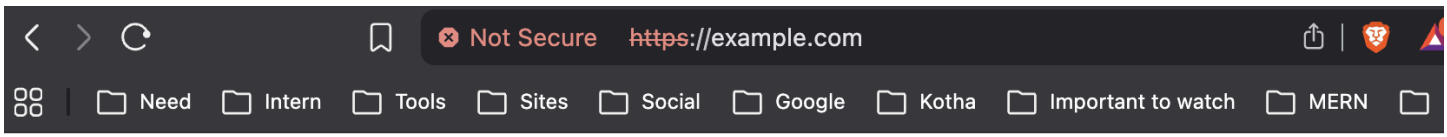
```
shakera@Shakera-MacBook-Air-291 apachesecure % openssl x509 -req -in
example.csr -CA ca.crt -CAkey private/ca.key -CAcreateserial -out exa
mple.crt -days 365 -sha256
Certificate request self-signature ok
subject=C=BD, CN=example.com
Enter pass phrase for private/ca.key:
shakera@Shakera-MacBook-Air-291 apachesecure %
```





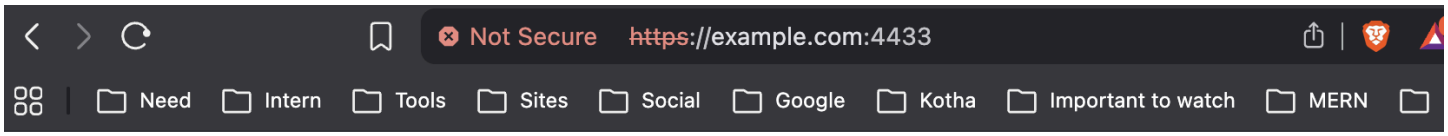



```
s_server -cert webserverlab.pem -www -accept 4443
This TLS version forbids renegotiation.
Ciphers supported in s_server binary
TLSv1.3    :TLS_AES_256_GCM_SHA384    TLSv1.3    :TLS_CHACHA20_POLY1305_SHA256
TLSv1.3    :TLS_AES_128_GCM_SHA256    TLSv1.2    :ECDHE-ECDSA-AES256-GCM-SHA384
TLSv1.2    :ECDHE-RSA-AES256-GCM-SHA384 TLSv1.2    :DHE-RSA-AES256-GCM-SHA384
TLSv1.2    :ECDHE-ECDSA-CHACHA20-POLY1305 TLSv1.2    :ECDHE-RSA-CHACHA20-POLY1305
TLSv1.2    :DHE-RSA-CHACHA20-POLY1305 TLSv1.2    :ECDHE-ECDSA-AES128-GCM-SHA256
TLSv1.2    :ECDHE-RSA-AES128-GCM-SHA256 TLSv1.2    :DHE-RSA-AES128-GCM-SHA256
TLSv1.2    :ECDHE-ECDSA-AES256-SHA384 TLSv1.2    :ECDHE-RSA-AES256-SHA384
TLSv1.2    :DHE-RSA-AES256-SHA256     TLSv1.2    :ECDHE-ECDSA-AES128-SHA256
TLSv1.2    :ECDHE-RSA-AES128-SHA256   TLSv1.2    :DHE-RSA-AES128-SHA256
TLSv1.0    :ECDHE-ECDSA-AES256-SHA    TLSv1.0    :ECDHE-RSA-AES256-SHA
SSLv3      :DHE-RSA-AES256-SHA        TLSv1.0    :ECDHE-ECDSA-AES128-SHA
TLSv1.0    :ECDHE-RSA-AES128-SHA      SSLv3      :DHE-RSA-AES128-SHA
TLSv1.2    :RSA-PSK-AES256-GCM-SHA384 TLSv1.2    :DHE-PSK-AES256-GCM-SHA384
TLSv1.2    :RSA-PSK-CHACHA20-POLY1305 TLSv1.2    :DHE-PSK-CHACHA20-POLY1305
TLSv1.2    :ECDHE-PSK-CHACHA20-POLY1305 TLSv1.2    :AES256-GCM-SHA384
TLSv1.2    :PSK-AES256-GCM-SHA384     TLSv1.2    :PSK-CHACHA20-POLY1305
TLSv1.2    :RSA-PSK-AES128-GCM-SHA256 TLSv1.2    :DHE-PSK-AES128-GCM-SHA256
TLSv1.2    :AES128-GCM-SHA256         TLSv1.2    :PSK-AES128-GCM-SHA256
TLSv1.2    :AES256-SHA256             TLSv1.2    :AES128-SHA256
TLSv1.0    :ECDHE-PSK-AES256-CBC-SHA384 TLSv1.0    :ECDHE-PSK-AES256-CBC-SHA
SSLv3      :SRP-RSA-AES-256-CBC-SHA   SSLv3      :SRP-AES-256-CBC-SHA
TLSv1.0    :RSA-PSK-AES256-CBC-SHA384 TLSv1.0    :DHE-PSK-AES256-CBC-SHA384
SSLv3      :RSA-PSK-AES256-CBC-SHA    SSLv3      :DHE-PSK-AES256-CBC-SHA
SSLv3      :AES256-SHA                TLSv1.0    :PSK-AES256-CBC-SHA384
SSLv3      :PSK-AES256-CBC-SHA        TLSv1.0    :ECDHE-PSK-AES128-CBC-SHA256
TLSv1.0    :ECDHE-PSK-AES128-CBC-SHA  SSLv3      :SRP-RSA-AES-128-CBC-SHA
SSLv3      :SRP-AES-128-CBC-SHA       TLSv1.0    :RSA-PSK-AES128-CBC-SHA256
TLSv1.0    :DHE-PSK-AES128-CBC-SHA256 SSLv3      :RSA-PSK-AES128-CBC-SHA
SSLv3      :DHE-PSK-AES128-CBC-SHA    SSLv3      :AES128-SHA
TLSv1.0    :PSK-AES128-CBC-SHA256     SSLv3      :PSK-AES128-CBC-SHA
---
Ciphers common between both SSL end points:
TLS_AES_128_GCM_SHA256     TLS_AES_256_GCM_SHA384     TLS_CHACHA20_POLY1305_SHA256
ECDHE-ECDSA-AES128-GCM-SHA256 ECDHE-RSA-AES128-GCM-SHA256 ECDHE-ECDSA-AES256-GCM-SHA384
ECDHE-RSA-AES256-GCM-SHA384 ECDHE-ECDSA-CHACHA20-POLY1305 ECDHE-RSA-CHACHA20-POLY1305
ECDHE-RSA-AES128-SHA       ECDHE-RSA-AES256-SHA       AES128-GCM-SHA256
AES256-GCM-SHA384          AES128-SHA                 AES256-SHA
Signature Algorithms: ECDSA+SHA256:RSA-PSS+SHA256:RSA+SHA256:ECDSA+SHA384:RSA-PSS+SHA384:RSA+SHA384:RSA-PSS+SHA512:RSA+SHA512
Shared Signature Algorithms: ECDSA+SHA256:RSA-PSS+SHA256:RSA+SHA256:ECDSA+SHA384:RSA-PSS+SHA384:RSA+SHA384:RSA-PSS+SHA512:RSA+SHA512
Supported groups: :X25519MLKEM768:x25519:secp256r1:secp384r1
Shared groups: X25519MLKEM768:x25519:secp256r1:secp384r1
```



Simple Calculator

Number 1 | Number 2 | Add




```
s_server -cert example.pem -www
This TLS version forbids renegotiation.
Ciphers supported in s_server binary
TLSv1.3    :TLS_AES_256_GCM_SHA384    TLSv1.3    :TLS_CHACHA20_POLY1305_SHA256
TLSv1.3    :TLS_AES_128_GCM_SHA256    TLSv1.2    :ECDHE-ECDSA-AES256-GCM-SHA384
TLSv1.2    :ECDHE-RSA-AES256-GCM-SHA384 TLSv1.2    :DHE-RSA-AES256-GCM-SHA384
TLSv1.2    :ECDHE-ECDSA-CHACHA20-POLY1305 TLSv1.2    :ECDHE-RSA-CHACHA20-POLY1305
TLSv1.2    :DHE-RSA-CHACHA20-POLY1305 TLSv1.2    :ECDHE-ECDSA-AES128-GCM-SHA256
TLSv1.2    :ECDHE-RSA-AES128-GCM-SHA256 TLSv1.2    :DHE-RSA-AES128-GCM-SHA256
TLSv1.2    :ECDHE-ECDSA-AES256-SHA384 TLSv1.2    :ECDHE-RSA-AES256-SHA384
TLSv1.2    :DHE-RSA-AES256-SHA256     TLSv1.2    :ECDHE-ECDSA-AES128-SHA256
TLSv1.2    :ECDHE-RSA-AES128-SHA256   TLSv1.2    :DHE-RSA-AES128-SHA256
TLSv1.0    :ECDHE-ECDSA-AES256-SHA    TLSv1.0    :ECDHE-RSA-AES256-SHA
SSLv3      :DHE-RSA-AES256-SHA        TLSv1.0    :ECDHE-ECDSA-AES128-SHA
TLSv1.0    :ECDHE-RSA-AES128-SHA      SSLv3      :DHE-RSA-AES128-SHA
TLSv1.2    :RSA-PSK-AES256-GCM-SHA384 TLSv1.2    :DHE-PSK-AES256-GCM-SHA384
TLSv1.2    :RSA-PSK-CHACHA20-POLY1305 TLSv1.2    :DHE-PSK-CHACHA20-POLY1305
TLSv1.2    :ECDHE-PSK-CHACHA20-POLY1305 TLSv1.2    :AES256-GCM-SHA384
TLSv1.2    :PSK-AES256-GCM-SHA384     TLSv1.2    :PSK-CHACHA20-POLY1305
TLSv1.2    :RSA-PSK-AES128-GCM-SHA256 TLSv1.2    :DHE-PSK-AES128-GCM-SHA256
TLSv1.2    :AES128-GCM-SHA256         TLSv1.2    :PSK-AES128-GCM-SHA256
TLSv1.2    :AES256-SHA256             TLSv1.2    :AES128-SHA256
TLSv1.0    :ECDHE-PSK-AES256-CBC-SHA384 TLSv1.0    :ECDHE-PSK-AES256-CBC-SHA
SSLv3      :SRP-RSA-AES-256-CBC-SHA   SSLv3      :SRP-AES-256-CBC-SHA
TLSv1.0    :RSA-PSK-AES256-CBC-SHA384 TLSv1.0    :DHE-PSK-AES256-CBC-SHA384
SSLv3      :RSA-PSK-AES256-CBC-SHA    SSLv3      :DHE-PSK-AES256-CBC-SHA
SSLv3      :AES256-SHA                TLSv1.0    :PSK-AES256-CBC-SHA384
SSLv3      :PSK-AES256-CBC-SHA        TLSv1.0    :ECDHE-PSK-AES128-CBC-SHA256
TLSv1.0    :ECDHE-PSK-AES128-CBC-SHA  SSLv3      :SRP-RSA-AES-128-CBC-SHA
SSLv3      :SRP-AES-128-CBC-SHA       TLSv1.0    :RSA-PSK-AES128-CBC-SHA256
TLSv1.0    :DHE-PSK-AES128-CBC-SHA256 SSLv3      :RSA-PSK-AES128-CBC-SHA
SSLv3      :DHE-PSK-AES128-CBC-SHA    SSLv3      :AES128-SHA
TLSv1.0    :PSK-AES128-CBC-SHA256     SSLv3      :PSK-AES128-CBC-SHA
---
Ciphers common between both SSL end points:
TLS_AES_128_GCM_SHA256     TLS_AES_256_GCM_SHA384     TLS_CHACHA20_POLY1305_SHA256
ECDHE-ECDSA-AES128-GCM-SHA256 ECDHE-RSA-AES128-GCM-SHA256 ECDHE-ECDSA-AES256-GCM-SHA384
ECDHE-RSA-AES256-GCM-SHA384 ECDHE-ECDSA-CHACHA20-POLY1305 ECDHE-RSA-CHACHA20-POLY1305
ECDHE-RSA-AES128-SHA       ECDHE-RSA-AES256-SHA       AES128-GCM-SHA256
AES256-GCM-SHA384          AES128-SHA                 AES256-SHA
Signature Algorithms: ECDSA+SHA256:RSA-PSS+SHA256:RSA+SHA256:ECDSA+SHA384:RSA-PSS+SHA384:RSA+SHA384:RSA-PS
Shared Signature Algorithms: ECDSA+SHA256:RSA-PSS+SHA256:RSA+SHA256:ECDSA+SHA384:RSA-PSS+SHA384:RSA+SHA384
Supported groups: :X25519MLKEM768:x25519:secp256r1:secp384r1
Shared groups: X25519MLKEM768:x25519:secp256r1:secp384r1
```