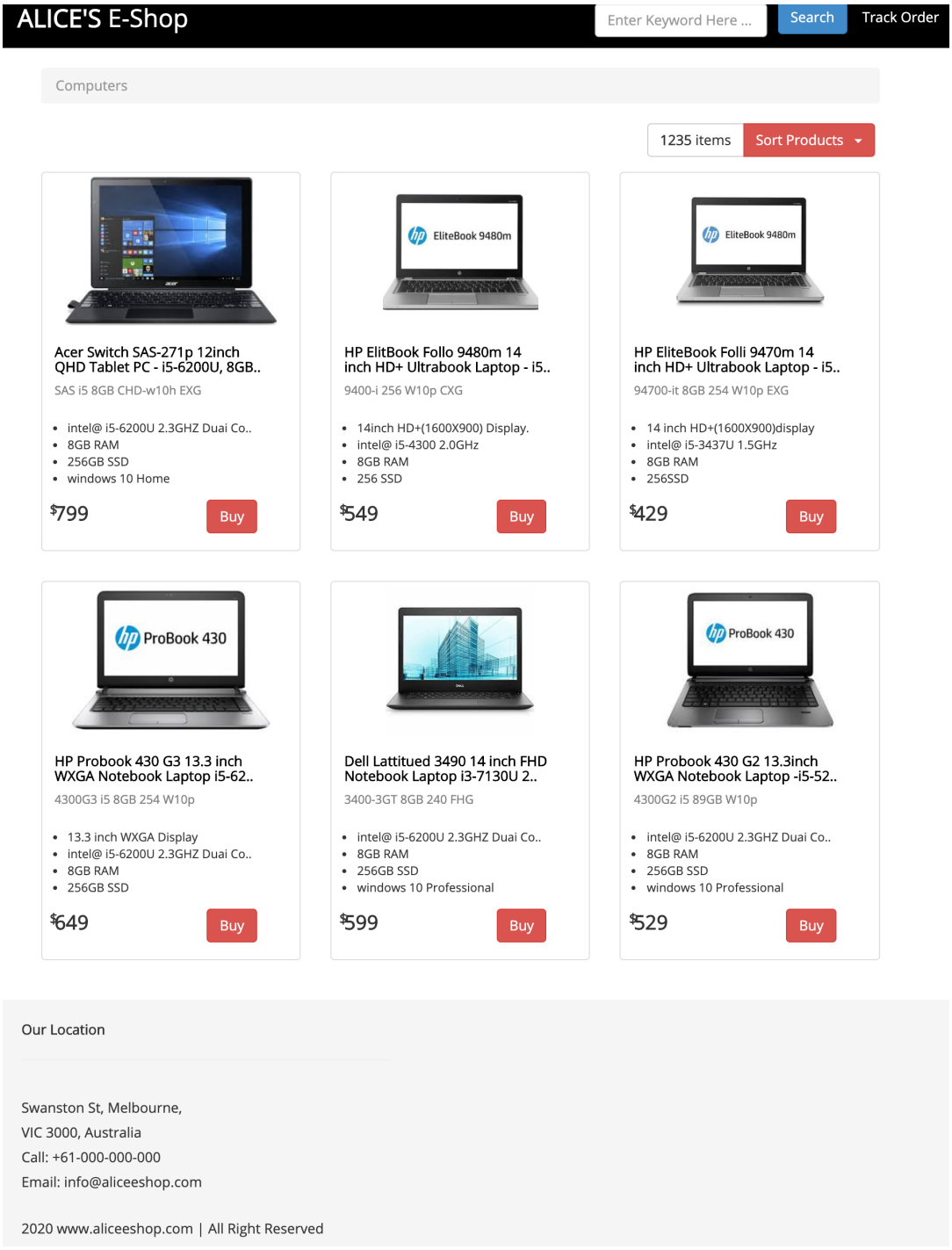
Q1(a):
All realted files in templates folder and static folder



127.0.0.1:5000/shopping_cart/1

github ITpart HY BingDic YouTube douban Job 临时 Quora 喜 谷歌翻译

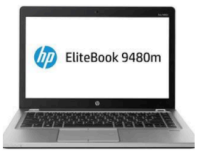
LICE'S E-Shop

Enter Keyword Here ... Search Track Order

Computers

1235 items Sort Products

Shopping Cart

Remove	Image	Product Description	Price	Qty	Total
☐		HP ElitBook Follo 9480m 14 inch HD+ Ultrabook Laptop - i5.. 9400-i 256 W10p CXG • 14inch HD+(1600X900) Display. • intel@ i5-4300 2.0GHz • 8GB RAM • 256 SSD	$549	1	$549

Remove Update Qty

Select Payment Option

VISA MasterCard PayPal AMERICAN EXPRESS Alipay G Pay Pay

Check out Now >>>

127.0.0.1:5000/shopping_cart/1

mail github ITpart HY BingDic YouTube douban Job 临时 Quora 喜 谷歌翻译

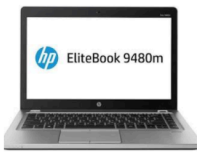
ALICE'S E-Shop

Enter Keyword Here ... Search Track Order

Computers

1235 items Sort Products

Shopping Cart

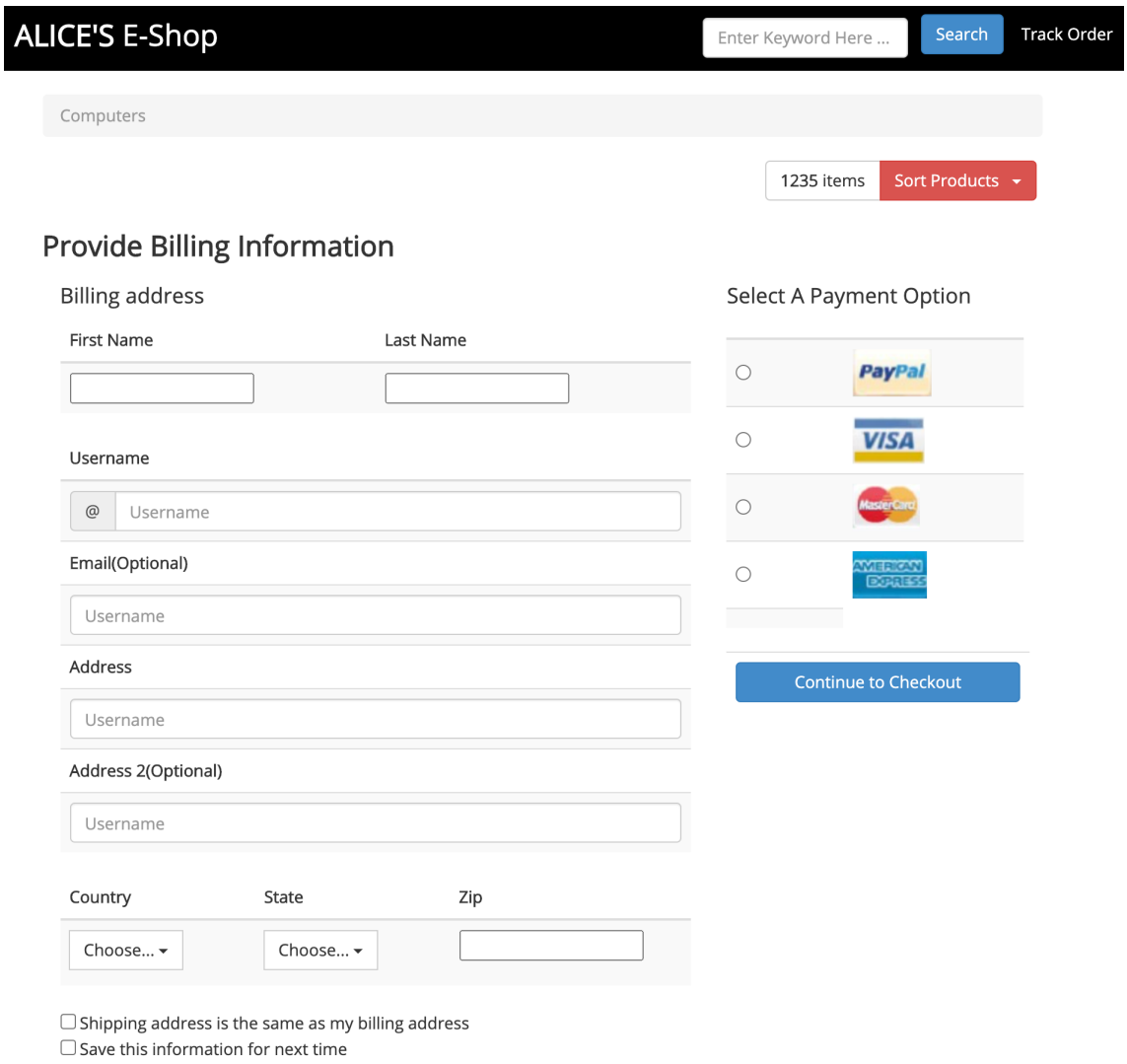
Remove	Image	Product Description	Price	Qty	Total
☐		HP ElitBook Follo 9480m 14 inch HD+ Ultrabook Laptop - i5.. 9400-i 256 W10p CXG • 14inch HD+(1600X900) Display. • intel@ i5-4300 2.0GHz • 8GB RAM • 256 SSD	$549	2	$1098

Remove Update Qty

Select Payment Option

VISA MasterCard PayPal AMERICAN EXPRESS Alipay G Pay Pay

Check out Now >>>



Q1 (b)

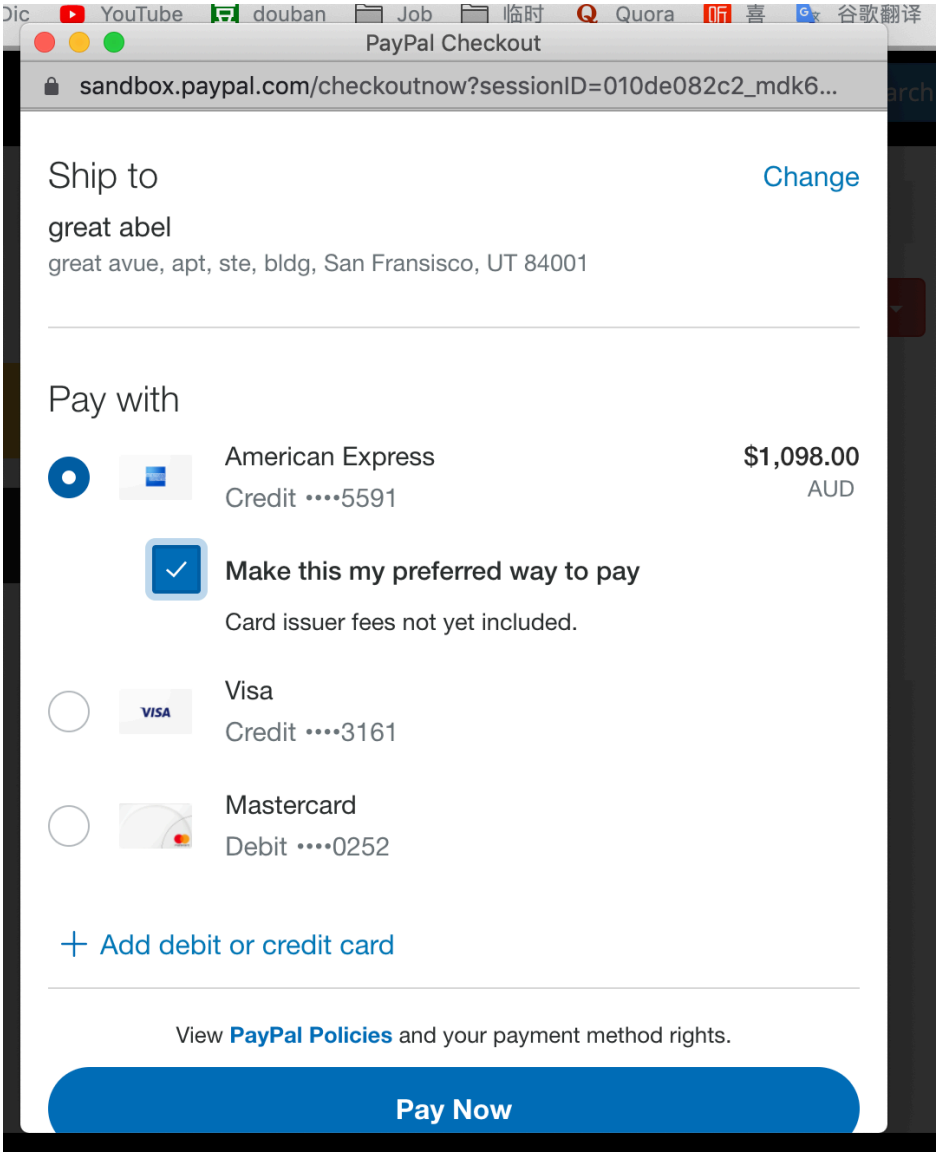
Paypal , mastercard, visa, America_express integrated by folowing way:

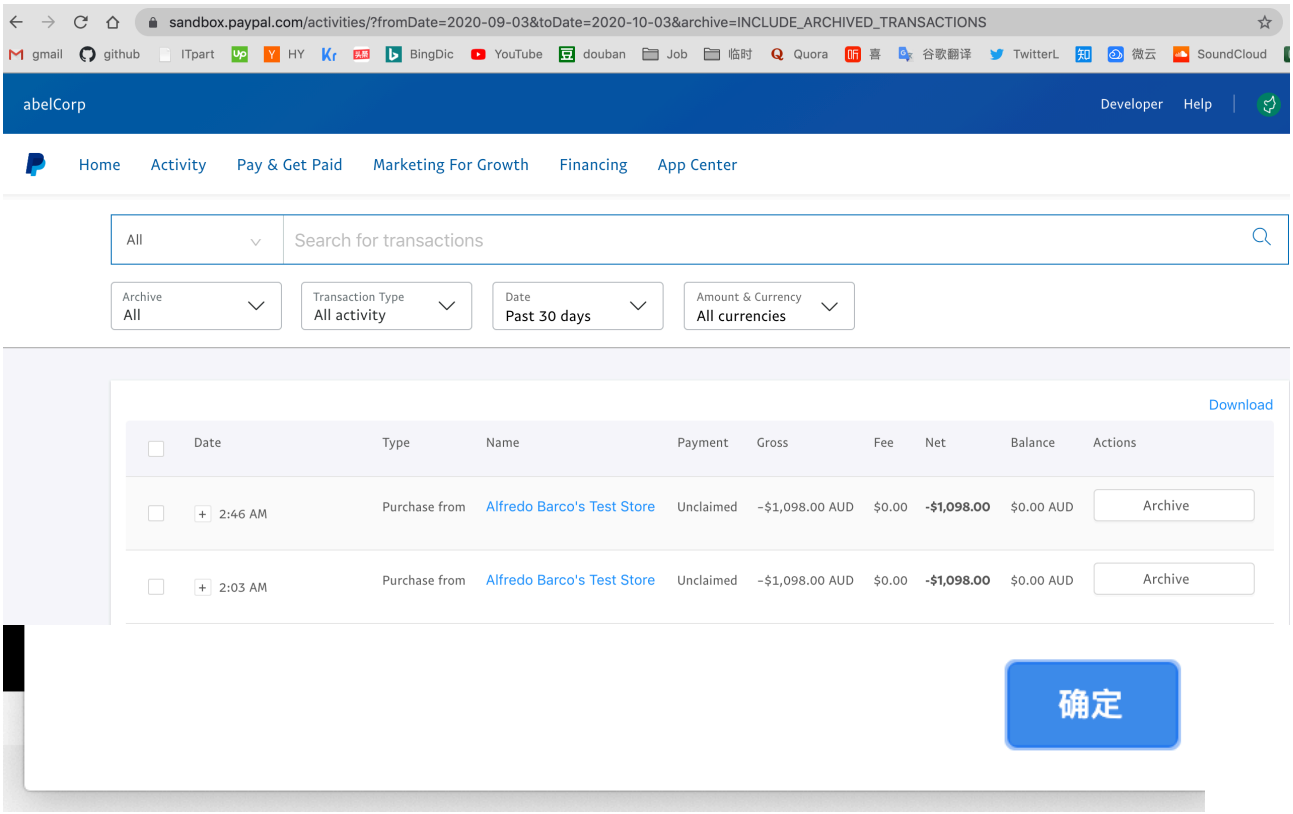
1. goto setting of soundbox.paypal , add all the payment (mastercard, visa, America_express)options into pay options
2. and set one of card/bank to be defualt of paypal payment.
3. goto sdk of paypal , generate related javascript codes and css files.
4. Add related javascript and css files into my html template files:

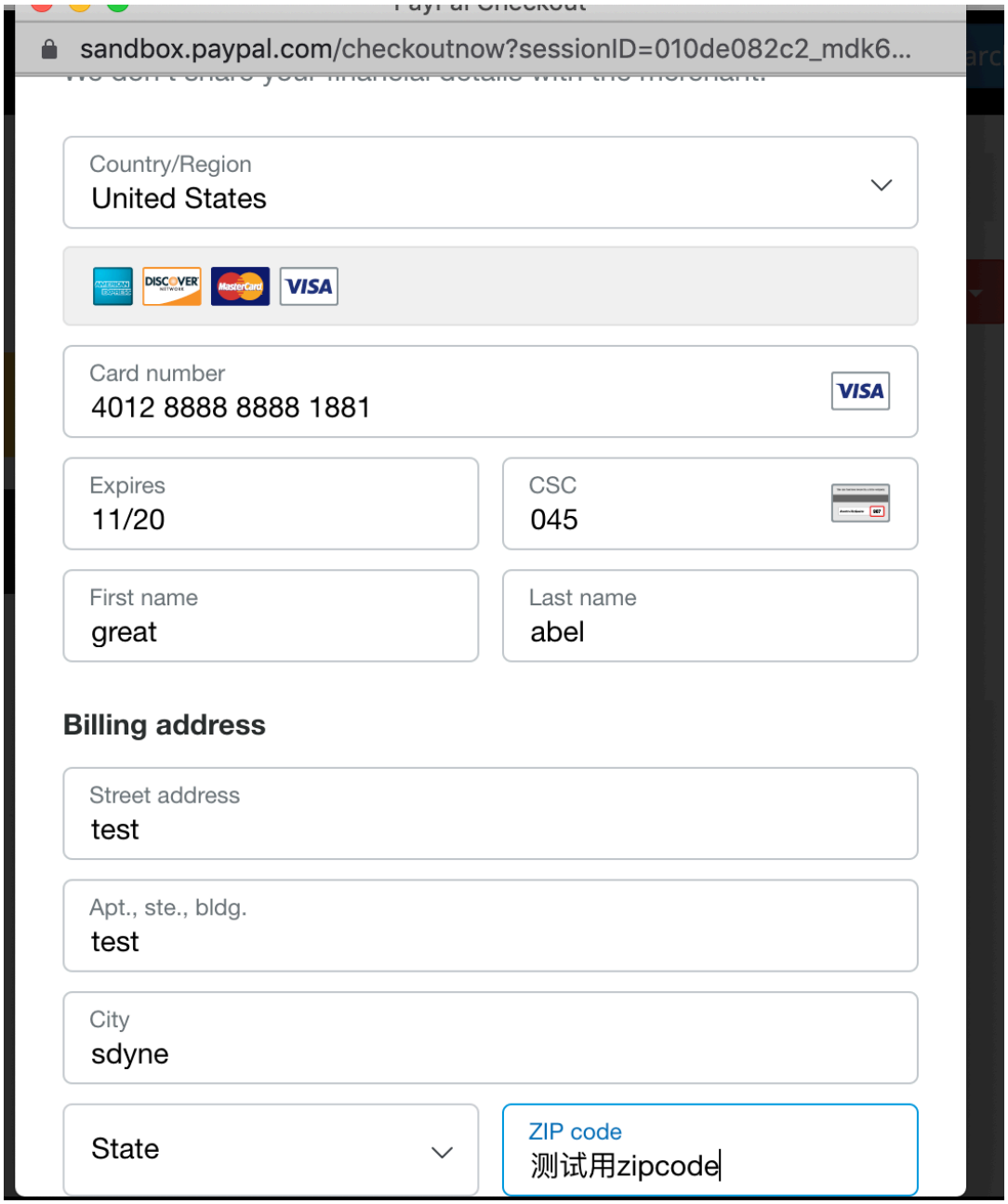
```
<div id="smart-button-container">
    <div style="text-align: center;">
      <div id="paypal-button-container"></div>
    </div>
  </div>
 <script src="https://www.paypal.com/sdk/js?client-id=sb&currency=AUD"
data-sdk-integration-source="button-factory"></script>
 <script>
  function initPayPalButton() {
    paypal.Buttons({
      style: {
```

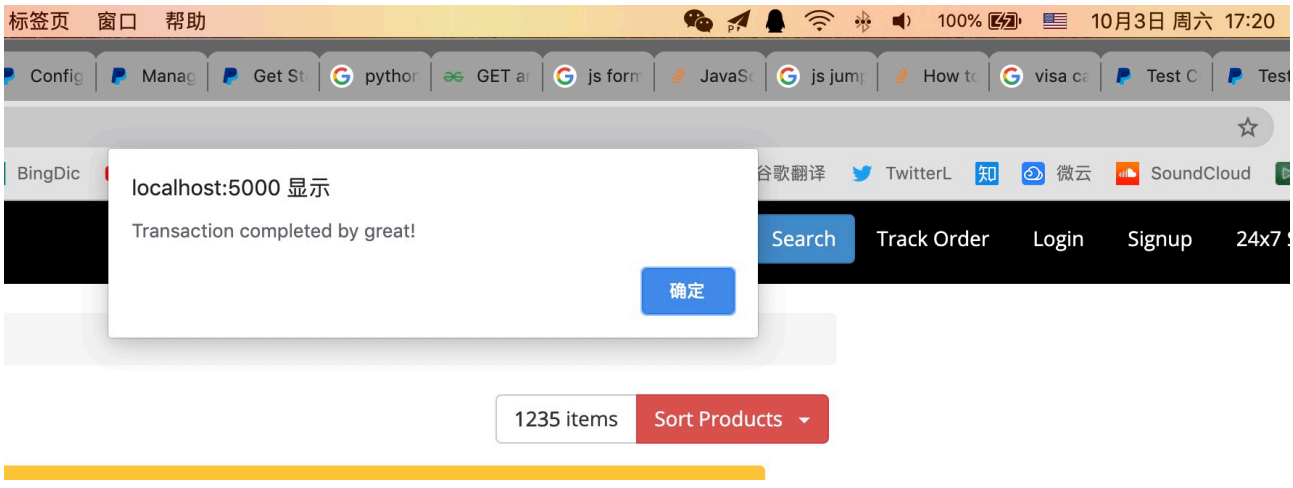
```
        shape: 'rect',
        color: 'gold',
        layout: 'vertical',
        label: 'paypal',

      },

      createOrder: function(data, actions) {
          var total = $('#total').val();
        return actions.order.create({
          purchase_units: [{"amount":{"currency_code":"AUD","value":total}}]
        });
      },

      onApprove: function(data, actions) {
        return actions.order.capture().then(function(details) {
          alert('Transaction completed by ' + details.payer.name.given_name +
'!');
        });
      },

      onError: function(err) {
        console.log(err);
      }
    }).render('#paypal-button-container');
  }
  initPayPalButton();
</script>

            </div>
            <!-- /.row -->

          </div>
          <!-- /.col -->
        </div>
        <!-- /.row -->
    </div>
```

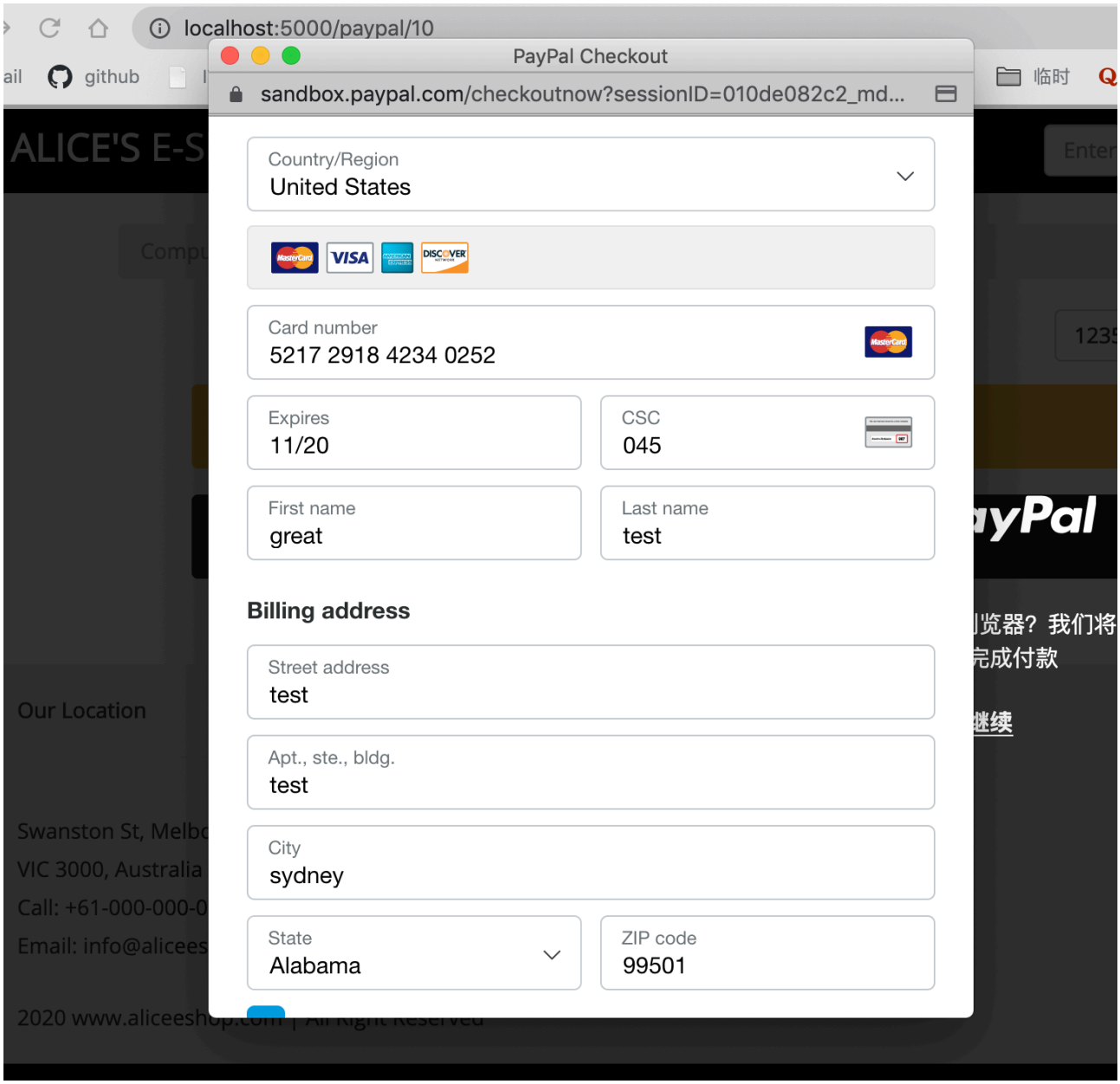
5. then we can pay with : papal , or other integrated 3 credit card:

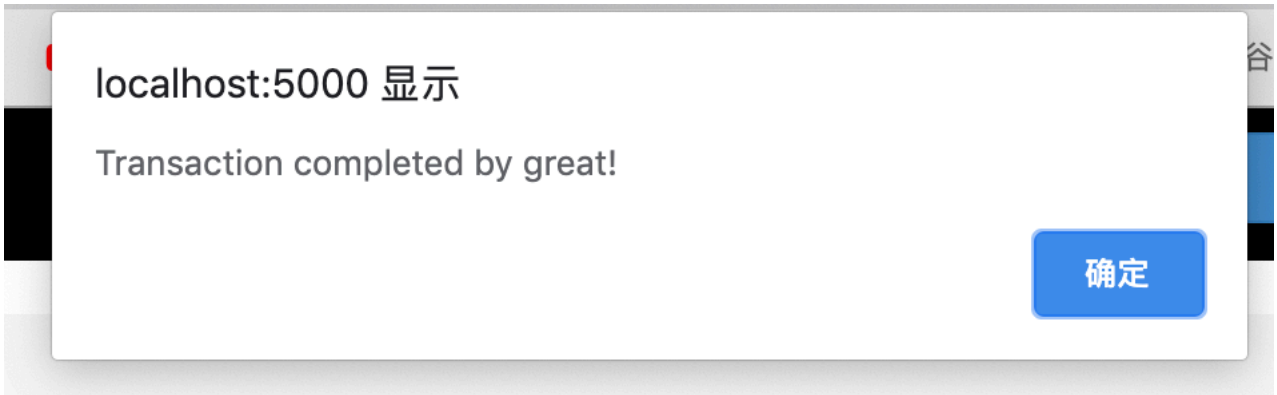

YouTube
douban
Job
临时
Quora
喜
谷歌翻译
PayPal Checkout
sandbox.paypal.com/checkoutnow?sessionID=010de082c2_mdk6...
Ship to
Change
great abel
great avue, apt, ste, bldg, San Fransisco, UT 84001
Pay with
American Express
Credit ••••5591
$1,098.00
AUD
Make this my preferred way to pay
Card issuer fees not yet included.
Visa
Credit ••••3161
Mastercard
Debit ••••0252
Add debit or credit card
View PayPal Policies and your payment method rights.
Pay Now

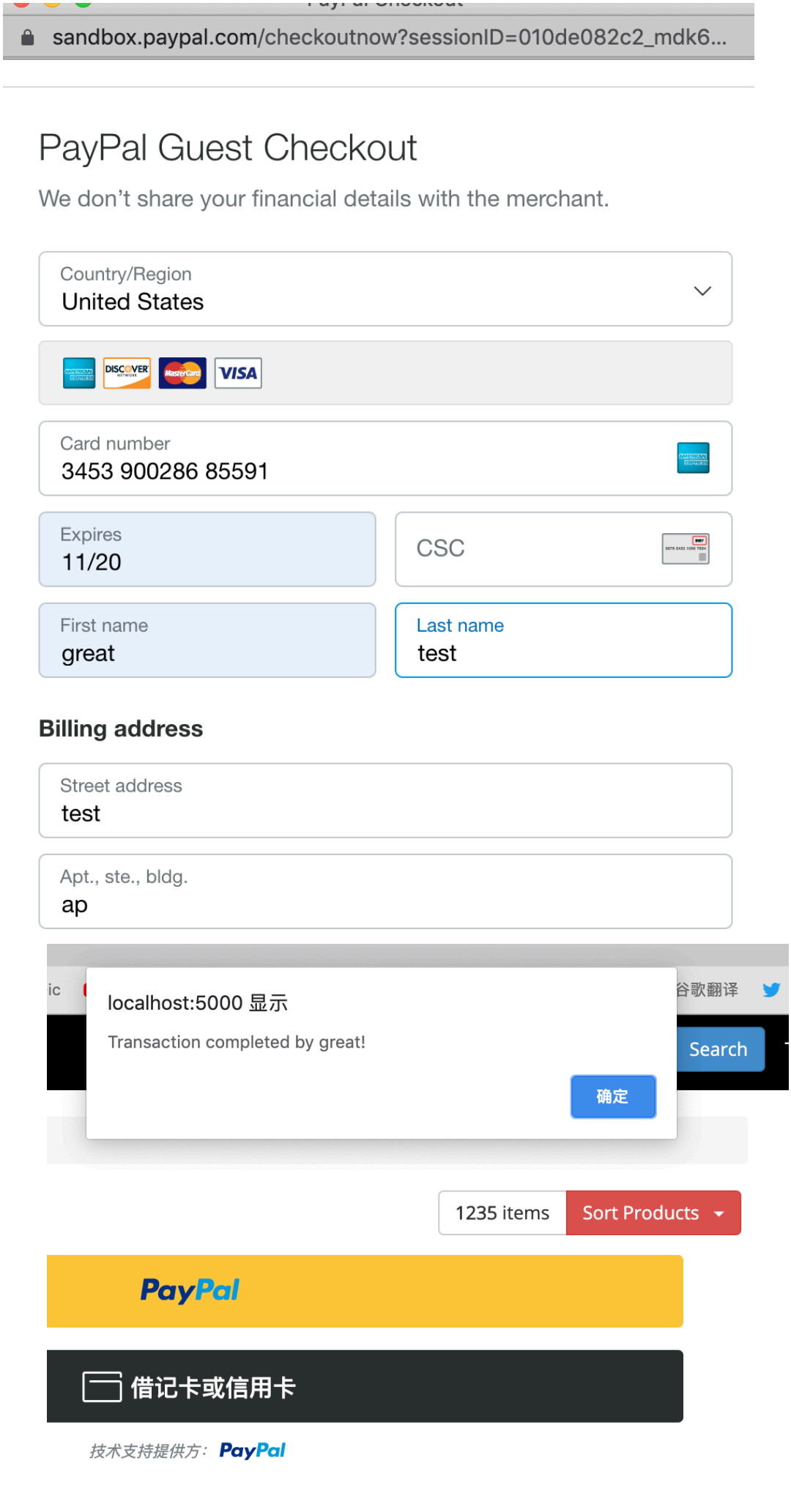

sandbox.paypal.com/activities/?fromDate=2020-09-03&toDate=2020-10-03&archive=INCLUDE_ARCHIVED_TRANSACTIONS
abelCorp
Developer
Help
Home
Activity
Pay & Get Paid
Marketing For Growth
Financing
App Center
All
Search for transactions
Archive
All
Transaction Type
All activity
Date
Past 30 days
Amount & Currency
All currencies
Download
Date
Type
Name
Payment
Gross
Fee
Net
Balance
Actions
2:46 AM
Purchase from
Alfredo Barco's Test Store
Unclaimed
-$1,098.00 AUD
$0.00
-$1,098.00
$0.00 AUD
Archive
2:03 AM
Purchase from
Alfredo Barco's Test Store
Unclaimed
-$1,098.00 AUD
$0.00
-$1,098.00
$0.00 AUD
Archive
确定


sandbox.paypal.com/checkoutnow?sessionID=010de082c2_mdk6...
Country/Region
United States
Card number
4012 8888 8888 1881
Expires
11/20
CSC
045
First name
great
Last name
abel
Billing address
Street address
test
Apt., ste., bldg.
test
City
sdyne
State
ZIP code
测试用zipcode


localhost:5000 显示
Transaction completed by great!
确定
Search
Track Order
Login
Signup
1235 items
Sort Products


localhost:5000/paypal/10
PayPal Checkout
sandbox.paypal.com/checkoutnow?sessionID=010de082c2_md...
Country/Region
United States
Card number
5217 2918 4234 0252
Expires
11/20
CSC
045
First name
great
Last name
test
Billing address
Street address
test
Apt., ste., bldg.
test
City
sydney
State
Alabama
ZIP code
99501


localhost:5000 显示
Transaction completed by great!
确定


sandbox.paypal.com/checkoutnow?sessionID=010de082c2_mdk6...
PayPal Guest Checkout
We don't share your financial details with the merchant.
Country/Region
United States
Card number
3453 900286 85591
Expires
11/20
CSC
First name
great
Last name
test
Billing address
Street address
test
Apt., ste., bldg.
ap
localhost:5000 显示
Transaction completed by great!
确定
谷歌翻译
Search
1235 items
Sort Products
PayPal
借记卡或信用卡
技术支持提供方： PayPal

Q2(a):

steps:

```
import ast
import math
from Crypto.Random import random
from Crypto.PublicKey import DSA
from Crypto.Hash import SHA


# s1 = 'cf80cf5858c00cf654cd39644ec66873'
# s2 = '789041040361e1bf4dc3a120e1e1397'
# s3 = '674a611a52d39e462b05acd95f2aab1'

# i1 = int(s1, 16)
# i2 = int(s2, 16)
# i3 = int(s3, 16)

'''


# print(i1, i2, i3)

# print('n=', 151 * 157)
# print(150 * 156)

# print('e=', 20981)
# print('-'*20)

# x = 0
# y = 0
# 20981*x + 23400*y = 1
# x = (1 - 23400*y)/20981

for i in range(-100000, 100000):
    x = (1 - 23400*i)/20981
    if x.is_integer():
        print('possilbe private d in consideration:', x, 'i=', i)

print('-'*20)
# 97421.0 i= -87350
# 74021.0 i= -66369
# 50621.0 i= -45388
# 27221.0 i= -24407
# 3821.0 i= -3426
for i in range(-100000, 100000):
    x = (1 - 23400*i)/20983
    if x.is_integer():
        print('possilbe private d in consideration:', x, 'i=', i)

print('-'*20)

for i in range(-100000, 100000):
    x = (1 - 23400*i)/21067
    if x.is_integer():
        print('possilbe private d in consideration:', x, 'i=', i)

print('-end of rsa(n,e,d) design consideration.\n')
```

```
print('#'*20)


# print('d=', 3821)

# message = 88


# private_d = 23
# common_n = 187
# public_e = 7

# private_d = 2753
# common_n = 3233
# public_e = 17

message = 10000
print('message is:', message)
# private_d = 50621
common_n = 23707
public_e = 20981

true_count = 0

for name, private_d, public_e in \
    [('Alice', 50621 , 20981), ('Bob',12247, 20983), ('Karen',1003, 21067)]:
    print('At client side[' + name + '], encrypt with private_d:',private_d)
    print('\nencrypt process is: pow(message, private_d) % common_n')
    s0 = pow(message, private_d) % common_n
    print('encrypt output=', s0)

    print('\nAt bank side, decrypt with common_n, public_e:', common_n, public_e)
    print('decrypt process is: pow(s0, public_e) % common_n')
    t0 = pow(s0, public_e) % common_n
    print('decrypt message=', t0)

    if t0 == message:
        print('The bank believes this signature is authentic\n')
        true_count+= 1
    else:
        print('The signature is not passed!')

if true_count == 3:
    print("All 3 signature is authentic, now the pay check can be paid!")
else:
    print('BanK: you need all 3 signature authentic')


output is:

python3 Q2_a.py
possilbe private d in consideration: 97421.0 i= -87350
possilbe private d in consideration: 74021.0 i= -66369
possilbe private d in consideration: 50621.0 i= -45388
possilbe private d in consideration: 27221.0 i= -24407
possilbe private d in consideration: 3821.0 i= -3426
possilbe private d in consideration: -19579.0 i= 17555
possilbe private d in consideration: -42979.0 i= 38536
possilbe private d in consideration: -66379.0 i= 59517
```

```
possilbe private d in consideration: -89779.0 i= 80498
--------------------
possilbe private d in consideration: 105847.0 i= -94914
possilbe private d in consideration: 82447.0 i= -73931
possilbe private d in consideration: 59047.0 i= -52948
possilbe private d in consideration: 35647.0 i= -31965
possilbe private d in consideration: 12247.0 i= -10982
possilbe private d in consideration: -11153.0 i= 10001
possilbe private d in consideration: -34553.0 i= 30984
possilbe private d in consideration: -57953.0 i= 51967
possilbe private d in consideration: -81353.0 i= 72950
possilbe private d in consideration: -104753.0 i= 93933
--------------------
possilbe private d in consideration: 94603.0 i= -85171
possilbe private d in consideration: 71203.0 i= -64104
possilbe private d in consideration: 47803.0 i= -43037
possilbe private d in consideration: 24403.0 i= -21970
possilbe private d in consideration: 1003.0 i= -903
possilbe private d in consideration: -22397.0 i= 20164
possilbe private d in consideration: -45797.0 i= 41231
possilbe private d in consideration: -69197.0 i= 62298
possilbe private d in consideration: -92597.0 i= 83365
-end of rsa(n,e,d) design consideration.

####################
message is: 10000
At client side[Alice], encrypt with private_d: 50621

encrypt process is: pow(message, private_d) % common_n
encrypt output= 23200

At bank side, decrypt with common_n, public_e: 23707 20981
decrypt process is: pow(s0, public_e) % common_n
decrypt message= 10000
The bank believes this signature is authentic

At client side[Bob], encrypt with private_d: 12247

encrypt process is: pow(message, private_d) % common_n
encrypt output= 4819

At bank side, decrypt with common_n, public_e: 23707 20983
decrypt process is: pow(s0, public_e) % common_n
decrypt message= 10000
The bank believes this signature is authentic

At client side[Karen], encrypt with private_d: 1003

encrypt process is: pow(message, private_d) % common_n
encrypt output= 16206

At bank side, decrypt with common_n, public_e: 23707 21067
decrypt process is: pow(s0, public_e) % common_n
decrypt message= 10000
The bank believes this signature is authentic
```

```
All 3 signature is authentic, now the pay check can be paid!
abeltekiMacBook-Pro:b5793pay_integration abel$
```

Q2(b):

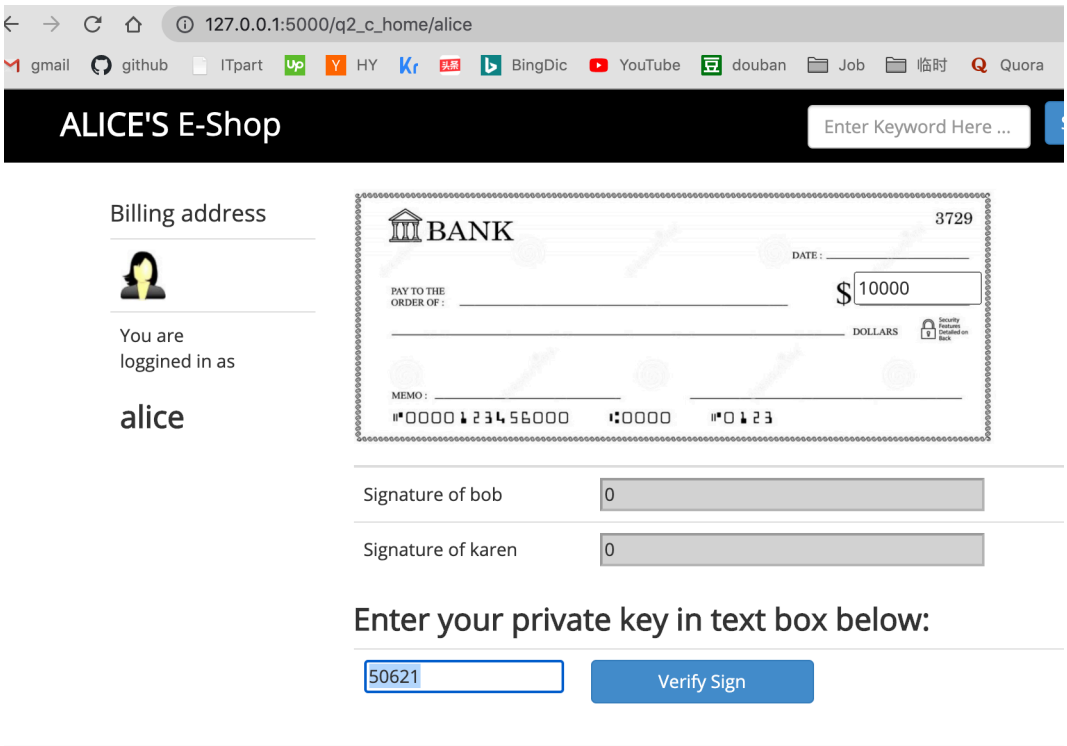
steps:

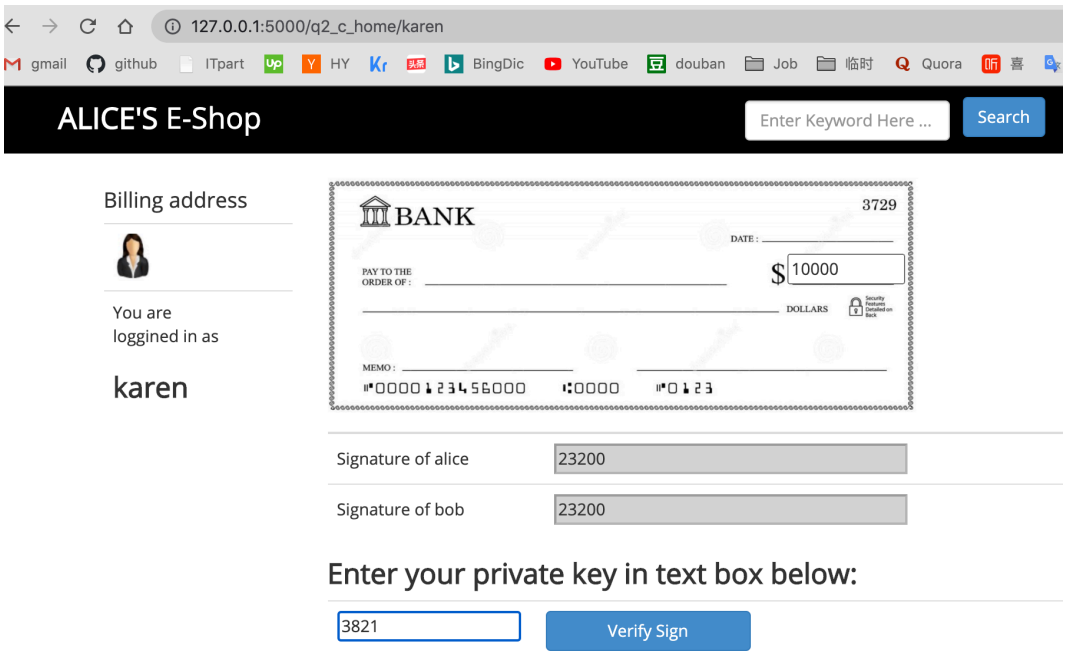
```
import ast
import math
from Crypto.Random import random
from Crypto.PublicKey import DSA
from Crypto.Hash import SHA


# s1 = 'cf80cf5858c00cf654cd39644ec66873'
# s2 = '789041040361e1bf4dc3a120e1e1397'
# s3 = '674a611a52d39e462b05acd95f2aab1'

# i1 = int(s1, 16)
# i2 = int(s2, 16)
# i3 = int(s3, 16)



# print(i1, i2, i3)

# print('n=', 151 * 157)
# print(150 * 156)

# print('e=', 20981)
# print('-'*20)

# x = 0
# y = 0
# 20981*x + 23400*y = 1
# x = (1 - 23400*y)/20981
for i in range(-100000, 100000):
    x = (1 - 23400*i)/20981
    if x.is_integer():
        print('possilbe private d in consideration:', x, 'i=', i)

print('-'*20)
# 97421.0 i= -87350
# 74021.0 i= -66369
# 50621.0 i= -45388
# 27221.0 i= -24407
# 3821.0 i= -3426

# print('d=', 3821)

# message = 88


# private_d = 23
# common_n = 187
# public_e = 7
```

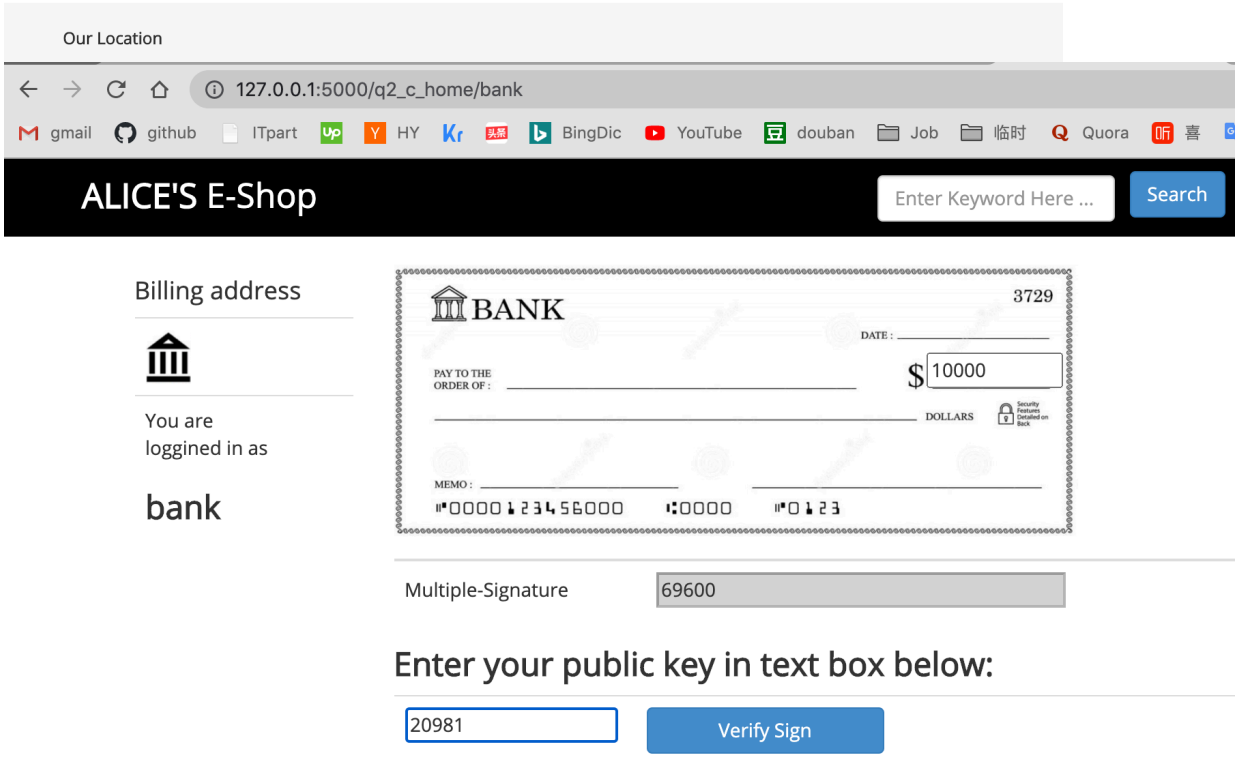
```
# private_d = 2753
# common_n = 3233
# public_e = 17

message = 10000
print('message is:', message)
# private_d = 50621
common_n = 23707
public_e = 20981



print('Q2_b 3 client shere public_e, common_n, so if Alice, Bob Karen
first check\
        whether their 3 signatures are same, if not re-sign it, if is
the same, then\
        send the same output-signature to bank, bank only have to check
the comon-signature')

signatures = []
for name, private_d in [('Alice', 50621), ('Bob',27221), ('Karen',
3821)]:
    print('At client side[' + name + '], encrypt with
private_d:',private_d)
    print('\nencrypt process is: pow(message, private_d) % common_n')
    s = pow(message, private_d) % common_n
    print('encrypt output=', s)
    signatures.append(s)

if signatures[0] == signatures[1] == signatures[2]:
    print('Alice, Bob Karen send  multi-signature-in-one to book',
signatures[0])

print('At bank side, decrypt with public_e:', public_e)
print('\ndecrypt process is: pow(s0, public_e) % common_n')
t0 = pow(signatures[0], public_e) % common_n
print('decrypt message=', t0)

if t0 == message:
    print('The bank believes this signature is authentic\n')

else:
    print('The signature is not passed!')



outputs:
```

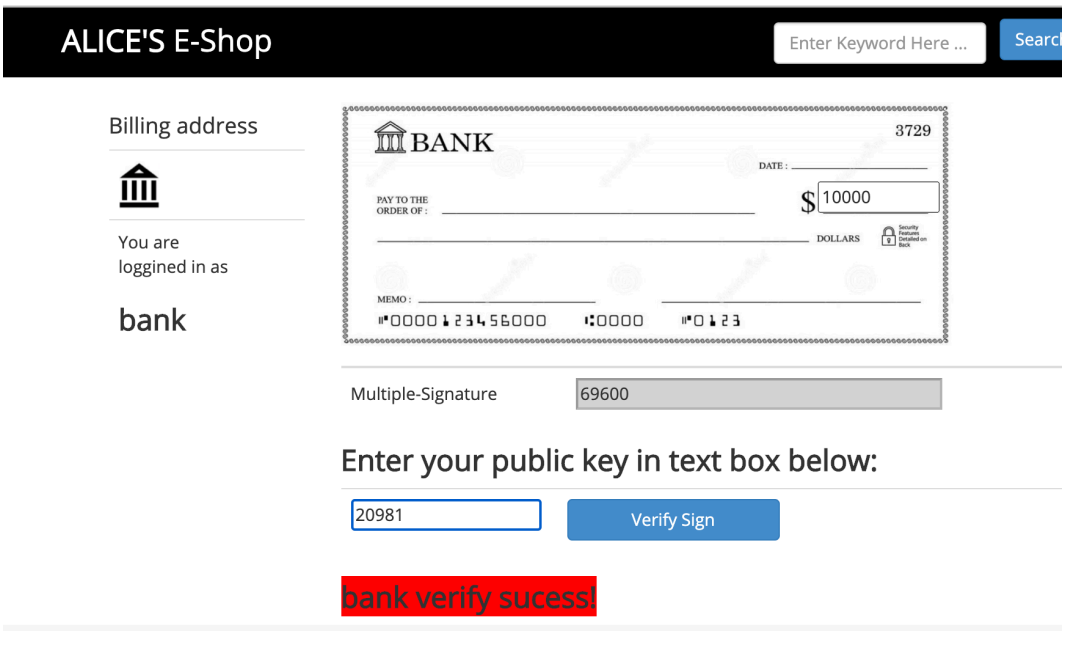
```
abeltekiMacBook-Pro:b5793pay_integration abel$ python3 Q2_b.py
possilbe private d in consideration: 97421.0 i= -87350
possilbe private d in consideration: 74021.0 i= -66369
possilbe private d in consideration: 50621.0 i= -45388
possilbe private d in consideration: 27221.0 i= -24407
possilbe private d in consideration: 3821.0 i= -3426
possilbe private d in consideration: -19579.0 i= 17555
possilbe private d in consideration: -42979.0 i= 38536
possilbe private d in consideration: -66379.0 i= 59517
possilbe private d in consideration: -89779.0 i= 80498
--------------------
message is: 10000
Q2_b 3 client shere public_e, common_n, so if Alice, Bob Karen first check
  whether their 3 signatures are same, if not re-sign it, if is the same, then
      send the same output-signature to bank, bank only have to check the comon-
signature
At client side[Alice], encrypt with private_d: 50621

encrypt process is: pow(message, private_d) % common_n
encrypt output= 23200
At client side[Bob], encrypt with private_d: 27221

encrypt process is: pow(message, private_d) % common_n
encrypt output= 23200
At client side[Karen], encrypt with private_d: 3821

encrypt process is: pow(message, private_d) % common_n
encrypt output= 23200
Alice, Bob Karen send  multi-signature-in-one to book 23200
At bank side, decrypt with public_e: 20981

decrypt process is: pow(s0, public_e) % common_n
decrypt message= 10000
The bank believes this signature is authentic

abeltekiMacBook-Pro:b5793pay_integration abel$
```

Q2(c):




127.0.0.1:5000/q2_c_home/karen
gmail
github
ITpart
HY
BingDic
YouTube
douban
Job
临时
Quora
ALICE'S E-Shop
Enter Keyword Here ...
Search
Billing address
You are loggined in as
karen
BANK
3729
DATE :
PAY TO THE ORDER OF :
$ 10000
DOLLARS
MEMO :
Signature of alice
23200
Signature of bob
23200
Enter your private key in text box below:
3821
Verify Sign


Our Location
127.0.0.1:5000/q2_c_home/bank
gmail
github
ITpart
HY
BingDic
YouTube
douban
Job
临时
Quora
ALICE'S E-Shop
Enter Keyword Here ...
Search
Billing address
You are loggined in as
bank
BANK
3729
DATE :
PAY TO THE ORDER OF :
$ 10000
DOLLARS
MEMO :
Multiple-Signature
69600
Enter your public key in text box below:
20981
Verify Sign


ALICE'S E-Shop
Enter Keyword Here ...
Billing address
You are loggined in as
bank
BANK
3729
DATE :
PAY TO THE ORDER OF :
$ 10000
DOLLARS
MEMO :
Multiple-Signature
69600
Enter your public key in text box below:
20981
Verify Sign
bank verify sucess!

Q3

```
abeltekiMacBook-Pro:b5793pay_integration abel$ python3 Q3.py
web server down's probability is:
        1 - 0.99999  = 0.00001
        one old pc down's probability is:
        1 - 0.8 = 0.2
        set x is the amount of the pc, when all x amount of pc is down, the pc c
luster is down
        0.2^^x = 0.00001
        we want to know x:

--------------------
x = math.log(0.00001, 0.2)
x= 7.153382790366966
Q3_a:
8 pc is needed
Q3_b:
 Because the layers are connected in series, overall reliability is the product
of 3 layers:

0.998890110999  so it's 99.8890110999% in overall reliability
abeltekiMacBook-Pro:b5793pay_integration abel$
```

Q4:

1. sequence steps:

GQ invloves 3 message betwen Alice(cliament) and verifier(bob).
Bank generate paremters for protol to work.

Alice (the Prover) generates 3 values:
x(secret)= 3
N= 101
X= 27
Alice generates a random value (y):
y= 20
Alice computes Y = y^e (mod N) and passes to Office-Bob:
Y= 21
Office-Bob generates a random value (c) and passes to Alice:
c= 85
Alice calculates z = y.x^c (mod N) and send to Office-Bob (the Verifier):
Office-Bob now computes val=z^e (mod N) and (y x^c (mod N)) and determines if they are the same
val1= 48 val2= 48
Alice has proven that he knows x

2. also illustion sequence charts in Q4.png

Let me add,in parenthesis: in fact , in Q2_b I alreay using some of 'Guillou-Quisquater (GQ) Identification',
and made a code implementation.

3.what the bank must prepare in advance to facilitate this?
Bank must generate paremters for protol to work: generete public key and private key. Like save questions and answers before this happened.
For example: bank should know some questions and asked alice in advanced ,and save it for future's difficult

situation. When alice lost all cards , now she goto bob's brank office, now answered some pre-saved questions correctly,
now bob can trust her, gave her new private key to get her assets or trust she have rights to acess certain level of assets.