System Secutiry Assingment 1
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Part One: Short Answer Questions:

Question1

Password Structure:

English alphabet consists of 26 letters. There are 5 Vowels
Δ is a consonant (C): 26−5=21choices
Φ is Vowel: 5 choices

Each Segment

Since each segment is Δ Φ Δ (consonant, vowel, consonant),
21 × 5 × 21 =2205

Total Number of Password

Since each password consist of two segment
2205 × 2205 =4860205

As a result, the generator has the capacity to produce 4,860,205 different passwords.

Question2

Alice’s pwd: Alice1234567
N =5

Challenge (n-c)	Counter (c)	Respond$H^{n-c}(S) = pw_{n-i}$
4	1	$H^4 (S) = pw4$
3	2	$H^3(S) = pw3$
2	3	$H^2 (S) = pw2$
1	4	$H^1 (S) = pw1$
0	5	

The first three one-time passwords (OTPs) will be:

- OTP 1: H^4(P)
- OTP 2: H^3(P)
- OTP 3: H^2(P)

The first three one-time passwords (OTPs) transmitted by Alice are:

1. **OTP 1**: H4(P)= 7620a7f4c73177c31620cdfe3eded58e
2. **OTP 2**: H3(P)= f3ad0072adf2803a4dd7afd4ceec6d7d
3. **OTP 3**: H2(P)= 58d412d46635f99d5a65fc9b9d19b98f

Question3

a. Does a lattice get defined in the diagram?

A lattice in the context of BLP must satisfy two conditions:

For each pair of components (levels) in the hierarchy, there needs to have a

1. **Least Upper Bound (LUB),** requires that there be a distinct, least level that is bigger than or equal to each pair of levels
2. **Greatest Lower Bound (GLB),** or meet: There must be a distinct, greatest level that is less than or equal to each of each pair of levels.

Looking at the diagram, we can see that the structure permits some elements to connect via more than one way, but not every node has distinct greatest lower bounds and least upper bounds for every pair that could exist. For example, node T is connected to S (directly) and P (indirectly through Y).

This structure **does not constitute a lattice** because of these ambiguities in the unique least upper bounds and largest lower bounds for specific pairs.

b. List two such relationships and provide an explanation for their needlessness.

1. **P → S relationship is redundant:**
   If P→Q and Q→S are maintained, then P→S is implied by transitivity. Thus, the direct relationship from P→S would be redundant.

2. **P → T relationship is redundant:**
   if P→Y and Y→T exist, then P→T can be considered redundant by transitivity.

Since other paths in the diagram can be used to deduce these links, they are not required. Lessening these repetitions could make the diagram simpler and guarantee that, with additional modifications, it defines the correct lattice structure.

Question4

a. subjects, objects, and actions

Subject : Alexis, Boris, Catherine, Duggy

Object: Balls, Sticks, Boris

Actions: Kick, Throw, catch, snap, roll, chew, fetch

b. Access Control Matrix

	Balls	**Sticks**	**Boris**
Alexis	Kick	Throw	-
Boris	Catch, Kick	Throw	-
Catherine	Roll	Snap	-
Duggy	Chew	Fetch	Chew

c. access control lists

Balls: (Alexis, kick), (Boris, catch,kick), (Catherine, roll), (Duggy, chew)

Sticks: (Alexis,throw), (Boris, throw), (Catherine, snap), (Duggy, fetch)

Boris: (Duggy, chew)

d. capability lists

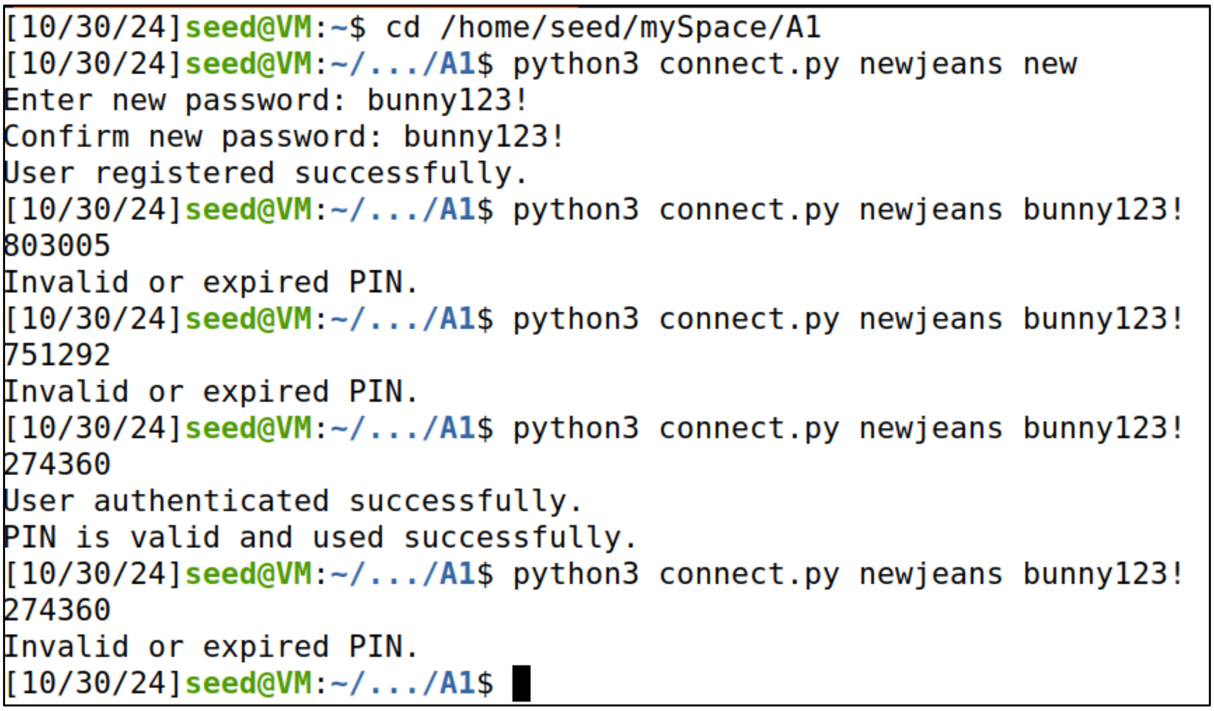
Alexis:	(Balls, Kick), (Sticks, Throw)
Boris:	(Balls, Catch, Kick), (Sticks, Throw)
Catherine:	(Balls, Roll), (Sticks, Snap)
Duggy:	(Balls, Chew), (Sticks, Fetch), (Boris, Chew)

Part Two: Two factor Authentication

Output

1st terminal for connect.py

```
[10/30/24]seed@VM:~$ cd /home/seed/mySpace/A1
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans new
Enter new password: bunny123!
Confirm new password: bunny123!
User registered successfully.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123! 803005
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123! 751292
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123! 274360
User authenticated successfully.
PIN is valid and used successfully.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123! 274360
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$
```



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[10/30/24]seed@VM:~$ cd /home/seed/mySpace/A1
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans new
Enter new password: bunny123!
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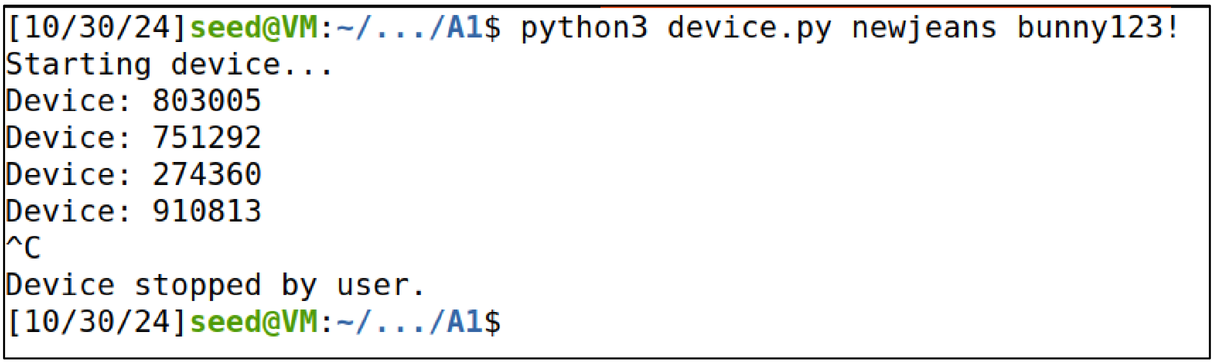
User registered successfully.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123!
803005
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123!
751292
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123!
274360
User authenticated successfully.
PIN is valid and used successfully.
[10/30/24]seed@VM:~/.../A1$ python3 connect.py newjeans bunny123!
274360
Invalid or expired PIN.
[10/30/24]seed@VM:~/.../A1$
```

Output

2st terminal for device.py

```
[10/30/24]seed@VM:~/.../A1$ python3 device.py newjeans bunny123!
Starting device...
Device: 803005
Device: 751292
Device: 274360
Device: 910813
^C
Device stopped by user.
[10/30/24]seed@VM:~/.../A1$
```



```
[10/30/24]seed@VM:~/.../A1$ python3 device.py newjeans bunny123!
Starting device...
Device:  803005
Device:  751292
Device:  274360
Device:  910813
^C
Device stopped by user.
[10/30/24]seed@VM:~/.../A1$
```