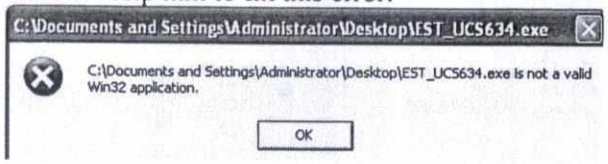
Roll Number:

Thapar Institute of Engineering and Technology, Patiala
Department of Computer Science & Engineering

BE- CoE, CSE (VI Semester) MST **UCS638: Secure Coding**
8 April 2022
Time: 02 Hours; MM: 35 Name of Faculty: Dr. Maninder Singh
Note: Attempt any five questions.

Q1. a) Dr. Singh edited EST_UCS634.exe file with LordPE and got this error message, what could had been the reason? Help him to fix this error.



b) Comment about this memory map capture of EST_UCS634 file.

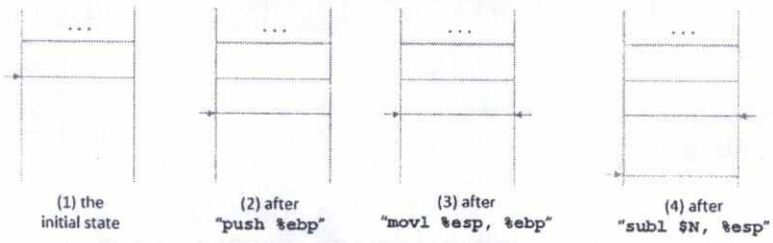
(2, 5)

Q2. Refer to the memory map given above:
a) What changes are to be made in order to jump to the "Code Cave address"?
b) What should be the startup instructions at 00484000 memory address?
c) Dr. Singh started a putty session on port 22 to 192.168.240.137 but connection failed, give appropriate reason for the same and offer solution to overcome this issue. Dr. Singh wrote one liner to create shell with RAW payload for reverse TCP connection to port 443. Produce same one liner code.
d) Give instructions with proper addresses to proceed with normal flow of execution after injection & realignment.

(1, 2, 2, 2)

Q3.

a) Fill the blank spaces and arrow positions for the function prologue execution:



b) In the function epilogue, the previous frame pointer, which is stored in the area below the return address, will be retrieved and assigned to the *ebp* register. However, when we overflow the return address, the previous frame pointer region is already modified, so after the function epilogue, *ebp* contains some arbitrary value. Does this matter?

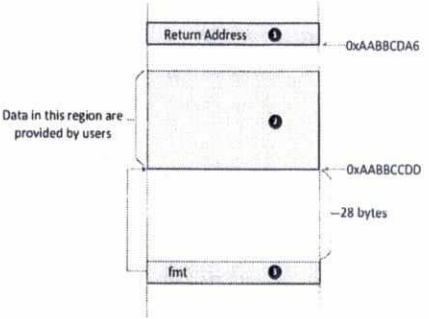
c) As we know, the system() function calls /bin/sh, which is a symbolic link to /bin/bash. Recent versions of bash will drop the privilege if it detects that the effective user ID and the real user ID are different. Assume that we still want to use system() in our Return-to-libc attack, please describe how you can overcome this challenge. You are allowed to have zeros in your input (assume that memcpy() is used for memory copy, instead of strcpy())

(2, 2, 3)

Q4. a) When printf(fmt) is executed, the stack (from low address to high address) contains the following values (4 bytes each), where the first number is the content of the variable fmt, which is a pointer pointing to a format string. If you can decide the content of the format string, what is the smallest number of format specifiers that you can use to crash the program with a 100 percent probability?

0xAABBCCDD, 0xAABBDDFF, 0x22334455, 0x00000000, 0x99663322

b) A server program takes an input from a remote user, saves the input in a buffer allocated on the stack. The address of this buffer is then stored in the local variable fmt, which is used in the following statement in the server program: printf(fmt); When the above statement is executed, the current stack layout is depicted in Figure. If you are a malicious attacker, can you construct



the input, so when the input is fed into the server program, you can get the server program to execute your code? Please write down the actual content of the input (you do not need to provide the exact content of the code; just put "malicious code" in your answer, but you need to put it in the correct location).

(2, 5)

Q5. a) There are three kinds of Honeypots used in security implementation: elaborate each of one of these with appropriate use case.

b) Rootkits use various methods to hide malware from anti-malware software, what are these methods, explain in detail working of rootkits with appropriate example.

(3, 4)

Q6. It was a morning ritual. Mrs. Singh sipped her coffee as she quickly went through the email that arrived during the night. One of the messages caught her eye, because it was clearly spam that somehow got past the email filter. The message extolled the virtues of being slim and contained a link to the on-line slim-tea offerings web site. "Do people really fall for this stuff?" Mrs. Singh thought. She was curious to know how the website would convince its visitors to make the purchase, so she clicked on the link. The website was slow to load and seemed to be broken. There was no major content on the page, it only said "Animated Cursor Demo". Disappointed, Mrs. Singh closed the browser's window and continued with her day. "*She didn't realize that her Windows XP computer just got infected.*"

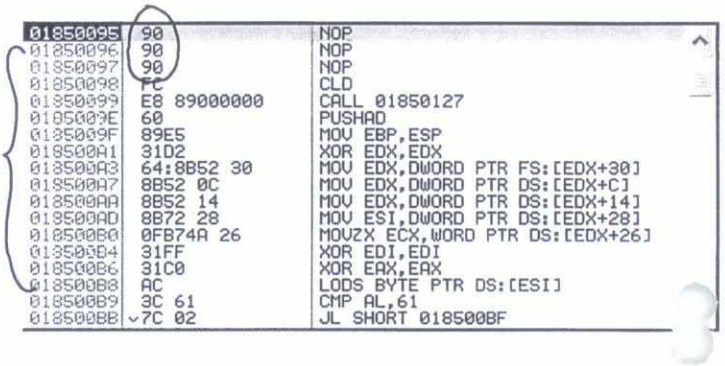
You are a Secure Coding Professional. You possess the following capture.

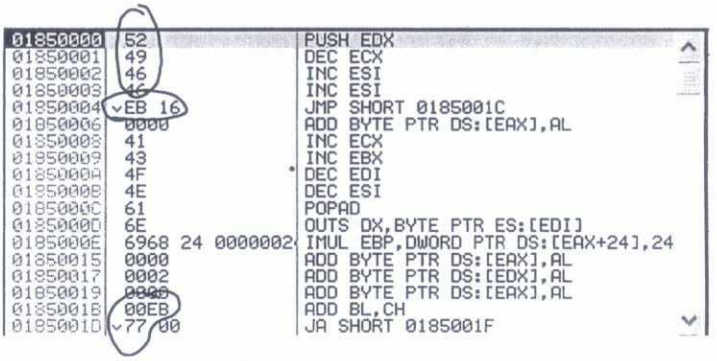
```
00 00 00 00   52 49 46 46  EB 77 00 00  41 43 4F 4E  61 6E 69 68
00 00 00 10   24 00 00 00  24 00 00 00  02 00 00 00  EB 16 00 00
00 00 00 20   00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
00 00 00 30   00 00 00 00  01 00 00 00  61 6E 69 68  58 00 00 00
00 00 00 40   41 41 41 41  41 41 41 41  41 41 41 41  41 41 41 41
00 00 00 50   41 41 41 41  41 41 41 41  41 41 41 41  41 41 41 41
00 00 00 60   00 41 41 41  41 41 41 41  41 41 41 41  41 41 41 41
00 00 00 70   41 41 41 41  41 41 41 41  41 41 41 41  00 00 00 00
00 00 00 80   00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
00 00 00 90   90 90 90 90  CC CC CC CC
```

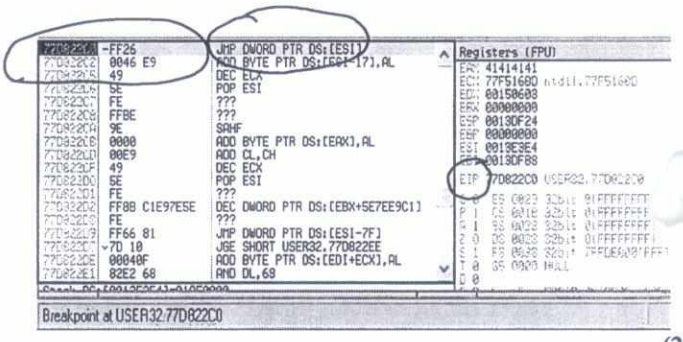
a) Help Mrs. Singh to craft a stream of hexadecimal numbers, which will be used to create ANI file (give one line command with proper use of piping).

b) Also, your mission is to understand what probably would have happened to Mrs. Singh's system after she clicked the link. Your analysis should reveal intent. Give technical commentary step by step and conclusion, emphasizing each of the markings on the figures: like EIP: 77D822C0.

```
27 20.400149 192.168.72.130   192.168.72.128   HTTP   GET /exp.html HTTP/1.1
30 20.414699 192.168.72.130   192.168.72.128   HTTP   GET /demo.ani HTTP/1.1
31 20.415158 192.168.72.128   192.168.72.130   HTTP   HTTP/1.1 200 OK  (text/plain)
```

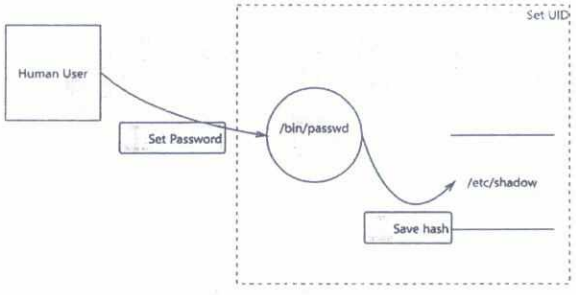






(2, 5)

Q7. Study the given design view of the system being developed, apply your know-how of STRIDE at each actor and boundary place and produce **a)** threat list and **b)** threat properties.



(3, 4)