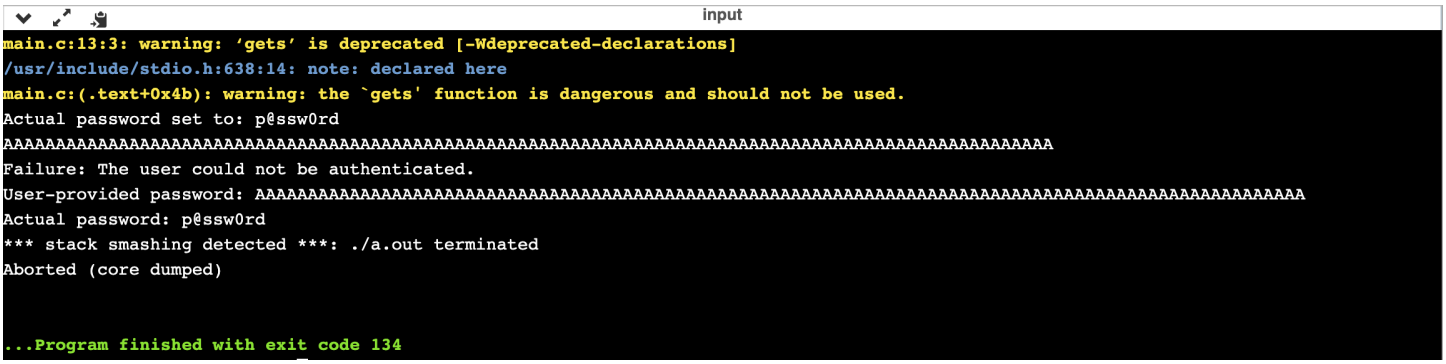
Step 2:

The input I found that causes a segmentation fault is a passwords that contains one hundred of A's.

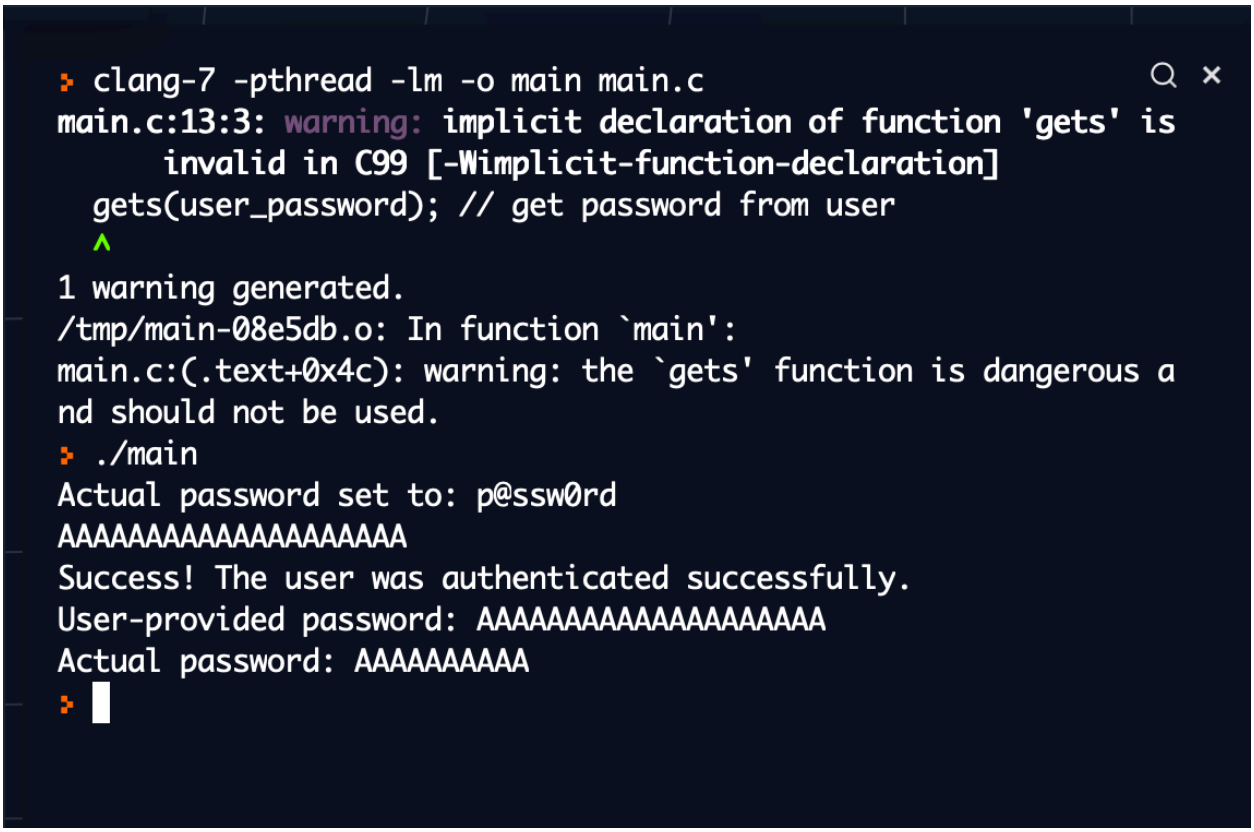


In the main function, the password is set to contain 10 characters at most. The length of the password I provide is long enough to cover all the space reserved for both username and password. The original content of the stored values of $fp and $ra now have been overwritten.

The stored value of $ra contains the address of the next instruction to execute once the main function completes executing. The content of the actual register $ra will be restored with the old value stored in the stack. But my very long password has overwritten the value stored in the stack. Then $ra restored part of my password, AAAA. Then the program will try to execute the instruction at the address of 0x41414141. This will lead to core dump.

Step 3:

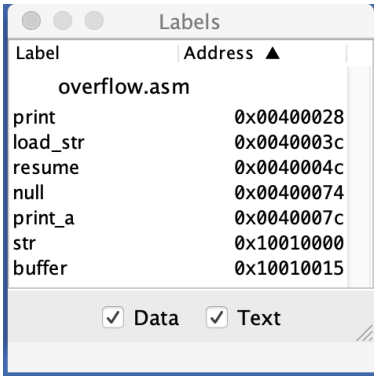
The input I found that won't crash the application but authorized me in is a password that contains twenty A's. In line 15, the strncmp() function compares the first ten bytes of user_password and password. So I want to take advantage of overflow and overwrite the 'Actual password' to be the last ten bytes of my input. So my password at least needs to be longer than 10 to start overwriting the 'Actual password' and actually needs to be longer than 20 to completely overwrite the 'Actual password'. So I choose to input twenty A's because it overwrites the 'Actual password' to be ten A's which is exactly equal to the last ten bytes of my input.



Step 4:

1)

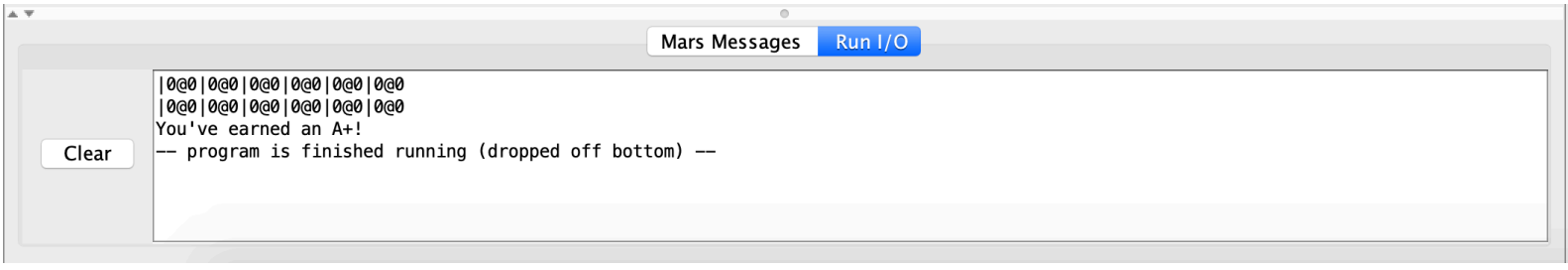
By looking at the Labels section, I notice the print_a function is stored at the address ‘0x0040007c’. So this will made up part of my malicious input.



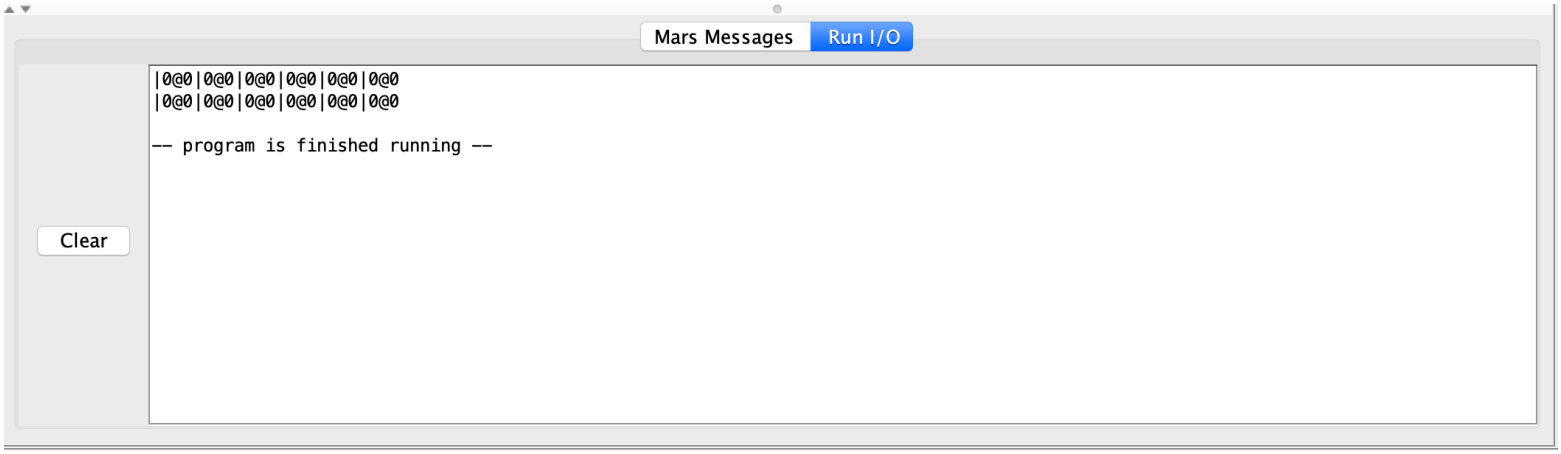
By referring to AsciiTable.com, I found the following interchange results:

Hex	Char	Name
40	@	At-sgin
7c	|	Vertical-bar

And by playing around, I found zero will be stored as ’00’ in address and I notice Data Segment uses little-endian order to store values. So part of my malicious input will look like ‘vertical-bar zero at-sign zero’. I simply repeat this pattern six times to make sure I will overwrite address of $ra. And I was able to trigger print_a function.



2)


Mars Messages
Run I/O
|0@0|0@0|0@0|0@0|0@0|0@0
|0@0|0@0|0@0|0@0|0@0|0@0
-- program is finished running --
Clear