Vulnerable C Code Buffer Overflow Exploit

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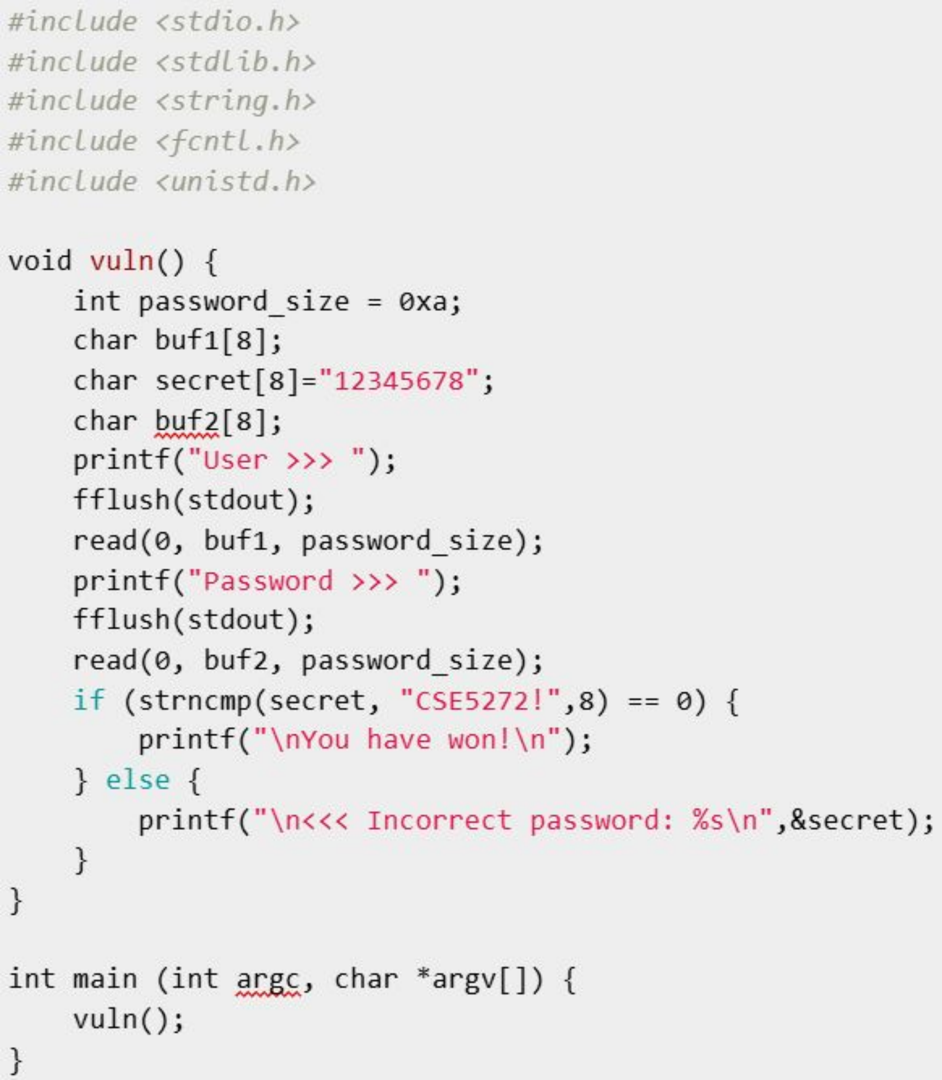
Source Code



```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <fcntl.h>
#include <unistd.h>

void vuln() {
    int password_size = 0xa;
    char buf1[8];
    char secret[8]="12345678";
    char buf2[8];
    printf("User >>> ");
    fflush(stdout);
    read(0, buf1, password_size);
    printf("Password >>> ");
    fflush(stdout);
    read(0, buf2, password_size);
    if (strncmp(secret, "CSE5272!",8) == 0) {
        printf("\nYou have won!\n");
    } else {
        printf("\n<<< Incorrect password: %s\n",&secret);
    }
}

int main (int argc, char *argv[]) {
    vuln();
}
```

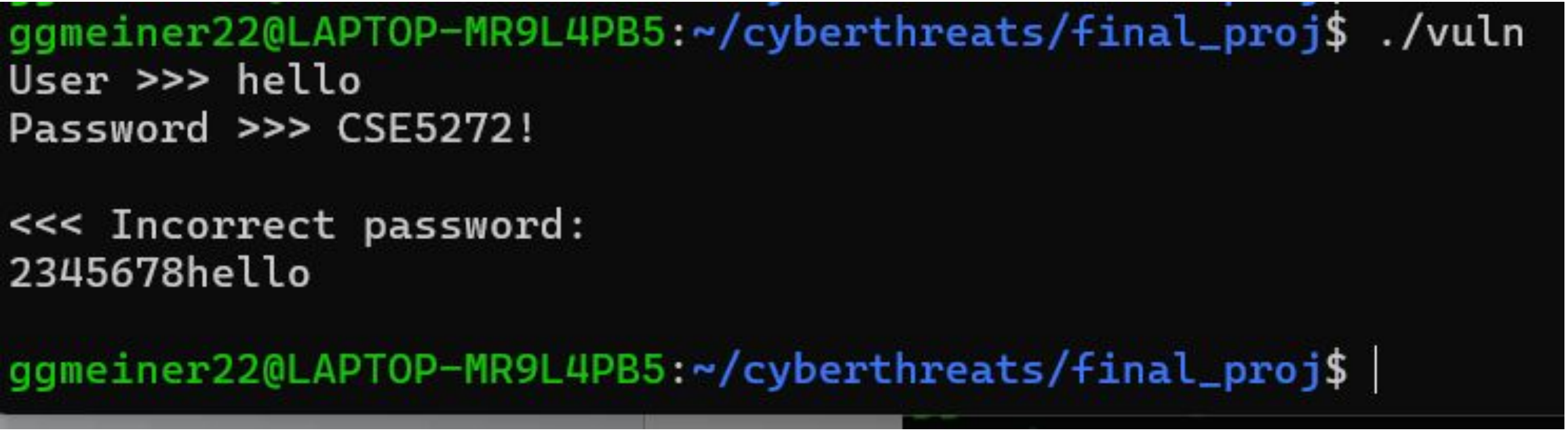
Compilation & Execution

-
  ```
  $ gcc vuln.c -o vuln
  ```

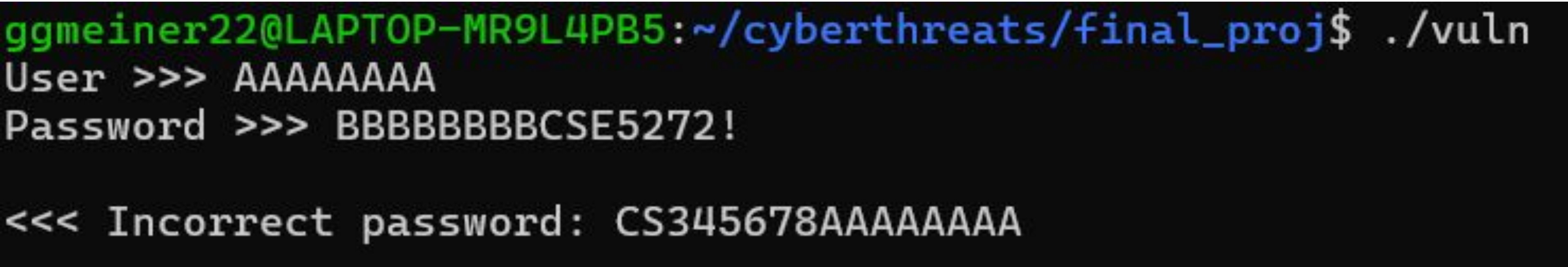
-
  ```
  $ gcc -std=gnu89 -fno-stack-protector -z execstack vuln.c -o vuln
  ```

-
  ```
  ./vuln
  ```

Execution

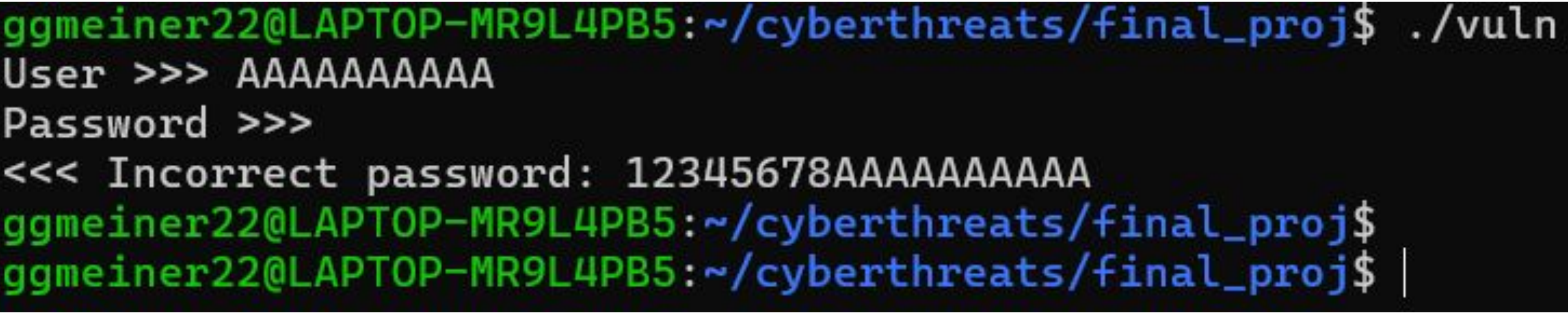


```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./vuln
User >>> hello
Password >>> CSE5272!

<<< Incorrect password:
2345678hello

ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ 
```



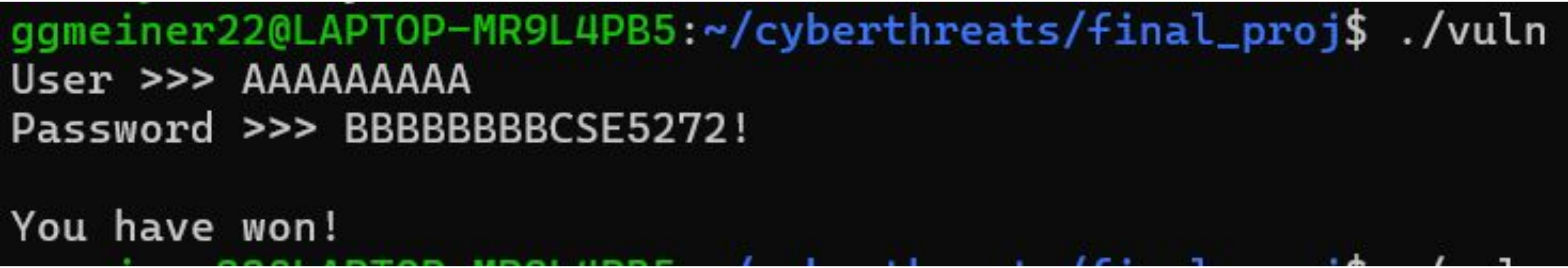
```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./vuln
User >>> AAAAAAAA
Password >>> BBBBBBBBCSE5272!

<<< Incorrect password: CS345678AAAAAAAA
```

Execution



```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./vuln
User >>> AAAAAAAAAA
Password >>>
<<< Incorrect password: 12345678AAAAAAAAAA
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$
```

Solution



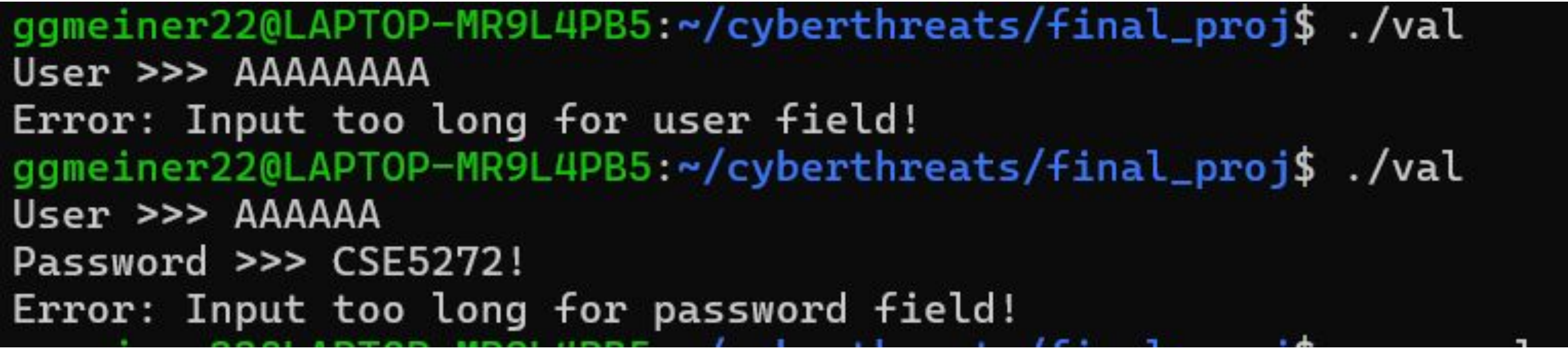
```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./vuln
User >>> AAAAAAAAA
Password >>> BBBBBBBBCSE5272!

You have won!
```

Securing The Code

Input Length Validation

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>

void vuln() {
    char tmp[100];   // Temporary buffer to hold input
    char buf1[8];
    char secret[8] = "12345678";
    char buf2[8];
    ssize_t bytes_read;

    printf("User >>> ");
    fflush(stdout);
    bytes_read = read(0, tmp, sizeof(tmp));
    if (bytes_read < 0) {
        perror("read error");
        exit(EXIT_FAILURE);
    }
    tmp[bytes_read] = '\0';
    if (bytes_read >= sizeof(buf1)) {
        fprintf(stderr, "Error: Input too long for user
field!\n");
        exit(EXIT_FAILURE);
    }
    strcpy(buf1, tmp);
    printf("Password >>> ");
    fflush(stdout);
    bytes_read = read(0, tmp, sizeof(tmp));
    if (bytes_read < 0) {
        perror("read error");
        exit(EXIT_FAILURE);
    }
    tmp[bytes_read] = '\0';
    if (bytes_read >= sizeof(buf2)) {
        fprintf(stderr, "Error: Input too long for
password field!\n");
        exit(EXIT_FAILURE);
    }
    strcpy(buf2, tmp);

    if (strncmp(secret, "CSE5272!", 8) == 0) {
        printf("\nYou have won!\n");
    } else {
        printf("\n<<< Incorrect password: %s\n", secret);
    }
}

int main(void) {
    vuln();
    return 0;
}
```

Solution

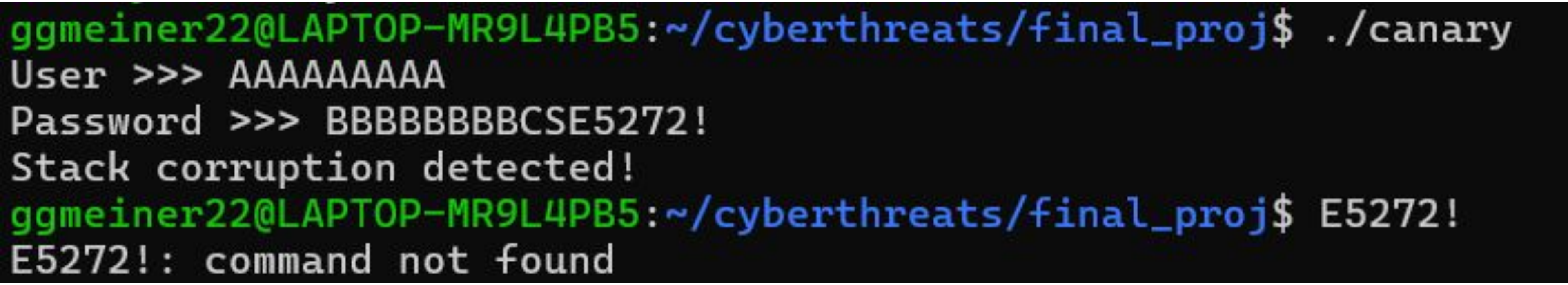


```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./val
User >>> AAAAAAAA
Error: Input too long for user field!
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./val
User >>> AAAAAA
Password >>> CSE5272!
Error: Input too long for password field!
```

Stack Canary

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>

#define CANARY 0xDEADBEEF

void vuln() {
    int password_size = 0xa;
    char buf1[8];
    char secret[8] = "12345678";
    char buf2[8];
    unsigned int canary = CANARY;

    printf("User >>> ");
    fflush(stdout);
    read(0, buf1, password_size);
    printf("Password >>> ");
    fflush(stdout);
    read(0, buf2, password_size);

    if (canary != CANARY) {
        fprintf(stderr, "Stack corruption
detected!\n");
        exit(EXIT_FAILURE);
    }

    if (strncmp(secret, "CSE5272!", 8) == 0) {
        printf("\nYou have won!\n");
    } else {
        printf("\n<<< Incorrect password: %s\n",
secret);
    }
}

int main(void) {
    vuln();
    return 0;
}
```

Solution

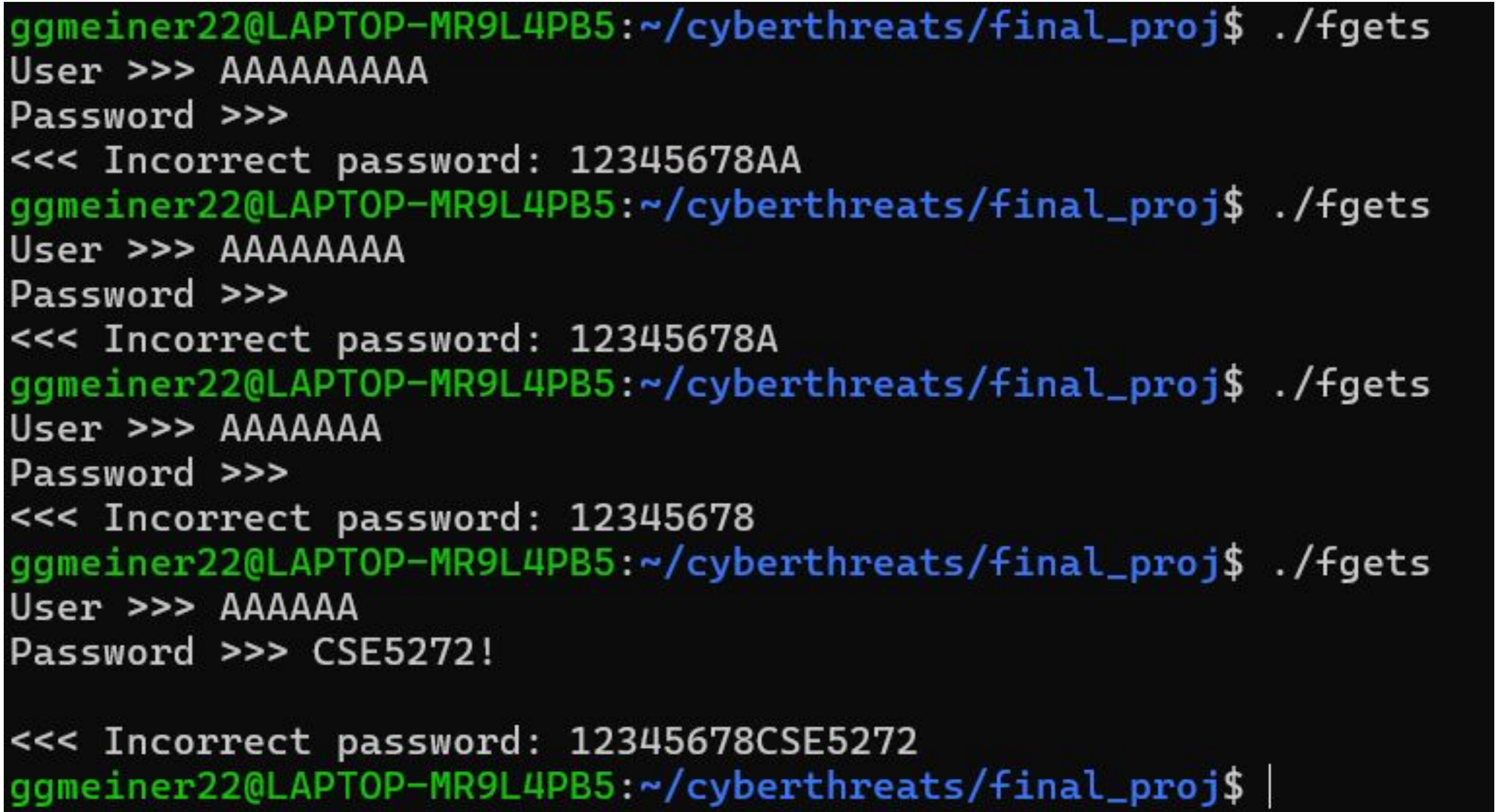


```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./canary
User >>> AAAAAAAAA
Password >>> BBBBBBBBCSE5272!
Stack corruption detected!
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ E5272!
E5272!: command not found
```

Input Size Limiting and Null-Termination

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

void vuln() {
    char buf1[8];
    char secret[8] = "12345678";
    char buf2[8];

    printf("User >>> ");
    fflush(stdout);
    if (fgets(buf1, sizeof(buf1), stdin) == NULL)
{
        perror("fgets error");
        exit(EXIT_FAILURE);
    }
    buf1[strcspn(buf1, "\n")] = '\0';
    printf("Password >>> ");
    fflush(stdout);
    if (fgets(buf2, sizeof(buf2), stdin) == NULL)
{
        perror("fgets error");
        exit(EXIT_FAILURE);
    }
    buf2[strcspn(buf2, "\n")] = '\0';

    if (strncmp(secret, "CSE5272!", 8) == 0) {
        printf("\nYou have won!\n");
    } else {
        printf("\n<<< Incorrect password: %s\n",
secret);
    }
}

int main(void) {
    vuln();
    return 0;
}
```

Solution



```
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./fgets
User >>> AAAAAAAAA
Password >>>
<<< Incorrect password: 12345678AA
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./fgets
User >>> AAAAAAAA
Password >>>
<<< Incorrect password: 12345678A
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./fgets
User >>> AAAAAAA
Password >>>
<<< Incorrect password: 12345678
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ ./fgets
User >>> AAAAAA
Password >>> CSE5272!

<<< Incorrect password: 12345678CSE5272
ggmeiner22@LAPTOP-MR9L4PB5:~/cyberthreats/final_proj$ |
```