Studio4 Report

STUDIO4

Step1:

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Step2:

```
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=2500
pi@lbxpi:~/modules $ sudo rmmod kernel_memory.ko
pi@lbxpi:~/modules $ dmesg
[1555661.994928] Loaded kernel_memory module
[1555661.995214] Hello from thread k_memory. nr_structs=2500
[1555661.995226] The kernel's page size is 4096.
[1555661.995236] The datatype struct is 32.
[1555661.995247] The number of "datatype" structs that fill fit in a single page of memory is 128
[1555668.714743] Unloaded kernel_memory module
pi@lbxpi:~/modules $
```

Step3:

```
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=1000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[1572780.123860] Loaded kernel_memory module
[1572780.124082] Hello from thread k_memory. nr_structs=1000
[1572780.124088] The kernel's page size is 4096.
[1572780.124094] The size of "datatype" struct is 32.
[1572780.124100] The number of "datatype" structs that fill fit in a single page of memory is 128
[1572780.124104] nr_pages = 8
[1572780.124109] order = 3
[1572780.124114] nr_structs_per_page = 125
[1572785.200859] Unloaded kernel_memory module
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=2000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[1572806.628737] Loaded kernel_memory module
[1572806.628955] Hello from thread k_memory. nr_structs=2000
[1572806.628966] The kernel's page size is 4096.
[1572806.628973] The size of "datatype" struct is 32.
[1572806.628981] The number of "datatype" structs that fill fit in a single page of memory is 128
[1572806.628986] nr_pages = 16
[1572806.628993] order = 4
[1572806.629000] nr_structs_per_page = 125
[1572814.759994] Unloaded kernel_memory module
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=3000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[1572849.493874] Loaded kernel_memory module
[1572849.494185] Hello from thread k_memory. nr_structs=3000
[1572849.494199] The kernel's page size is 4096.
[1572849.494209] The size of "datatype" struct is 32.
[1572849.494220] The number of "datatype" structs that fill fit in a single page of memory is 128
[1572849.494225] nr_pages = 24
[1572849.494235] order = 5
[1572849.494245] nr_structs_per_page = 125
```

```
[1572857.385169] Unloaded kernel_memory module
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=4000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[1572912.000779] Loaded kernel_memory module
[1572912.001576] Hello from thread k_memory. nr_structs=4000
[1572912.001591] The kernel's page size is 4096.
[1572912.001602] The size of "datatype" struct is 32.
[1572912.001613] The number of "datatype" structs that fill fit in a single page of memory is 128
[1572912.001619] nr_pages = 32
[1572912.001628] order = 5
[1572912.001638] nr_structs_per_page = 125
[1572916.407507] Unloaded kernel_memory module
pi@lbxpi:~/modules $
```

The my_get_order function return the `order` that must be set to the base 2 logarithm of the next power of 2 equal to or above `nr_pages`. Within the function, it first check if the nr_pages is equal to zero. If it is, then return zero, which means we don't need to allocate memory at all. If it isn't, we need to figure out if the nr_pages is some power of 2. if it is, we need to minus one and then calculate the shifts, otherwise, the shift will be one more than the correct one. Finally we calculate shifts, which is pretty simple. The only thing we need to do is calculate how many times do we need to right shift nr_pages to zero. Then, the number is the order. This is because all of the number which is the power of 2. In binary, it is an one and several zeros, so the shifts number is the order.

Step4:

```
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=200
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[  258.497749] kernel_memory: loading out-of-tree module taints kernel.
[  258.498339] Loaded kernel_memory module
[  258.500184] Hello from thread k_memory. nr_structs=200
[  258.500199] The kernel's page size is 4096.
[  258.500209] The size of "datatype" struct is 32.
[  258.500220] The number of "datatype" structs that fill fit in a single page of memory is 128
[  258.500226] nr_pages = 2
[  258.500236] order = 1
[  258.500246] nr_structs_per_page = 100
[  258.500263] In page 0, the value of the first element is: 0
[  258.500278] In page 1, the value of the first element is: 800
[  266.630974] Unloaded kernel_memory module
pi@lbxpi:~/modules $
```

Step5:

```
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=1000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[ 1329.037227] Loaded kernel_memory module
[ 1329.037479] Hello from thread k_memory. nr_structs=1000
[ 1329.037491] The kernel's page size is 4096.
[ 1329.037502] The size of "datatype" struct is 32.
[ 1329.037513] The number of "datatype" structs that fill fit in a single page of memory is 128
[ 1329.037518] nr_pages = 8
[ 1329.037528] order = 3
[ 1329.037538] nr_structs_per_page = 125
[ 1338.519548] Unloaded kernel_memory module
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=10000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[ 1388.489690] Loaded kernel_memory module
[ 1388.490443] Hello from thread k_memory. nr_structs=10000
```

```
[ 1388.490457] The kernel's page size is 4096.
[ 1388.490468] The size of "datatype" struct is 32.
[ 1388.490478] The number of "datatype" structs that fill fit in a single page of memory is 128
[ 1388.490483] nr_pages = 79
[ 1388.490493] order = 7
[ 1388.490503] nr_structs_per_page = 126
[ 1404.984532] Unloaded kernel_memory module
pi@lbxpi:~/modules $ sudo dmesg --clear
pi@lbxpi:~/modules $ sudo insmod kernel_memory.ko nr_structs=50000
pi@lbxpi:~/modules $ sudo rmmod kernel_memory
pi@lbxpi:~/modules $ dmesg
[ 1431.939070] Loaded kernel_memory module
[ 1431.939356] Hello from thread k_memory. nr_structs=50000
[ 1431.939368] The kernel's page size is 4096.
[ 1431.939379] The size of "datatype" struct is 32.
[ 1431.939390] The number of "datatype" structs that fill fit in a single page of memory is 128
[ 1431.939395] nr_pages = 391
[ 1431.939405] order = 9
[ 1431.939415] nr_structs_per_page = 127
[ 1449.728356] Unloaded kernel_memory module
pi@lbxpi:~/modules $
```