

Readme for Q3

Downloading the kernel headers with the following question

```
sudo apt-get install linux-headers-generic
```

```
<linux/module.h>
```

A kind of header which provides essential macros and functions for defining and working with kernel modules. It includes macros like `module_init` and `module_exit`, which are used to specify initialization and cleanup functions for the module.

```
<linux/kernel.h>
```

Includes macros importantly used for module initialisation and cleanup .

`__init` and `__exit` are under this header.

```
<linux/sched/signal.h>
```

Important for working with `task_struct` data structure

All the function related to task control group and signal handling and process state information are under this header only.

Then in the proceeding lines we are giving the license of general purpose license.

Then providing authors name/ contributors of the module

Loading and unloading description is provided

Static keyword to limit the scope of function to current source file only.

Then we are using the `task_struct` data structure to count the number of running processes

`init` macro to let kernel know that this function is for initialization purposes

Next function is for cleanup purposes specifically the `__exit` macro

`Kern_info` is a log level. There are so many log levels it is just for printing purposes and not a warning

Then we are creating a makefile in which we are making `hello.o` our target and writing commands to make and clean the files

When we type `make` on the Terminal of ubuntu

```

kiopi@kiopi-virtual-machine:~/kiopi/my_module$ make
make -C /lib/modules/6.2.0-33-generic/build M=/home/kiopi/kiopi/my_module module
S
make[1]: Entering directory '/usr/src/linux-headers-6.2.0-33-generic'
warning: the compiler differs from the one used to build the kernel
The kernel was built by: x86_64-linux-gnu-gcc-11 (Ubuntu 11.4.0-1ubuntu1~22.04) 11.4.0
You are using: gcc-11 (Ubuntu 11.4.0-1ubuntu1~22.04) 11.4.0
CC [M] /home/kiopi/kiopi/my_module/hello.o
MODPOST /home/kiopi/kiopi/my_module/Module.symvers
CC [M] /home/kiopi/kiopi/my_module/hello.mod.o
LD [M] /home/kiopi/kiopi/my_module/hello.ko
BTF [M] /home/kiopi/kiopi/my_module/hello.ko
Skipping BTF generation for /home/kiopi/kiopi/my_module/hello.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-6.2.0-33-generic'

```

Sudo insmod hello.ko to load in the kernel

```

make[1]: Leaving directory '/usr/src/linux-headers-6.2.0-33-generic'
kiopi@kiopi-virtual-machine:~/kiopi/my_module$ sudo insmod hello.ko
[sudo] password for kiopi:
kiopi@kiopi-virtual-machine:~/kiopi/my_module$ sudo dmesg
[    0.000000] Linux version 6.2.0-33-generic (buildd@lcy02-amd64-073)
DYNAMIC Thu Sep  7 10:33:52 UTC 2 (Ubuntu 6.2.0-33.33~22.04.1-generic

```

After it gets loaded to the kernel

Sudo dmesg to view the output of the module , dmesg for kernel logs

```

[ 593.411541] hello: module verification failed: signature and/or required key missing - tainting kernel
[ 593.425855] Custom module loaded
[ 593.425930] Number of running processes: 2
[ 689.793276] Custom module unloaded
[ 773.369895] Custom module loaded
[ 773.369973] Number of running processes: 3
[ 810.332600] Custom module unloaded
[ 2335.341968] e1000: ens33 NIC Link is Down
[ 2339.391593] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 3262.833163] Module loading done
[ 3262.835537] Number of running processes: 1
kiopi@kiopi-virtual-machine:~/kiopi/my_module$

```

For module cleanup

```

kiopi@kiopi-virtual-machine:~/kiopi/my_module$ sudo rmmod hello.ko
kiopi@kiopi-virtual-machine:~/kiopi/my_module$ sudo dmesg

```

