Screenshot 1

File   Actions   Edit   View   Help

```
┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ ls
Makefile  dpp.c

┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ []
```

Shell No. 1

File   Actions   Edit   View   Help

```c
#include <linux/module.h>
#include <linux/kernel.h>
#include <linux/kthread.h>
#include <linux/delay.h>
#include <linux/semaphore.h>

#define N 5 // Number of philosophers

// Semaphores representing chopsticks
static struct semaphore chopsticks[N];

// Task structures for philosopher threads
static struct task_struct *philosophers[N];

// Function for philosophers to simulate dining behavior
static int philosopher_thread(void *arg)
{
    int id = *(int *)arg;

    while (!kthread_should_stop())
    {
        printk(KERN_INFO "Philosopher %d is THINKING\n", id);
        msleep(500); // Simulate thinking time

        if (id % 2 == 0)
        {
            // Even philosopher picks the right chopstick first
            down(&chopsticks[(id + 1) % N]);
```

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Screenshot 2

File   Actions   Edit   View   Help

```
┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ ls
Makefile  dpp.c

┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ []
```

Shell No. 1

File   Actions   Edit   View   Help

```
obj-m += dpp.o
~
~
~
~
~
~
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~
~
~
~
~
~
~
~
~
```

1,14   All

Screenshot 3

```
┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ ls
Makefile  dpp.c

┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ make -C /lib/modules/$(uname -r)/build M=$PWD
make: Entering directory '/usr/src/linux-headers-6.11.2-amd64'
  CC [M]  /home/muhammadrayyan/Documents/dining_philosophers_problem/dpp.o
  MODPOST /home/muhammadrayyan/Documents/dining_philosophers_problem/Module.symvers
  CC [M]  /home/muhammadrayyan/Documents/dining_philosophers_problem/dpp.mod.o
  LD [M]  /home/muhammadrayyan/Documents/dining_philosophers_problem/dpp.ko
  BTF [M] /home/muhammadrayyan/Documents/dining_philosophers_problem/dpp.ko
Skipping BTF generation for /home/muhammadrayyan/Documents/dining_philosophers_problem/dpp.ko due to unavailability of vmlinux
make: Leaving directory '/usr/src/linux-headers-6.11.2-amd64'

┌─(muhammadrayyan vbox)-[~/Documents/dining_philosophers_problem]
└─$ []
```

```
┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ ls
Makefile  Module.symvers  dpp.c  dpp.ko  dpp.mod  dpp.mod.c  dpp.mod.o  dpp.o  modules.order

┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ sudo insmod dpp.ko
[sudo] password for muhammadrayyan:

┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$
```

```
┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ dmesg | tail -n 30
[ 6776.423756] Philosopher 1 picks up right chopstick 2
[ 6776.423757] Philosopher 1 is EATING
[ 6776.423759] Philosopher 4 picks up right chopstick 0
[ 6776.423760] Philosopher 4 picks up left chopstick 4
[ 6776.423761] Philosopher 4 is EATING
[ 6776.423762] Philosopher 3 picks up left chopstick 3
[ 6776.935437] Philosopher 1 puts down left chopstick 1
[ 6776.935447] Philosopher 1 puts down right chopstick 2
[ 6776.935451] Philosopher 1 is THINKING
[ 6776.935474] Philosopher 4 puts down left chopstick 4
[ 6776.935477] Philosopher 4 puts down right chopstick 0
[ 6776.935479] Philosopher 4 is THINKING
[ 6776.937370] Philosopher 3 picks up right chopstick 4
[ 6776.937378] Philosopher 3 is EATING
[ 6776.937386] Philosopher 0 picks up right chopstick 1
[ 6776.937389] Philosopher 0 picks up left chopstick 0
[ 6776.937391] Philosopher 0 is EATING
[ 6777.446432] Philosopher 3 puts down left chopstick 3
[ 6777.446439] Philosopher 3 puts down right chopstick 4
[ 6777.446441] Philosopher 3 is THINKING
[ 6777.446443] Philosopher 2 picks up right chopstick 3
[ 6777.446444] Philosopher 2 picks up left chopstick 2
[ 6777.446445] Philosopher 2 is EATING
[ 6777.446448] Philosopher 0 puts down left chopstick 0
[ 6777.446449] Philosopher 0 puts down right chopstick 1
[ 6777.446494] Philosopher 0 is THINKING
[ 6777.446497] Philosopher 1 picks up left chopstick 1
```

```
┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ sudo rmmod dpp

┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ make -C /lib/modules/$(uname -r)/build M=$PWD clean
make: Entering directory '/usr/src/linux-headers-6.11.2-amd64'
  CLEAN   /home/muhammadrayyan/Documents/dining_philosophers_problem/Module.symvers
make: Leaving directory '/usr/src/linux-headers-6.11.2-amd64'

┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$ ls
Makefile  dpp.c

┌──(muhammadrayyan㉿vbox)-[~/Documents/dining_philosophers_problem]
└─$
```

```
muhammadrayyan@vbox: ~/Documents/dpp
File  Actions  Edit  View  Help

┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ ls
dpp.c

┌──(muhammadrayyan㉿vbox)-[~
└─$
```

```
Shell No. 1
File  Actions  Edit  View  Help

#include<stdio.h>
#include<stdlib.h>
#include<pthread.h>
#include<semaphore.h>
#include<unistd.h>
sem_t chopstick[5];
void * philos(void *);
void eat(int);
int main()
 {
        int i,n[5];
        pthread_t T[5];
        for(i=0;i<5;i++)
        sem_init(&chopstick[i],0,1);
        for(i=0;i<5;i++){
                n[i]=i;
                pthread_create(&T[i],NULL,philos,(void *)&n[i]);
                }
        for(i=0;i<5;i++)
                pthread_join(T[i],NULL);
 }
void * philos(void * n)
 {
        int ph=*(int *)n;
        printf("Philosopher %d wants to eat\n",ph);
        printf("Philosopher %d tries to pick left chopstick\n",ph);
        sem_wait(&chopstick[ph]);
        printf("Philosopher %d picks the left chopstick\n",ph);
                                                        1,1        Top
```

```
┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ ls
dpp.c

┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ gcc dpp.c -lpthread

┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ ls
a.out  dpp.c

┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ █
```

```
┌──(muhammadrayyan㉿vbox)-[~/Documents/dpp]
└─$ ./a.out
Philosopher 0 wants to eat
Philosopher 0 tries to pick left chopstick
Philosopher 1 wants to eat
Philosopher 1 tries to pick left chopstick
Philosopher 1 picks the left chopstick
Philosopher 1 tries to pick the right chopstick
Philosopher 1 picks the right chopstick
Philosopher 1 begins to eat
Philosopher 2 wants to eat
Philosopher 2 tries to pick left chopstick
Philosopher 3 wants to eat
Philosopher 3 tries to pick left chopstick
Philosopher 3 picks the left chopstick
Philosopher 3 tries to pick the right chopstick
Philosopher 3 picks the right chopstick
Philosopher 3 begins to eat
Philosopher 4 wants to eat
Philosopher 4 tries to pick left chopstick
Philosopher 0 picks the left chopstick
Philosopher 0 tries to pick the right chopstick
Philosopher 3 has finished eating
Philosopher 4 picks the left chopstick
Philosopher 4 tries to pick the right chopstick
Philosopher 3 leaves the right chopstick
Philosopher 3 leaves the left chopstick
Philosopher 1 has finished eating
Philosopher 1 leaves the right chopstick
```