CS342 - Project 3

Çelik Köseoğlu - 21400196

Introduction

In this report I will explain how I solved the dining philosophers problem using the pthreads library with mutex locks.

The solution I implemented uses one mutex lock and <NO_OF_PHILOSOPHERS> conditional variables. When a philosopher wants to pick up the chopsticks, he has to stop other philosophers and pick up the sticks. Then, he can signal the other philosophers to continue as well. So, the critical section is picking up and releasing the chopsticks.

A philosopher cannot eat while any of their neighbours are eating. I used modular arithmetic to check if the neighbouring chopsticks are available or not.

I have created two header files:

diningphil.h: Contains enums to make the code easier to read. Also, contains global arrays which are used by the philosopher functions.

probabilityengine.h: contains methods for uniform or exponential random variable generation

I have added comments to nearly every line. Start from the main function and read line by line to learn more about the execution of the program.

Random Number Generation:

For uniform random number generation, I have the rand() method of the C stdlib.

For exponential random number generation, I have used the following formula:

val = -log(rand(0,1))/(1/mean)

Which is, minus natural logarithm of a value between 0 and 1 multiplied by the mean value.

Hungry Durations:

I have tried running the program with these inputs:

Number of Philosophers: 15
Minthink Time: 5
Maxthink Time: 10
Mineat Time: 2
Maxeat Time: 4
Distribution: uniform
Eat Count: 2

Here is the time spent hungry for each philosopher:

philosopher 0 duration of hungry state = 645
philosopher 1 duration of hungry state = 1516
philosopher 2 duration of hungry state = 131
philosopher 3 duration of hungry state = 2491
philosopher 4 duration of hungry state = 577
philosopher 5 duration of hungry state = 2496
philosopher 6 duration of hungry state = 712
philosopher 7 duration of hungry state = 1568
philosopher 8 duration of hungry state = 228
philosopher 9 duration of hungry state = 1328
philosopher 10 duration of hungry state = 1084
philosopher 11 duration of hungry state = 1278
philosopher 12 duration of hungry state = 188
philosopher 13 duration of hungry state = 4143
philosopher 14 duration of hungry state = 1495

The average of these values is: 19,880 / 15 = 1325,333

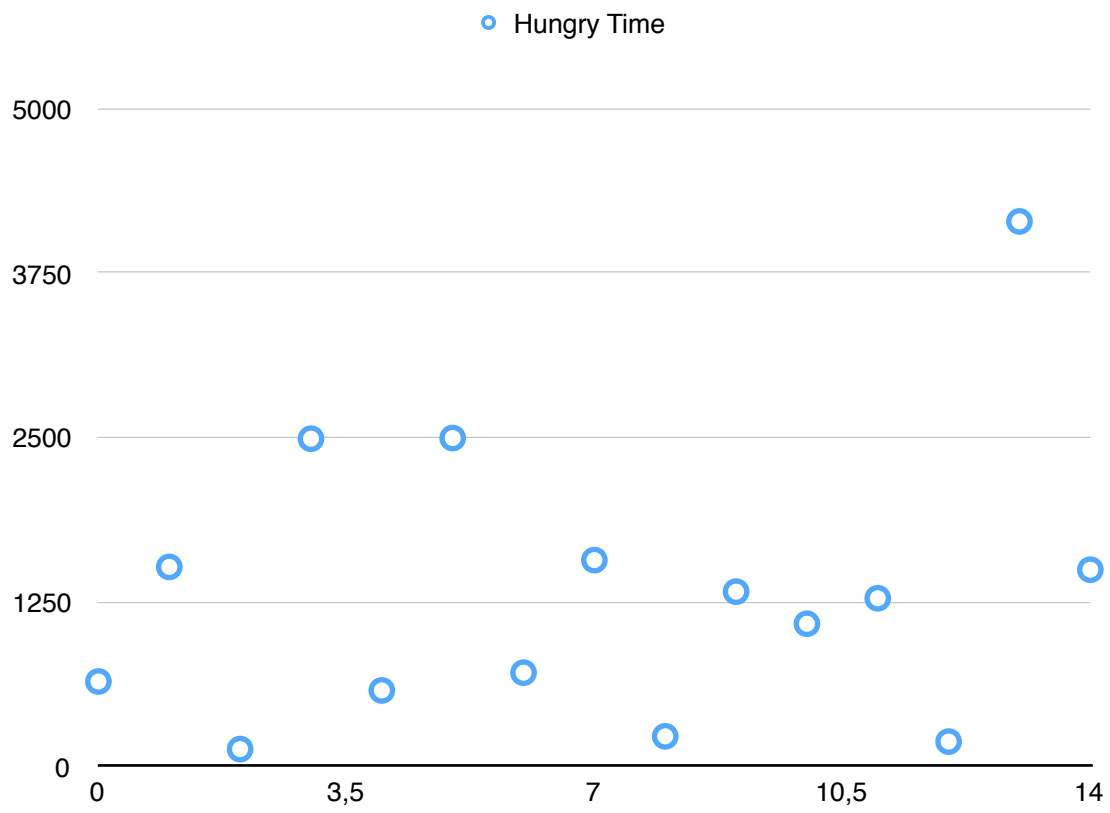

Figure 1 - Scatterplot Graph for Hungry Times of Philosophers

Standard Deviation: 1074.91313
Variance: 1155438.2381

Example Output With Showing Standard Deviations

```
Number of Philosophers: 5
Minthink Time: 5000 ms
Maxthink Time: 10000 ms
Mineat Time: 0 ms
Maxeat Time: 60000 ms
Distribution: exponential
Eat Count: 2

philosopher 0 hungry
philosopher 1 hungry
philosopher 4 hungry
philosopher 3 hungry
philosopher 2 hungry
philosopher 0 eating
philosopher 3 eating
philosopher 3 thinking
philosopher 2 eating
philosopher 0 thinking
philosopher 4 eating
philosopher 2 thinking
philosopher 1 eating
philosopher 2 hungry
philosopher 4 thinking
philosopher 3 hungry
philosopher 3 eating
philosopher 0 hungry
philosopher 1 thinking
philosopher 0 eating
philosopher 3 thinking
philosopher 2 eating
philosopher 4 hungry
philosopher 0 thinking
philosopher 4 eating
philosopher 2 thinking
philosopher 4 thinking
philosopher 1 hungry
philosopher 1 eating
philosopher 1 thinking
philosopher 0 duration of hungry state = 138
philosopher 1 duration of hungry state = 443
philosopher 2 duration of hungry state = 596
philosopher 3 duration of hungry state = 3
philosopher 4 duration of hungry state = 395

Now find the standard deviation of each philosopher's hungry times

time phil 0 spent for hungry time 0 is 3
time phil 0 spent for hungry time 1 is 135
Standard deviation for philosopher 0 is 66.0
time phil 1 spent for hungry time 0 is 437
time phil 1 spent for hungry time 1 is 6
Standard deviation for philosopher 1 is 215.5
time phil 2 spent for hungry time 0 is 71
```

```
time phil 2 spent for hungry time 1 is 525
Standard deviation for philosopher 2 is 227.0
time phil 3 spent for hungry time 0 is 0
time phil 3 spent for hungry time 1 is 3
Standard deviation for philosopher 3 is 1.5
time phil 4 spent for hungry time 0 is 217
time phil 4 spent for hungry time 1 is 178
Standard deviation for philosopher 4 is 19.5
```

Test Environment Specs

-Intel Core i5-2410M
-IntelHD 3000
-Corsair Force LS SSD 120GB SATA 3