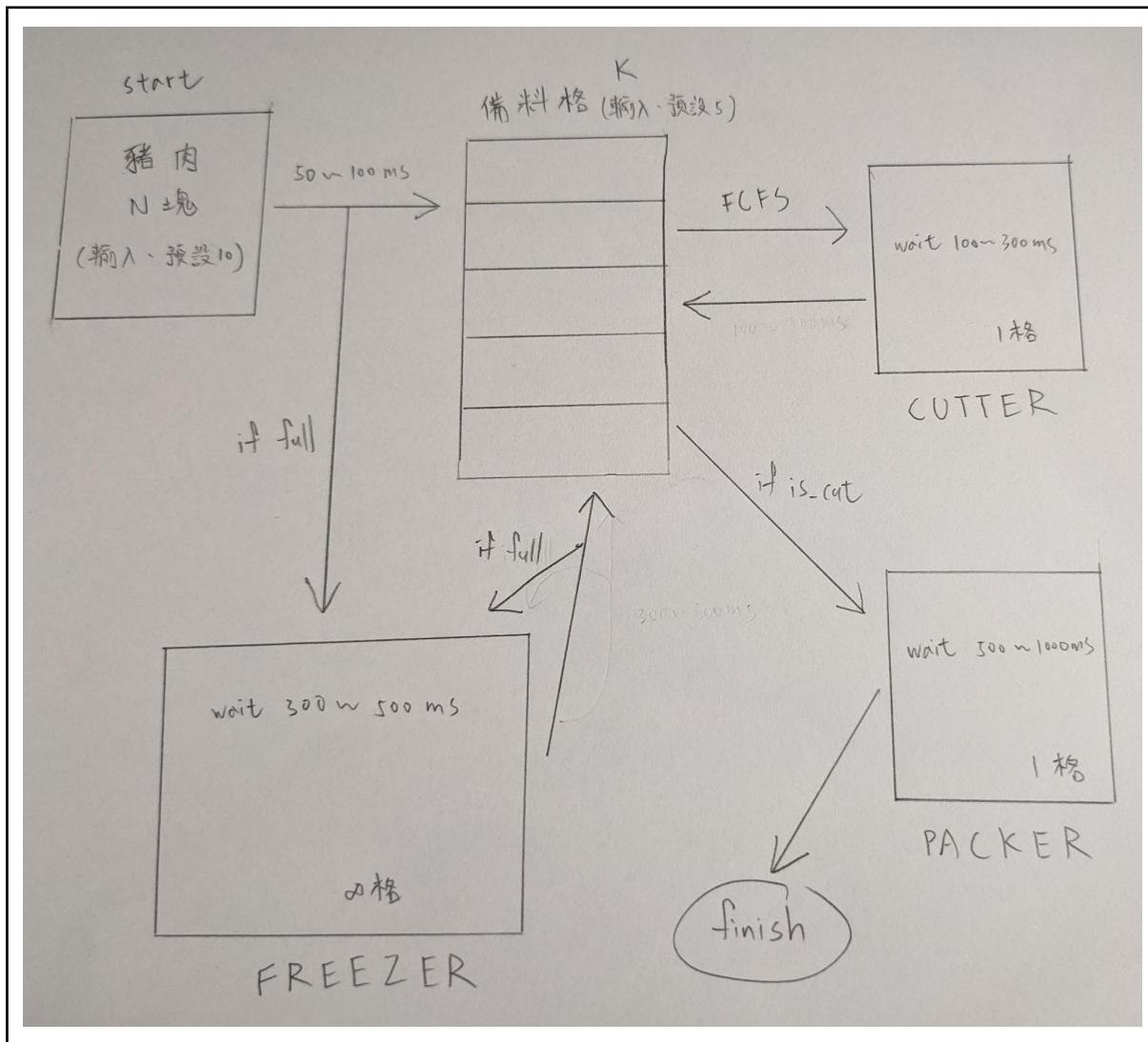


# Pork Zongzi maker 歡樂包粽機

s1083321 葉品和

## 一、題目說明



流程圖

題目會輸入豬肉的數量及備料格的大小，豬肉預設為10塊、備料格預設為5格，每50 ~ 100ms會有一塊豬肉被送到備料格，如果備料格滿了則會送到FREEZER，豬肉在FREEZER裡會經過300 ~ 500ms的等待，之後嘗試送到備料格，如果備料格還是滿的，則再進入FREEZER，備料格中的豬肉以FCFS的方式送到CUTTER中做處理，需要100 ~ 300ms的時間，處理結束會再送回備料格並標示已切割，之後已切割的豬肉也是以FCFS的方式送到PACKER中處理，經過500 ~ 1000ms的時間後，一顆粽子處理完成。

## 二、編譯說明

編譯的指令為: (linux環境)

```
gcc -o hw.out s1083321_OShw3.cpp -lrt -lpthread
```

-lrt timer會使用到

-lpthread pthread會使用到

執行的指令為: (第一個數字為豬肉的數量、第二個數字為備料格的大小)

```
./hw.out 10 5
```

```
ping@ping-VirtualBox:~/vb_share/s1083321_OShw3$ g++ -o hw.out s1083321_OShw3.cpp -lrt -lpthread
ping@ping-VirtualBox:~/vb_share/s1083321_OShw3$ ./hw.out 10 5
```

指令執行圖

### 三、執行結果

```
10ms - CUTTER: under reviewing together...
20ms - PACKER: under reviewing together...
30ms - PACKER: under reviewing together...
40ms - PACKER: under reviewing together...
50ms - PACKER: under reviewing together...
60ms - Pork#1 : waiting in the slot
60ms - Pork#1 : enters the CUTTER
60ms - CUTTER: cutting... cutting... Pork#1 (270ms)
60ms - PACKER: under maintenance.
70ms - PACKER: under maintenance.
80ms - PACKER: under maintenance.
90ms - PACKER: under maintenance.
100ms - PACKER: under maintenance.
110ms - PACKER: under maintenance.
120ms - PACKER: under maintenance.
130ms - PACKER: under maintenance.
140ms - Pork#2 : waiting in the slot
140ms - PACKER: under maintenance.
150ms - PACKER: under maintenance.
160ms - PACKER: under maintenance.
170ms - PACKER: under maintenance.
180ms - PACKER: under maintenance.
190ms - PACKER: under maintenance.
200ms - PACKER: under maintenance.
210ms - PACKER: under maintenance.
220ms - Pork#3 : waiting in the slot

220ms - PACKER: under maintenance.
230ms - PACKER: under maintenance.
240ms - PACKER: under maintenance.
250ms - PACKER: under maintenance.
260ms - PACKER: under maintenance.
270ms - PACKER: under maintenance.
280ms - Pork#4 : waiting in the slot
280ms - PACKER: under maintenance.
290ms - PACKER: under maintenance.
310ms - PACKER: under maintenance.
320ms - PACKER: under maintenance.
330ms - Pork#1 : leaves CUTTER (complete 1st stage)
330ms - Pork#2 : enters the CUTTER
330ms - CUTTER: cutting... cutting... Pork#2 (180ms)
330ms - Pork#1 : enters to the factory (PACKER)
330ms - PACKER : processing & Packing the Pork#1 (740ms)
330ms - Pork#5 : waiting in the slot
380ms - Pork#6 : waiting in the slot
470ms - Pork#7 : waiting in the slot
510ms - Pork#2 : leaves CUTTER (complete 1st stage)
510ms - Pork#3 : enters the CUTTER
510ms - CUTTER: cutting... cutting... Pork#3 (230ms)
540ms - Pork#8 has been sent to the Freezer (450ms)
630ms - Pork#9 has been sent to the Freezer (470ms)
700ms - Pork#10 has been sent to the Freezer (430ms)
740ms - Pork#3 : leaves CUTTER (complete 1st stage)
740ms - Pork#4 : enters the CUTTER
740ms - CUTTER: cutting... cutting... Pork#4 (280ms)
990ms - Pork#8 has been sent to the Freezer (450ms)
```

```
1020ms - Pork#4 : leaves CUTTER (complete 1st stage)
1020ms - Pork#5 : enters the CUTTER
1020ms - CUTTER: cutting... cutting... Pork#5 (130ms)
1070ms - Pork#1 : leaves PACKER (Complete)
1070ms - Pork#2 : enters to the factory (PACKER)
1070ms - PACKER : processing & Packing the Pork#2 (610ms)
1100ms - Pork#9 : waiting in the slot
1130ms - Pork#10 has been sent to the Freezer (340ms)
1150ms - Pork#5 : leaves CUTTER (complete 1st stage)
1150ms - Pork#6 : enters the CUTTER
1150ms - CUTTER: cutting... cutting... Pork#6 (170ms)
1320ms - Pork#6 : leaves CUTTER (complete 1st stage)
1320ms - Pork#7 : enters the CUTTER
1320ms - CUTTER: cutting... cutting... Pork#7 (120ms)
1440ms - Pork#8 has been sent to the Freezer (370ms)
1440ms - Pork#7 : leaves CUTTER (complete 1st stage)
1440ms - Pork#9 : enters the CUTTER
1440ms - CUTTER: cutting... cutting... Pork#9 (220ms)
1470ms - Pork#10 has been sent to the Freezer (330ms)
1660ms - Pork#9 : leaves CUTTER (complete 1st stage)
1660ms - Pork#9 : enters the CUTTER
1660ms - CUTTER: cutting... cutting... Pork#9 (140ms)
1680ms - Pork#2 : leaves PACKER (Complete)
1680ms - Pork#3 : enters to the factory (PACKER)
1680ms - PACKER : processing & Packing the Pork#3 (570ms)
1800ms - Pork#10 : waiting in the slot
1800ms - Pork#9 : leaves CUTTER (complete 1st stage)
1800ms - Pork#10 : enters the CUTTER
1800ms - CUTTER: cutting... cutting... Pork#10 (220ms)
1810ms - Pork#8 has been sent to the Freezer (490ms)
2020ms - Pork#10 : leaves CUTTER (complete 1st stage)
2020ms - Pork#10 : enters the CUTTER
2020ms - CUTTER: cutting... cutting... Pork#10 (210ms)
2230ms - Pork#10 : leaves CUTTER (complete 1st stage)
2230ms - Pork#10 : enters the CUTTER
2230ms - CUTTER: cutting... cutting... Pork#10 (160ms)
2250ms - Pork#3 : leaves PACKER (Complete)
2250ms - Pork#4 : enters to the factory (PACKER)
2250ms - PACKER : processing & Packing the Pork#4 (600ms)
2300ms - Pork#8 : waiting in the slot
2390ms - Pork#10 : leaves CUTTER (complete 1st stage)
2390ms - Pork#8 : enters the CUTTER
2390ms - CUTTER: cutting... cutting... Pork#8 (280ms)
2670ms - Pork#8 : leaves CUTTER (complete 1st stage)
2670ms - Pork#8 : enters the CUTTER
2670ms - CUTTER: cutting... cutting... Pork#8 (210ms)
2850ms - Pork#4 : leaves PACKER (Complete)
2850ms - Pork#5 : enters to the factory (PACKER)
2850ms - PACKER : processing & Packing the Pork#5 (670ms)
2880ms - Pork#8 : leaves CUTTER (complete 1st stage)
3520ms - Pork#5 : leaves PACKER (Complete)
3520ms - Pork#6 : enters to the factory (PACKER)
3520ms - PACKER : processing & Packing the Pork#6 (730ms)
4250ms - Pork#6 : leaves PACKER (Complete)
4250ms - Pork#7 : enters to the factory (PACKER)
```

```

4250ms - PACKER : processing & Packing the Pork#7 (560ms)
4810ms - Pork#7 : leaves PACKER (Complete)
4810ms - Pork#9 : enters to the factory (PACKER)
4810ms - PACKER : processing & Packing the Pork#9 (910ms)
5720ms - Pork#9 : leaves PACKER (Complete)
5720ms - Pork#10 : enters to the factory (PACKER)
5720ms - PACKER : processing & Packing the Pork#10 (560ms)
6280ms - Pork#10 : leaves PACKER (Complete)
6280ms - Pork#8 : enters to the factory (PACKER)
6280ms - PACKER : processing & Packing the Pork#8 (560ms)
6840ms - Pork#8 : leaves PACKER (Complete)
ping@ping-VirtualBox:~/vb_share/s1083321_0Shw3$ 

```

### 程式執行結果

豬肉編號	送來時間	進入備料格	進入 CUTTER	離開 CUTTER	進入 PACKER	離開 PACKER	進入 FREEZER
1	60ms	60ms	60ms	330ms	330ms	1070ms	-
2	140ms	140ms	330ms	510ms	1070ms	1680ms	-
3	220ms	220ms	510ms	740ms	1680ms	2250ms	-
4	280ms	280ms	740ms	1020ms	2250ms	2850ms	-
5	330ms	330ms	1020ms	1150ms	2850ms	3520ms	-
6	380ms	380ms	1150ms	1320ms	3520ms	4250ms	-
7	470ms	470ms	1320ms	1440ms	4250ms	4810ms	-
8	540ms	2300ms	2390ms	2880ms	6280ms	6840ms	540ms 990ms 1440ms 1810ms
9	630ms	1100ms	1440ms	1800ms	4810ms	5720ms	630ms
10	700ms	1800ms	1800ms	2390ms	5720ms	6280ms	700ms 1130ms 1470ms

時間表

大致跑的順序是1 2 3 4 5 6 7 9 10 8。9因為在FREEZER裡等待的時間比較短，以及備料格有空間，所以比8先執行，10也是同理。

前面當豬肉尚未送來時，CUTTER與PACKER進入reviewing模式，豬肉送來後，剩下PACKER進入maintenance模式，後面則當CUTTER與PACKER個別結束後不再進入maintenance模式。

## 四、程式說明

總共使用了5個pthread

1. pork: 管理豬肉送來的事件，每50 ~ 100ms會送來一塊豬肉，若儲存格還有空閒則將之放入儲存格並利用semaphore喚醒CUTTER，若儲存格滿了，則會將之放入freezer並利用semaphore喚醒FREEZER。當所有豬肉都送完後，結束這個pthread。
2. cutter: 被喚醒之後，尋找第一塊豬肉(FCFS)放入CUTTER進行處理，處理100 ~ 300ms後將之放回儲存格、標示已切割並利用semaphore喚醒PACKER，若是儲存格中沒有任何豬肉或是儲存格中所有豬肉都已切割，進入sleep，等待下一次被喚醒。當所有豬肉都切割完後，結束這個pthread。
3. packer: 被喚醒之後，尋找第一塊已切割豬肉(FCFS)放入PACKER進行處理，處理500 ~ 3100ms後完成，若是儲存格中沒有任何豬肉或是儲存格中沒有豬肉標示已切割，進入sleep，等待下一次被喚醒。當所有豬肉包完後，結束這個pthread。
4. freezer: 當第一塊豬肉被送進儲存格時，喚醒這個pthread。處理FREEZER中豬肉的時間，每塊豬肉會等待300 ~ 500ms，當等待結束後，判斷儲存格是否有空間，有則將之放入儲存格，若無則再進入FREEZER進行下一輪的等待。當所有豬肉被送進儲存格後，結束這個pthread。
5. no\_work: 由CUTTER與PACKER決定是否喚醒這個pthread，若是兩者都沒有工作則進入reviewing模式，否則則進入個別的maintenance模式。當CUTTER與PACKER結束後，結束這個pthread。

程式中運用了mutex以確保印出的訊息不會交錯印出與共用變數不會發生存取錯誤。

程式中使用週期性(10ms)的timer來記錄時間，每過10ms，時間變數TS會加10，以此來同步所有pthread間的時間。