System Programming Homework 3

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Objective:

You implemented a small bakers simulation inspired by a classic synchronization problem. The whole problem is about converting a process (the chef) requiring double resources into one that operates with a single semaphore (of which the agent i.e. wholesaler) is unaware of.

Let's assume for the sake of simplicity that one needs exactly 4 ingredients for preparing güllaç:

- milk (M)

- flour (F)

- walnuts (W)

- and sugar (S).

Problem Solving :

What if the whosaler brings flour and sugar, but one chef gets the sugar and the other the flour ? None will be able to prepare, the system will be deadlocked. Each chef must either get both ingredients, if available, or otherwise none; in order to avoid effectively the deadlocks.

We have four helper processes called "pushers" that respond to the signals from the whosaler, keep track of the available ingredients, and signal the appropriate chef.

These are the semaphores I use to synchronize the system:

```
//FOR CHEF AND WHOSALER SEM
sem_t MF2,MS2,MW2,SW2,SF2,FW2,WholesalerSEM;
//INGREDIENT SEM
sem_t milkSEM,flourSEM,walnutSEM,sugarSEM;
//Helper mutex
sem_t helperMutex;
//SEM FLAG
sem_t MflagSEM,FflagSEM,WflagSEM,SflagSEM;
```

After the wholesaler is done (i.e. he has no more ingredients to deliver, he must notify the chefs that the procedure is over – how?

To solve this problem, I have a finished flag. Flag is stored in shared mem. If there is no product left, I change the flag and the chef either does his normal job according to the flag control or returns the Güllaç he has prepared until then and leaves.

Design Decision:

->The program accepts that each input from the input file is valid and has data consisting of 2 characters in each line. Apart from these, the arrival of a fake data is not checked.

->Sem_post and sem_wait functions are used to change the value of semaphores. In addition, the semaphore was used for the condition states in the pushers and the values in it were checked with the get value function.

->I use the whosaler semaphore so that chef and whosaler do not access the repository of ingredients at the same time.

->In order for whosaler to deliver every time, I read a line from the input file and present it to the chefs.

-> I have 4 helper, 6 chef and 1 whosaler(parent) processes to solve the problem.

->I print the contents of the character array containing the ingredients at the end of every outputline. So you can see the semaphores are working correctly.

-> The program works with both semaphore types. My semaphores for unnamed are available in shared mem and accessed from there. For this I created a second shared mem of type struct_Sems. In first SM, there are the items. There are semaphores in the second SM.

Running And Result

Unnamed Input file;
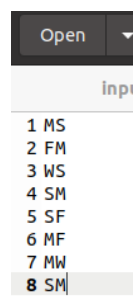
Compile and Run

make

./hw3named -i inputFilePath -n name

./hw3unnamed -i inputFilePath

Result:

```
atar@ubuntu:~/Desktop/hw3/unnamed$ make
gcc -Wall -o hw3unnamed hw3unnamed.c -lm -lrt -lpthread
atar@ubuntu:~/Desktop/hw3/unnamed$ ./hw3unnamed -i inputFilePath
chef0 (pid 3362) is waiting for walnuts and sugar ->Contents of the character array:
chef1 (pid 3363) is waiting for flour and walnuts ->Contents of the character array:
chef2 (pid 3364) is waiting for sugar and flour ->Contents of the character array:
chef3 (pid 3365) is waiting for milk and flour ->Contents of the character array:
chef4 (pid 3366) is waiting for milk and walnuts ->Contents of the character array:
chef5 (pid 3367) is waiting for sugar and milk ->Contents of the character array:
the wholesaler (pid 3361) delivers Sugar and Milk ->Contents of the character array: MS
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: MS
chef5 (pid 3367) has taken the M ->Contents of the character array:  S
chef5 (pid 3367) has taken the S ->Contents of the character array:
chef5 (pid 3367) is preparing the dessert ->Contents of the character array:
chef5 (pid 3367) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Milk and Flour ->Contents of the character array: FM
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: FM
chef3 (pid 3365) has taken the F ->Contents of the character array:  M
chef3 (pid 3365) has taken the M ->Contents of the character array:
chef3 (pid 3365) is preparing the dessert ->Contents of the character array:
chef3 (pid 3365) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Sugar and Walnuts ->Contents of the character array: WS
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: WS
chef0 (pid 3362) has taken the W ->Contents of the character array:  S
chef0 (pid 3362) has taken the S ->Contents of the character array:
chef0 (pid 3362) is preparing the dessert ->Contents of the character array:
chef0 (pid 3362) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Sugar and Milk ->Contents of the character array: SM
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: SM
chef5 (pid 3367) has taken the S ->Contents of the character array:  M
chef5 (pid 3367) has taken the M ->Contents of the character array:
chef5 (pid 3367) is preparing the dessert ->Contents of the character array:
chef5 (pid 3367) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Sugar and Flour ->Contents of the character array: SF
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: SF
chef2 (pid 3364) has taken the S ->Contents of the character array:  F
chef2 (pid 3364) has taken the F ->Contents of the character array:
chef2 (pid 3364) is preparing the dessert ->Contents of the character array:
chef2 (pid 3364) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Milk and Flour ->Contents of the character array: MF
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: MF
chef3 (pid 3365) has taken the M ->Contents of the character array:  F
chef3 (pid 3365) has taken the F ->Contents of the character array:
chef3 (pid 3365) is preparing the dessert ->Contents of the character array:
chef3 (pid 3365) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Milk and Walnuts ->Contents of the character array: MW
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: MW
chef4 (pid 3366) has taken the M ->Contents of the character array:  W
chef4 (pid 3366) has taken the W ->Contents of the character array:
chef4 (pid 3366) is preparing the dessert ->Contents of the character array:
chef4 (pid 3366) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 3361) delivers Sugar and Milk ->Contents of the character array: SM
the wholesaler (pid 3361) is waiting for the dessert ->Contents of the character array: SM
chef5 (pid 3367) has taken the S ->Contents of the character array:  M
chef5 (pid 3367) has taken the M ->Contents of the character array:
chef5 (pid 3367) is preparing the dessert ->Contents of the character array:
chef5 (pid 3367) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 3361) has obtained the dessert and left ->Contents of the character array:
chef0 (pid 3362) is exiting ->Contents of the character array:
chef1 (pid 3363) is exiting ->Contents of the character array:
chef3 (pid 3365) is exiting ->Contents of the character array:
chef2 (pid 3364) is exiting ->Contents of the character array:
chef5 (pid 3367) is exiting ->Contents of the character array:
chef4 (pid 3366) is exiting ->Contents of the character array:
the wholesaler (pid 3361) is done (total desserts: 8) ->Contents of the character array:
atar@ubuntu:~/Desktop/hw3/unnamed$
```

Input file for named:

```
1 MS
2 FM
3 WS
4 SM
5 SF
6 MF
7 MW
8 SM
```

Result:

```
atar@ubuntu:~/Desktop/hw3/named$ make
gcc -Wall -o hw3named hw3named.c -lm -lrt -lpthread
atar@ubuntu:~/Desktop/hw3/named$ ./hw3named -i inputFilePath -n name
chef0 (pid 4154) is waiting for walnuts and sugar ->Contents of the character array:
chef1 (pid 4155) is waiting for flour and walnuts ->Contents of the character array:
chef2 (pid 4156) is waiting for sugar and flour ->Contents of the character array:
chef3 (pid 4157) is waiting for milk and flour ->Contents of the character array:
chef4 (pid 4158) is waiting for milk and walnuts ->Contents of the character array:
chef5 (pid 4159) is waiting for sugar and milk ->Contents of the character array:
the wholesaler (pid 4153) delivers Sugar and Milk ->Contents of the character array: MS
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: MS
chef5 (pid 4159) has taken the M ->Contents of the character array:  S
chef5 (pid 4159) has taken the S ->Contents of the character array:
chef5 (pid 4159) is preparing the dessert ->Contents of the character array:
chef5 (pid 4159) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Milk and Flour ->Contents of the character array: FM
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: FM
chef3 (pid 4157) has taken the F ->Contents of the character array:  M
chef3 (pid 4157) has taken the M ->Contents of the character array:
chef3 (pid 4157) is preparing the dessert ->Contents of the character array:
chef3 (pid 4157) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Sugar and Walnuts ->Contents of the character array: WS
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: WS
chef0 (pid 4154) has taken the W ->Contents of the character array:  S
chef0 (pid 4154) has taken the S ->Contents of the character array:
chef0 (pid 4154) is preparing the dessert ->Contents of the character array:
chef0 (pid 4154) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Sugar and Milk ->Contents of the character array: SM
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: SM
chef5 (pid 4159) has taken the S ->Contents of the character array:  M
chef5 (pid 4159) has taken the M ->Contents of the character array:
chef5 (pid 4159) is preparing the dessert ->Contents of the character array:
chef5 (pid 4159) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Sugar and Flour ->Contents of the character array: SF
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: SF
chef2 (pid 4156) has taken the S ->Contents of the character array:  F
chef2 (pid 4156) has taken the F ->Contents of the character array:
chef2 (pid 4156) is preparing the dessert ->Contents of the character array:
chef2 (pid 4156) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Milk and Flour ->Contents of the character array: MF
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: MF
chef3 (pid 4157) has taken the M ->Contents of the character array:  F
chef3 (pid 4157) has taken the F ->Contents of the character array:
chef3 (pid 4157) is preparing the dessert ->Contents of the character array:
chef3 (pid 4157) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Milk and Walnuts ->Contents of the character array: MW
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: MW
chef4 (pid 4158) has taken the M ->Contents of the character array:  W
chef4 (pid 4158) has taken the W ->Contents of the character array:
chef4 (pid 4158) is preparing the dessert ->Contents of the character array:
chef4 (pid 4158) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
the wholesaler (pid 4153) delivers Sugar and Milk ->Contents of the character array: SM
the wholesaler (pid 4153) is waiting for the dessert ->Contents of the character array: SM
chef5 (pid 4159) has taken the S ->Contents of the character array:  M
chef5 (pid 4159) has taken the M ->Contents of the character array:
chef5 (pid 4159) is preparing the dessert ->Contents of the character array:
chef5 (pid 4159) has delivered the dessert ->Contents of the character array:
the wholesaler (pid 4153) has obtained the dessert and left ->Contents of the character array:
chef4 (pid 4158) is exiting ->Contents of the character array:
chef0 (pid 4154) is exiting ->Contents of the character array:
chef1 (pid 4155) is exiting ->Contents of the character array:
chef2 (pid 4156) is exiting ->Contents of the character array:
chef3 (pid 4157) is exiting ->Contents of the character array:
chef5 (pid 4159) is exiting ->Contents of the character array:
the wholesaler (pid 4153) is done (total desserts: 8) ->Contents of the character array:
atar@ubuntu:~/Desktop/hw3/named$
```