Kezie Osei

Dr.Ghosh

Operating Systems

1. My sigint_handler method works well for both fifo and lifo. After pressing control C, all the shared memory deattaches. For lifo and fifo, my insertbuffer and dequeuebuffer. In my dequeuebuffer, the second part of calculating average waiting time. My producer and consumer works. All my methods work, but on rare occasions, I get a segfault. For example the first time I ran my code I got a segfalut but I ran it for five more times and it didn't give me a segfault. Update: while doing question 5, I ran into a problem when sometimes I would get a segfault.

2. The terminating condition for the producer thread is by the for loop which is specified by pro_loop. Pro_loop is the number of jobs created by the producer and after the for loop finishes, doneProd is incremented by 1 indicating that the producer has completed its work. For the consumer thread, it continues to run until either the number of jobs consumed is equal to the number of jobs produced (jobsConsumed == *jobMade) or all producer threads have completed their work (*doneProd == num_prod). The consumer thread will wait for new jobs to be added to the buffer using sem_wait(empty_sem), and it will exit the loop once it has consumed all the jobs it needs to.

3. The semaphores and other book-keeping variables are shared between processes and threads using shared memory. In the code, the shared memory segments are created using shmget(), and the shared memory is attached to the processes/threads using shmat(). The semaphores are created using sem_open() and the shared memory segments are accessed by all the processes/threads using the pointer returned by shmat(). The semaphores are initialized using sem_init(). The shared memory is deallocated using shmdt() and shmctl().

4. Buffer_index in Lifo is used to keep track of the number of items stored in the buffer while in and out pointer are used to keep track of the positions in the buffer in Fifo.

5.The signal handler in the provided code is used to handle the SIGINT signal, which is sent to the process when the user types Ctrl-C on the command line. When this signal is received, the handler function sigint_handler() is called, which performs the following tasks: Waits for all the producer processes to exit using the wait() system call, cancels all the consumer threads by calling pthread_cancel(), destroys the semaphores using sem_destroy(), detaches the shared memory segments using shmdt(), removes the shared memory segments using shmctl() with the IPC_RMID flag, prints a message to the console indicating that the program has exited safely, and exits the program using exit(0).

3. Lifo

```
Producer [293741] added jobSize:[790] to buffer
Producer [293740] added jobSize:[911] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[911] from buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[790] from buffer
Producer [293741] added jobSize:[997] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[997] from buffer
Producer [293740] added jobSize:[311] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[311] from buffer
Producer [293741] added jobSize:[889] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[889] from buffer
Producer [293740] added jobSize:[889] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[889] from buffer
Producer [293740] added jobSize:[302] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[302] from buffer
Producer [293740] added jobSize:[167] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[167] from buffer
Producer [293740] added jobSize:[742] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[742] from buffer
Producer [293740] added jobSize:[722] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[722] from buffer
Producer [293740] added jobSize:[722] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[722] from buffer
Producer [293740] added jobSize:[137] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[137] from buffer
Producer [293740] added jobSize:[995] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[995] from buffer
Producer [293740] added jobSize:[852] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[852] from buffer
Producer [293740] added jobSize:[635] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[635] from buffer
Producer [293740] added jobSize:[530] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[530] from buffer
Producer [293740] added jobSize:[1000] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[1000] from buffer
Producer [293740] added jobSize:[721] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[721] from buffer
Producer [293740] added jobSize:[846] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[846] from buffer
```

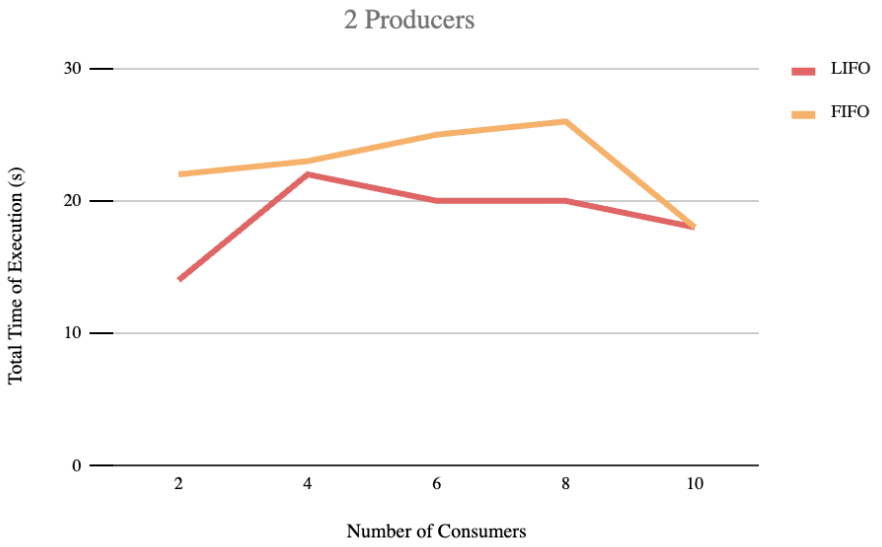
```
Producer [293740] added jobSize:[969] to buffer
Consumer ID:[ 140455853246016] dequeue pid[293739] jobSize:[969] from buffer
Producer [293740] added jobSize:[699] to buffer
Consumer ID:[ 140455861638720] dequeue pid[293739] jobSize:[699] from buffer
Total Execution Time: 21.000021 sec
Average Waiting Time: 0.004486 sec
Total jobs: 21
```

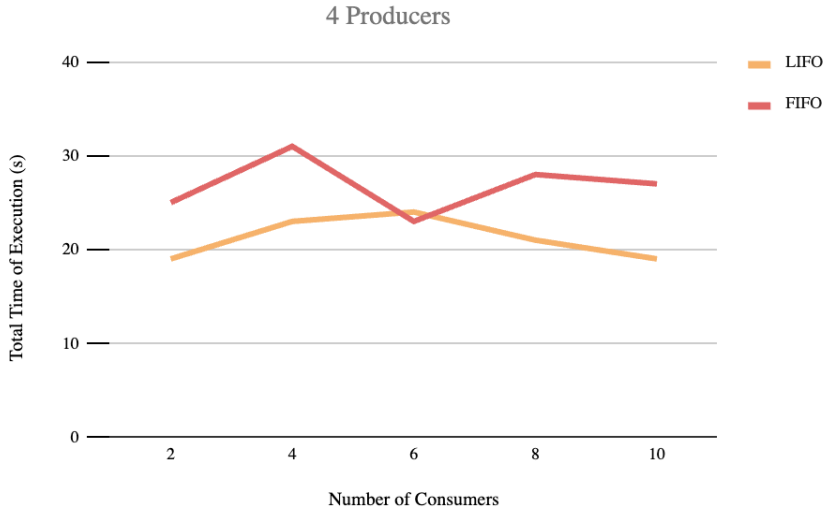
Fifo

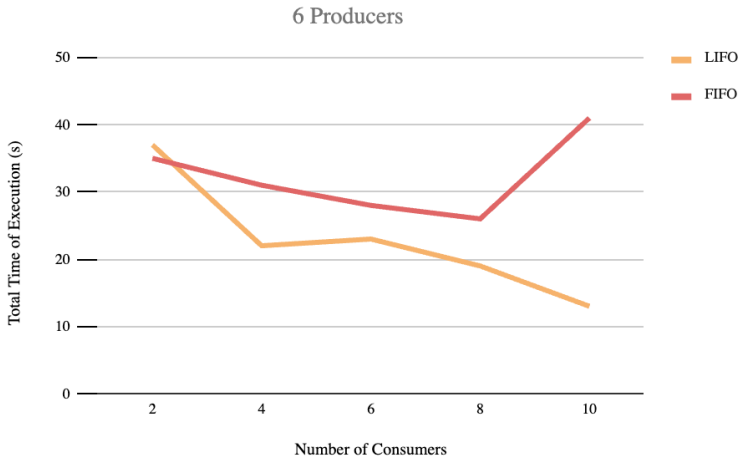
```
oseika@egr-v-cmsc312-3:~/Assignment2$ ./fifo 2 2
Producer [293857] added jobSize:[450] to buffer
Producer [293858] added jobSize:[902] to buffer
Producer [293857] added jobSize:[101] to buffer
Producer [293858] added jobSize:[293] to buffer
Producer [293858] added jobSize:[582] to buffer
Producer [293857] added jobSize:[455] to buffer
Producer [293857] added jobSize:[720] to buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[450] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[902] from buffer
Producer [293857] added jobSize:[855] to buffer
Producer [293857] added jobSize:[239] to buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[101] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[293] from buffer
Producer [293857] added jobSize:[446] to buffer
Producer [293857] added jobSize:[933] to buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[582] from buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[455] from buffer
Producer [293857] added jobSize:[487] to buffer
Producer [293857] added jobSize:[941] to buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[720] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[855] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[239] from buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[446] from buffer
Consumer ID:[ 140241635042880] dequeue pid:[293856], jobSize:[933] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[487] from buffer
Consumer ID:[ 140241626650176] dequeue pid:[293856], jobSize:[941] from buffer
Total Execution Time: 7.000007 sec
Average Waiting Time: 0.140271 sec
Total jobs: 34
```

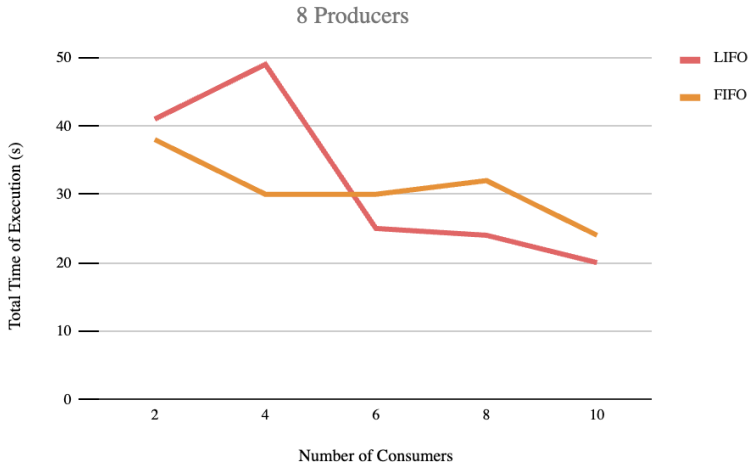
FIFO			
Producers:	**Consumers:**	**Total Time of Execution:**	**Average Wait Time:**
2	2	22.000022	0.000685
2	4	23.000023	0.000457
2	6	25.000025	0.00049
2	8	26.000026	0.000569
2	10	18.000018	0.000359
4	2	25.000025	0.00063
4	4	31.000031	0.000759
4	6	23.000023	0.000709
4	8	28.000028	0.00056
4	10	27.000027	0.001366
6	2	35.000035	0.02435
6	4	31.000031	0.007508
6	6	28.000028	0.005136
6	8	26.000026	0.003222
6	10	41.000041	0.047683
8	2	38.000038	0.632581
8	4	30.00003	0.009552
8	6	30.00003	0.005369
8	8	32.000032	0.003955
8	10	24.000024	0.000106386
10	2	47.000047	0.44965
10	4	32.000032	0.009136
10	6	28.000028	0.005281
10	8	33.000033	0.004026
10	10	28.000028	0.003254

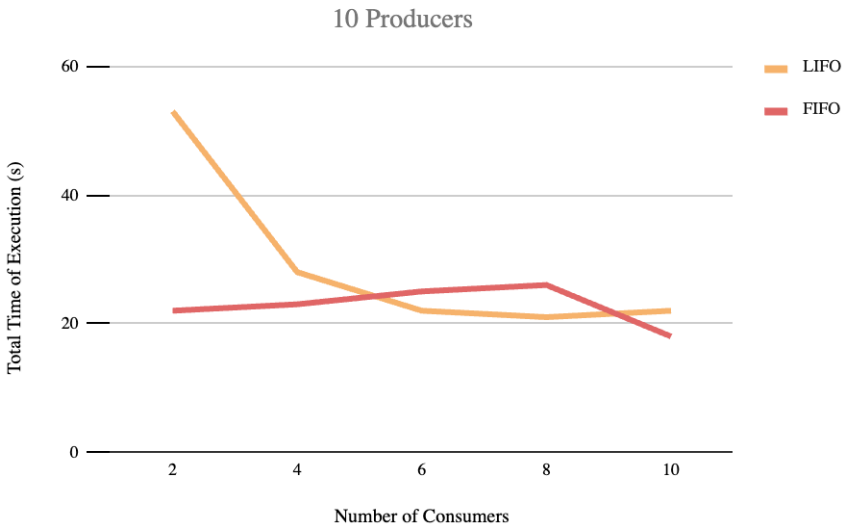
LIFO			
Producers:	**Consumers:**	**Total Time of Execution:**	**Average Wait Time:**
2	2	14.000014	0.004103
2	4	22.000022	0.003037
2	6	20.00002	0.001491
2	8	20.00002	0.00617
2	10	18.000018	0.002563
4	2	19.000019	0.023537
4	4	23.000023	0.007228
4	6	24.000024	0.002676
4	8	21.000021	0.002069
4	10	19.000019	0.001488
6	2	37.000037	1.285185
6	4	22.000022	0.007866
6	6	23.000023	0.010123
6	8	19.000019	0.003487
6	10	13.000013	0.008064
8	2	41.000041	0.764976
8	4	49.0051649	0.034147695
8	6	25.000025	0.002759
8	8	24.000024	0.009708
8	10	20.00002	0.004352
10	2	53.000053	0.266643
10	4	28.000028	0.057087
10	6	22.000022	0.011495
10	8	21.000021	0.002216
10	10	22.000022	0.012588


2 Producers
30
20
10
0
Total Time of Execution (s)
2
4
6
8
10
Number of Consumers
LIFO
FIFO


4 Producers
40
30
20
10
0
Total Time of Execution (s)
2
4
6
8
10
Number of Consumers
LIFO
FIFO


6 Producers
50
40
30
20
10
0
Total Time of Execution (s)
2
4
6
8
10
Number of Consumers
LIFO
FIFO


8 Producers
50
40
30
20
10
0
Total Time of Execution (s)
2
4
6
8
10
Number of Consumers
LIFO
FIFO


10 Producers
60
40
20
0
Total Time of Execution (s)
2
4
6
8
10
Number of Consumers
LIFO
FIFO