



```

109 void *producer(void *id)
110 {
111     int producer_id = *(int *) id;
112     for (int i = 0; i < num_job; i++){
113         int result = sem_wait_timed(semid2, 0, 20);

```

```

-:--- main.cc 69% L113 (C++/l Abbrev)

```

```

265520 zw322@ray24:given$ ./main 5 6 2 3
265521 producer(1): job id 0 duration 6
265522 producer(2): job id 1 duration 4
265523 consumer(1): job id 0 executing sleep duration 6
265524 consumer(2): job id 1 executing sleep duration 4
265525 producer(2): job id 2 duration 7
265526 consumer(3): job id 2 executing sleep duration 7
265527 producer(1): job id 3 duration 4
265528 consumer(2): job id 1 completed
265529 consumer(2): job id 3 executing sleep duration 4
265530 producer(2): job id 4 duration 1
265531 producer(1): job id 0 duration 2
265532 consumer(1): job id 0 completed
265533 consumer(1): job id 4 executing sleep duration 1
265534 producer(1): job id 1 duration 5
265535 consumer(1): job id 4 completed
265536 consumer(1): job id 0 executing sleep duration 0
265537 consumer(1): job id 0 completed
265538 consumer(1): job id 1 executing sleep duration 5
265539 consumer(2): job id 3 completed
265540 producer(2): job id 2 duration 4
265541 consumer(2): job id 2 executing sleep duration 4
265542 consumer(3): job id 2 completed
265543 producer(2): job id 3 duration 5
265544 consumer(3): job id 3 executing sleep duration 5
265545 producer(1): job id 4 duration 5
265546 consumer(1): job id 1 completed
265547 consumer(1): job id 4 executing sleep duration 5
265548 consumer(2): job id 2 completed
265549 producer(1): job id 0 duration 1
265550 producer(2): job id 1 duration 4
265551 consumer(2): job id 0 executing sleep duration 1
265552 consumer(2): job id 0 completed
265553 consumer(2): job id 1 executing sleep duration 4
265554 consumer(3): job id 3 completed
265555 consumer(1): job id 4 completed
265556 Producer(1): no more jobs to generate
265557 Producer(2): no more jobs to generate
265558 consumer(2): job id 1 completed
265559 zw322@ray24:given$ ipcs -s
265560
265561 ----- Semaphore Arrays -----
265562 key          semid      owner      perms      nsems
265563

```

```

U:*** *shell* 99% L265524 (Shell:run)

```

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```
9 #include "helper.h"
10
11 void *producer (void *id);
-:***- main.cc          7% L11      (C++//l Abbrev)
265706 g++ -Wall -pthread -o main helper.o main.o
265707 zw322@ray24:given$ ./main 5 4 4 2
265708 producer(1): job id 0 duration 6
265709 producer(2): job id 1 duration 9
265710 producer(3): job id 2 duration 8
265711 consumer(1): job id 0 executing sleep duration 6
265712 consumer(2): job id 1 executing sleep duration 9
265713 producer(4): job id 3 duration 9
265714 producer(3): job id 4 duration 4
265715 consumer(1): job id 0 completed
265716 producer(1): job id 0 duration 1
265717 consumer(1): job id 2 executing sleep duration 8
265718 consumer(2): job id 1 completed
265719 producer(4): job id 1 duration 6
265720 consumer(2): job id 3 executing sleep duration 9
265721 consumer(1): job id 2 completed
265722 producer(2): job id 2 duration 4
265723 consumer(1): job id 4 executing sleep duration 4
265724 consumer(2): job id 3 completed
265725 producer(3): job id 3 duration 6
265726 consumer(2): job id 0 executing sleep duration 1
265727 consumer(1): job id 4 completed
265728 producer(1): job id 4 duration 6
265729 consumer(1): job id 1 executing sleep duration 6
265730 consumer(2): job id 0 completed
265731 producer(4): job id 0 duration 8
265732 consumer(2): job id 2 executing sleep duration 4
265733 consumer(2): job id 2 completed
265734 producer(2): job id 1 duration 3
265735 consumer(2): job id 3 executing sleep duration 6
265736 consumer(1): job id 1 completed
265737 producer(3): job id 2 duration 7
265738 consumer(1): job id 4 executing sleep duration 6
265739 Producer(3): no more jobs to generate
265740 consumer(2): job id 3 completed
265741 producer(1): job id 3 duration 4
265742 consumer(2): job id 0 executing sleep duration 8
265743 consumer(1): job id 4 completed
265744 producer(4): job id 4 duration 1
265745 consumer(1): job id 1 executing sleep duration 0
265746 consumer(1): job id 1 completed
265747 consumer(1): job id 2 executing sleep duration 7
265748 producer(2): job id 0 duration 8
265749 Producer(2): no more jobs to generate
265750 Producer(1): no more jobs to generate
265751 Producer(4): no more jobs to generate
265752 consumer(2): job id 0 completed
265753 consumer(2): job id 3 executing sleep duration 4
265754 consumer(1): job id 2 completed
265755 consumer(1): job id 4 executing sleep duration 1
265756 consumer(1): job id 4 completed
265757 consumer(1): job id 0 executing sleep duration 0
265758 consumer(1): job id 0 completed
265759 consumer(2): job id 3 completed
265760 zw322@ray24:given$
U:***- *shell*          Bot L265730 (Shell:run -1)
```



```

1 zw322@ray24:given$ make
2 g++ -c -o helper.o helper.cc
3 g++ -Wall -c helper.cc main.cc
4 g++ -Wall -pthread -o main helper.o main.o
5 zw322@ray24:given$ ./main 6 4 7 3
6 producer(1): job id 0 duration 6
7 producer(3): job id 1 duration 2
8 producer(2): job id 2 duration 2
9 producer(5): job id 3 duration 3
10 producer(6): job id 4 duration 9
11 producer(4): job id 5 duration 1
12 consumer(1): job id 0 executing sleep duration 6
13 consumer(2): job id 1 executing sleep duration 2
14 consumer(3): job id 2 executing sleep duration 2
15 consumer(3): job id 2 completed
16 consumer(2): job id 1 completed
17 consumer(3): job id 3 executing sleep duration 3
18 producer(7): job id 0 duration 1
19 consumer(2): job id 4 executing sleep duration 9
20 producer(5): job id 1 duration 7
21 consumer(3): job id 3 completed
22 consumer(3): job id 5 executing sleep duration 1
23 producer(2): job id 2 duration 9
24 consumer(1): job id 0 completed
25 consumer(1): job id 0 executing sleep duration 0
26 producer(4): job id 3 duration 1
27 consumer(1): job id 0 completed
28 consumer(1): job id 1 executing sleep duration 7
29 producer(1): job id 4 duration 7
30 consumer(3): job id 5 completed
31 consumer(3): job id 2 executing sleep duration 9
32 producer(6): job id 5 duration 3
33 consumer(2): job id 4 completed
34 consumer(2): job id 3 executing sleep duration 1
35 producer(7): job id 0 duration 7
36 consumer(2): job id 3 completed
37 producer(3): job id 1 duration 1
38 consumer(2): job id 4 executing sleep duration 0
39 consumer(2): job id 4 completed
40 consumer(2): job id 5 executing sleep duration 3
41 producer(4): job id 2 duration 2
42 consumer(1): job id 1 completed
43 consumer(1): job id 0 executing sleep duration 7
44 producer(5): job id 3 duration 9
45 consumer(3): job id 2 completed
46 consumer(3): job id 1 executing sleep duration 0
47 producer(2): job id 4 duration 2
48 consumer(3): job id 1 completed
49 consumer(3): job id 2 executing sleep duration 0
50 producer(6): job id 5 duration 3

```

U:**- *shell* Top L49 (Shell:run)

Beginning of buffer



```
51 consumer(3): job id 2 completed
52 consumer(3): job id 3 executing sleep duration 9
53 producer(1): job id 0 duration 6
54 consumer(2): job id 5 completed
55 producer(7): job id 1 duration 1
56 consumer(2): job id 4 executing sleep duration 2
57 consumer(2): job id 4 completed
58 consumer(2): job id 5 executing sleep duration 0
59 producer(3): job id 2 duration 2
60 consumer(2): job id 5 completed
61 producer(7): job id 3 duration 9
62 consumer(2): job id 0 executing sleep duration 6
63 consumer(1): job id 0 completed
64 consumer(1): job id 1 executing sleep duration 1
65 producer(5): job id 4 duration 6
66 consumer(1): job id 1 completed
67 consumer(1): job id 2 executing sleep duration 2
68 producer(4): job id 5 duration 9
69 Producer(7): no more jobs to generate
70 consumer(1): job id 2 completed
71 consumer(1): job id 3 executing sleep duration 9
72 producer(2): job id 0 duration 2
73 consumer(2): job id 0 completed
74 producer(1): job id 1 duration 2
75 consumer(2): job id 4 executing sleep duration 6
76 consumer(3): job id 3 completed
77 consumer(3): job id 5 executing sleep duration 9
78 producer(6): job id 2 duration 3
79 Producer(5): no more jobs to generate
80 Producer(4): no more jobs to generate
81 Producer(2): no more jobs to generate
82 Producer(6): no more jobs to generate
83 Producer(1): no more jobs to generate
84 consumer(2): job id 4 completed
85 consumer(2): job id 0 executing sleep duration 0
86 producer(3): job id 3 duration 5
87 consumer(2): job id 0 completed
88 consumer(2): job id 1 executing sleep duration 2
89 consumer(2): job id 1 completed
90 consumer(2): job id 2 executing sleep duration 3
91 consumer(1): job id 3 completed
92 consumer(1): job id 3 executing sleep duration 0
93 consumer(1): job id 3 completed
94 consumer(3): job id 5 completed
95 Producer(3): no more jobs to generate
96 consumer(2): job id 2 completed
97 zw322@ray24:given$
```