

```
1 #include <stdio.h>
2 #include <pthread.h>
3 #include <semaphore.h>
4 #define BUFFER_SIZE 10
5 int buffer[BUFFER_SIZE];
6 int count = 0;
7 sem_t empty, full;
8 pthread_mutex_t mutex;
9 void *producer(void *arg) {
10 for (int i = 1; i ≤ 100; i++) {
11 sem_wait(&empty);
12 pthread_mutex_lock(&mutex);
13 buffer[count++] = i;
14 printf("Produced: %d\n", i);
15 pthread_mutex_unlock(&mutex);
16 sem_post(&full);
17 }
18 return NULL;
19 }
20 void *consumer(void *arg) {
21 for (int i = 1; i ≤ 100; i++) {
22 sem_wait(&full);
23 pthread_mutex_lock(&mutex);
24 int item = buffer[--count];
25 printf("Consumed: %d\n", item);
26 pthread_mutex_unlock(&mutex);
27 sem_post(&empty);
28 }
29 return NULL;
30 }
31 int main() {
32 pthread_t prod, cons;
33 sem_init(&empty, 0, BUFFER_SIZE);
34 sem_init(&full, 0, 0);
35 pthread_mutex_init(&mutex, NULL);
36 pthread_create(&prod, NULL, producer, NULL);
37 pthread_create(&cons, NULL, consumer, NULL);
38 pthread_join(prod, NULL);
39 pthread_join(cons, NULL);
40 sem_destroy(&empty);
41 sem_destroy(&full);
42 pthread_mutex_destroy(&mutex);
43 return 0;
44 }
```

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(munu@kali)-[~]  
$ gedit producer_consumer.c
```

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(gedit:5456): Gtk-WARNING **: 19:1  
^C
```

```
(munu@kali)-[~]  
$ chmod +x producer_consumer.c
```

```
(munu@kali)-[~]  
$ gcc producer_consumer.c
```

```
(munu@kali)-[~]  
$ ./a.out
```

Produced: 1	Consumed: 18	Consumed: 36	Consumed: 55	Consumed: 73
Produced: 2	Consumed: 17	Consumed: 35	Consumed: 54	Consumed: 72
Produced: 3	Consumed: 16	Consumed: 34	Consumed: 53	Consumed: 71
Produced: 4	Consumed: 15	Consumed: 33	Consumed: 52	Produced: 81
Produced: 5	Consumed: 14	Consumed: 32	Consumed: 51	Produced: 82
Produced: 6	Consumed: 13	Consumed: 31	Produced: 61	Produced: 83
Produced: 7	Consumed: 12	Produced: 41	Produced: 62	Produced: 84
Produced: 8	Consumed: 11	Produced: 42	Produced: 63	Produced: 85
Produced: 9	Consumed: 21	Produced: 43	Produced: 64	Produced: 86
Produced: 10	Consumed: 22	Produced: 44	Produced: 65	Produced: 87
Consumed: 10	Produced: 23	Produced: 45	Produced: 66	Produced: 88
Consumed: 9	Produced: 24	Produced: 46	Produced: 67	Produced: 89
Consumed: 8	Produced: 25	Produced: 47	Produced: 68	Produced: 90
Consumed: 7	Produced: 26	Produced: 48	Produced: 69	Consumed: 90
Consumed: 6	Produced: 27	Produced: 49	Produced: 70	Consumed: 89
Consumed: 5	Produced: 28	Produced: 50	Consumed: 70	Consumed: 88
Consumed: 4	Produced: 29	Consumed: 50	Consumed: 69	Consumed: 87
Consumed: 3	Produced: 30	Consumed: 49	Consumed: 68	Consumed: 86
Consumed: 2	Consumed: 30	Consumed: 48	Consumed: 67	Consumed: 85
Consumed: 1	Consumed: 29	Consumed: 47	Consumed: 66	Consumed: 84
Produced: 11	Consumed: 28	Consumed: 46	Consumed: 65	Consumed: 83
Produced: 12	Consumed: 27	Consumed: 45	Consumed: 64	Consumed: 82
Produced: 13	Consumed: 26	Consumed: 44	Consumed: 63	Consumed: 81
Produced: 14	Consumed: 25	Consumed: 43	Consumed: 62	Produced: 91
Produced: 15	Consumed: 24	Consumed: 42	Consumed: 61	Produced: 92
Produced: 16	Consumed: 23	Consumed: 41	Produced: 71	Produced: 93
Produced: 17	Consumed: 22	Consumed: 40	Produced: 72	Produced: 94
Produced: 18	Consumed: 21	Produced: 51	Produced: 73	Produced: 95
Produced: 19	Consumed: 20	Produced: 52	Produced: 74	Produced: 96
	Consumed: 19	Produced: 53	Produced: 75	Produced: 97
	Consumed: 18	Produced: 54	Produced: 76	Produced: 98
	Consumed: 17	Produced: 55	Produced: 77	Produced: 99
	Consumed: 16	Produced: 56	Produced: 78	Produced: 100
	Consumed: 15	Produced: 57	Produced: 79	Consumed: 100
	Consumed: 14	Produced: 58	Produced: 80	Consumed: 99
	Consumed: 13	Produced: 59	Consumed: 80	Consumed: 98
	Consumed: 12	Produced: 60	Consumed: 79	Consumed: 97
	Consumed: 11	Consumed: 60	Consumed: 78	Consumed: 96
	Consumed: 10	Consumed: 59	Consumed: 77	Consumed: 95
	Consumed: 9	Consumed: 58	Consumed: 76	Consumed: 94
	Consumed: 8	Consumed: 57	Consumed: 75	Consumed: 93
	Consumed: 7	Consumed: 56	Consumed: 74	Consumed: 92
	Consumed: 6	Consumed: 55	Consumed: 73	Consumed: 91

```

1 C code:
2 #include <stdio.h>
3 #include <pthread.h>
4 #include <semaphore.h>
5 sem_t sem_odd, sem_even;
6 void *print_odd(void *arg) {
7     for (int i = 1; i ≤ 20; i += 2) {
8         sem_wait(&sem_odd);
9         printf("%d ", i);
10        sem_post(&sem_even);
11    }
12    return NULL;
13 }
14 void *print_even(void *arg) {
15     for (int i = 2; i ≤ 20; i += 2) {
16         sem_wait(&sem_even);
17         printf("%d ", i);
18         sem_post(&sem_odd);
19     }
20     return NULL;
21 }
22 int main() {
23     pthread_t odd, even;
24     sem_init(&sem_odd, 0, 1);
25     sem_init(&sem_even, 0, 0);
26     pthread_create(&odd, NULL, print_odd, NULL);
27     pthread_create(&even, NULL, print_even, NULL);
28     pthread_join(odd, NULL);
29     pthread_join(even, NULL);
30     sem_destroy(&sem_odd);
31     sem_destroy(&sem_even);
32     return 0;
33 }

```

```

(munu@kali)-[~]
$ gedit altermtwothread.c

```

```

(gedit:13920): Gtk-WARNING **: 19:34:05.558: Calling org.x
^C

```

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(munu@kali)-[~]
$ gcc altermtwothread.c

```

```

(munu@kali)-[~]
$ ./a.out

```

```

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

```

```

1 #include <stdio.h>
2 #include <pthread.h>
3 #include <semaphore.h>
4 sem_t sem_A, sem_B;
5 void *print_A(void *arg) {
6     for (int i = 0; i < 10; i++) {
7         sem_wait(&sem_A);
8         printf("A");
9         sem_post(&sem_B);
10    }
11    return NULL;
12 }
13 void *print_B(void *arg) {
14     for (int i = 0; i < 10; i++) {
15         sem_wait(&sem_B);
16         printf("B");
17         sem_post(&sem_A);
18    }
19    return NULL;
20 }
21 int main() {
22     pthread_t thread_A, thread_B;
23     sem_init(&sem_A, 0, 1);
24     sem_init(&sem_B, 0, 0);
25     pthread_create(&thread_A, NULL, print_A, NULL);
26     pthread_create(&thread_B, NULL, print_B, NULL);
27     pthread_join(thread_A, NULL);
28     pthread_join(thread_B, NULL);
29     sem_destroy(&sem_A);
30     sem_destroy(&sem_B);
31     printf("\n");
32     return 0;
33 }

```

```

(munu@kali)-[~]
└─$ gedit alterchar.c
(gedit:15096): Gtk-WARNING **:
^C
(munu@kali)-[~]
└─$ chmod +x alterchar.c
(munu@kali)-[~]
└─$ gcc alterchar.c
(munu@kali)-[~]
└─$ ./a.out
ABABABABABABABABAB

```



```

1 #include <stdio.h>
2 #include <pthread.h>
3 #include <semaphore.h>
4 sem_t sem_countdown, sem_countup;
5 void *countdown(void *arg) {
6     for (int i = 10; i >= 1; i--) {
7         sem_wait(&sem_countdown);
8         printf("Countdown: %d\n", i);
9         sem_post(&sem_countup);
10    }
11    return NULL;
12 }
13 void *countup(void *arg) {
14     for (int i = 1; i <= 10; i++) {
15         sem_wait(&sem_countup);
16         printf("Countup: %d\n", i);
17         sem_post(&sem_countdown);
18    }
19    return NULL;
20 }
21 int main() {
22     pthread_t thread_countdown, thread_countup;
23     sem_init(&sem_countdown, 0, 1);
24     sem_init(&sem_countup, 0, 0);
25     pthread_create(&thread_countdown, NULL, countdown, NULL);
26     pthread_create(&thread_countup, NULL, countup, NULL);
27     pthread_join(thread_countdown, NULL);
28     pthread_join(thread_countup, NULL);
29     sem_destroy(&sem_countdown);
30     sem_destroy(&sem_countup);
31     return 0;
32 }

```

```

(munu@kali)-[~]
$ gedit count.c
(gedit:17029): Gtk-WARNING:
^C
(munu@kali)-[~]
$ chmod +x count.c
(munu@kali)-[~]
$ gcc count.c
(munu@kali)-[~]
$ ./a.out
Countdown: 10
Countup: 1
Countdown: 9
Countup: 2
Countdown: 8
Countup: 3
Countdown: 7
Countup: 4
Countdown: 6
Countup: 5
Countdown: 5
Countup: 6
Countdown: 4
Countup: 7
Countdown: 3
Countup: 8
Countdown: 2
Countup: 9
Countdown: 1
Countup: 10

```

```

1 #include <stdio.h>
2 #include <pthread.h>
3 #include <semaphore.h>
4 sem_t sem_A, sem_B, sem_C;
5 void *print_A(void *arg) {
6     for (int i = 1; i ≤ 20; i += 3) {
7         sem_wait(&sem_A);
8         printf("A%d ", i);
9         sem_post(&sem_B);
10    }
11    return NULL;
12 }
13 void *print_B(void *arg) {
14     for (int i = 2; i ≤ 20; i += 3) {
15         sem_wait(&sem_B);
16         printf("B%d ", i);
17         sem_post(&sem_C);
18    }
19    return NULL;
20 }
21 void *print_C(void *arg) {
22     for (int i = 3; i ≤ 20; i += 3) {
23         sem_wait(&sem_C);
24         printf("C%d ", i);
25         sem_post(&sem_A);
26    }
27    return NULL;
28 }
29 int main() {
30     pthread_t thread_A, thread_B, thread_C;
31     sem_init(&sem_A, 0, 1);
32     sem_init(&sem_B, 0, 0);
33     sem_init(&sem_C, 0, 0);
34     pthread_create(&thread_A, NULL, print_A, NULL);
35     pthread_create(&thread_B, NULL, print_B, NULL);
36     pthread_create(&thread_C, NULL, print_C, NULL);
37     pthread_join(thread_A, NULL);
38     pthread_join(thread_B, NULL);
39     pthread_join(thread_C, NULL);
40     sem_destroy(&sem_A);
41     sem_destroy(&sem_B);
42     sem_destroy(&sem_C);
43     printf("\n");
44     return 0;
45 }

```

```

(munu@kali)-[~]
$ gedit seqprint.c

(gedit:19488): Gtk-WARNING **: 19:45:06.309: Calling org.xfce.Session.Ma
^C
(munu@kali)-[~]
$ chmod +x seqprint.c
(munu@kali)-[~]
$ gcc seqprint.c
(munu@kali)-[~]
$ ./a.out
A1 B2 C3 A4 B5 C6 A7 B8 C9 A10 B11 C12 A13 B14 C15 A16 B17 C18 A19 B20

```