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# 实验3 进程同步

### 实验要求:

见书p236

#### 代码说明:

buffer.h 文件里带一个全局的 buffer变量声明 和两个对buffer变量进行操作的接口函数声明: int insert\_item(buffer\_item item); int remove\_item(buffer\_item\* item);

buffer.c 是对接口和全局变量的实现和定义。

main.c 是主程序,基本跟书上内容没差,osx不能用sem\_init就只能用sem\_open代替了。

#### 效果演示:

```
shiyan3 — crmrc@v — ..rk/os/shiyan3 — zsh — 80×24
producer1 produced 893351816
program exit
→/Users/crurc/Code/homework/os/shiyan3 >./main 20 2 2
producer1 produced 984943658
producer0 produced 1144108930
consumer1 consumed 984943658
producer0 produced 1457850878
consumer1 consumed 1144108930
producer0 produced 1784484492
producer1 produced 114807987
consumer1 consumed 1457850878
consumer1 consumed 1784484492
producer0 produced 896544303
consumer1 consumed 114807987
producer1 produced 1264817709
producer1 produced 197493099
producer1 produced 893351816
producer0 produced 1954899097
consumer1 consumed 896544303
consumer1 consumed 1264817709
producer1 produced 704877633
consumer1 consumed 197493099
consumer1 consumed 893351816
consumer1 consumed 1954899097
```

## 代码:

//buffer.h

#ifndef \_\_BUFFER\_H\_\_ #define \_\_BUFFER\_H\_\_ 班级: 2013211312 姓名: 楼燕 学号2012211451

```
#include <unistd.h>
#define BUFFER_SIZE 5
typedef int buffer_item;
typedef int buffer_idx;
typedef struct {
  buffer_item buf[BUFFER_SIZE];
  size_t len;
  buffer_idx head;
  buffer idx end;
} buffer_t;
extern buffer_t buffer;
int insert_item(buffer_item item);
int remove_item(buffer_item* item);
#endif
//buffer.c
#include "buffer.h"
buffer_t buffer = {
  .len = 0,
  .head = 0,
  .end = 0
};
int insert_item(buffer_item item)
  if (buffer.len >= BUFFER_SIZE){
     return -1;
  }else{
     buffer.len++;
     buffer.buf[buffer.end] = item;
     buffer.end = (buffer.end + 1) % BUFFER_SIZE;
     return 0;
  }
  return -1;
int remove_item(buffer_item* item)
  if (buffer.len \leq 0){
     return -1;
  }else{
     buffer.len--;
     (*item) = buffer.buf[buffer.head];
     buffer.head = (buffer.head + 1) % BUFFER_SIZE;
     return 0;
  }
  return -1;
```

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班级: 2013211312

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学号2012211451
```

```
}
//main.c
#include <stdlib.h>
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>
#include "buffer.h"
void *producer(void* pnumber);
void *consumer(void* pnumber);
pthread_mutex_t mutex;
sem_t *empty, *full;
const char *empty_name = "Empty!";
const char *full_name = "Full!"; //Die!!
int main(int argc, char const *argv[])
  // wtf,osx sem_init 不能用
  // sem_init(&empty, 0, 5);
  // sem_init(&full, 0, 0);
  int i;
  int sleep_time = atoi(argv[1]);
  int pro_thread_count = atoi(argv[2]);
  int con_thread_count = atoi(argv[3]);
  if ((empty = sem_open(empty_name, O_CREAT, 0644, 5)) == SEM_FAILED) {
     perror("semaphore initilization");
     exit(1);
  }
  if ((full = sem_open(full_name, O_CREAT, 0644, 0)) == SEM_FAILED) {
     perror("semaphore initilization");
     exit(1);
  }
  pthread_t pro, con;
  int *pnumber = malloc(sizeof(int));
  for (i = 0; i < pro_thread_count; ++i)
  {
     *pnumber = i;
     pthread_create(&pro, NULL, producer, (void*)pnumber);
  }
  for (i = 0; i < con_thread_count; ++i)
     *pnumber = i;
```

pthread\_create(&con, NULL, consumer, (void\*)pnumber);

姓名: 楼燕

学号2012211451

```
}
  // pthread_join(pro, NULL);
  // pthread_join(con, NULL);
  sleep(sleep_time);
  pthread_mutex_destroy(&mutex);
  // sem_destroy(&empty);
  // sem_destroy(&full);
  sem_unlink(empty_name);
  sem_unlink(full_name);
  printf("program exit\n");
  return 0;
}
void *producer(void* pnumber)
  buffer_item item;
  int number = *((int*)pnumber);
  while(1) {
     sleep(rand() % 3);
     item = rand();
     sem_wait(empty);
     pthread_mutex_lock(&mutex);
     printf("producer%d produced %d\n", number, item);
     if (insert_item(item)){
       fprintf(stderr, "report error condition");
     pthread_mutex_unlock(&mutex);
     sem_post(full);
}
void *consumer(void* pnumber)
  buffer_item item;
  int number = *((int*)pnumber);
  while(1) {
     sleep(rand() % 3);
     item = rand();
     sem_wait(full);
     pthread_mutex_lock(&mutex);
```

班级: 2013211312

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```
if (remove_item(&item)){
     fprintf(stderr, "report error condition");
}else{
     printf("consumer%d consumed %d\n", number, item);
}

pthread_mutex_unlock(&mutex);
     sem_post(empty);
}
```