CS341 #16 CV Cookies, Counting Semaphores, Ring buffer.

1. Condition Variables Warm-up Challenge: Eat cookies fast!

Meanwhile in a Parallel Universe …

Two threads viciously eat cookies but are blocked on a c.v. …

```
01 int jar = 0;
02 pthread_mutex_t m = PTHREAD_MUTEX_INITIALIZER;
03 pthread_cond_t cv1 = PTHREAD_COND_INITIALIZER;
04
05 void* cookie_eater(void*arg) {
06  char* name = (char*) arg;
07  while(game_running) {
08    while(jar == 0) {
09       printf("%s nap time\n", name);
10       ? p_cond_wait (&cv1, &m)
11    }
12    jar --;
13    printf("%s eats! %d remain\n",name, jar);
14  }
15  printf("%s is exiting...",name);
16  return NULL;
17 }
```

p_m_lock

p_m_unlock

Complete the `add_cookies` to add cookies to the cookie jar
(Pretend cookie jar has ∞ capacity)

```
18 void add_cookies(int add) {
19   assert(add > 0);
20   jar += add;
21
22   p_cond_broadcast
23
24
```

p_m_lock

because we don't want add and eat at same time

if switch, still won't, since lock is still there!

p_m_unlock

2. What must be locked before calling `p_cond_wait` ? mutex lock

3. You wake a thread blocked inside a condition variable but it does not return from `p_cond_wait`. Why?

Another thread still has the duck

The blocked thread will continue when the duck is released

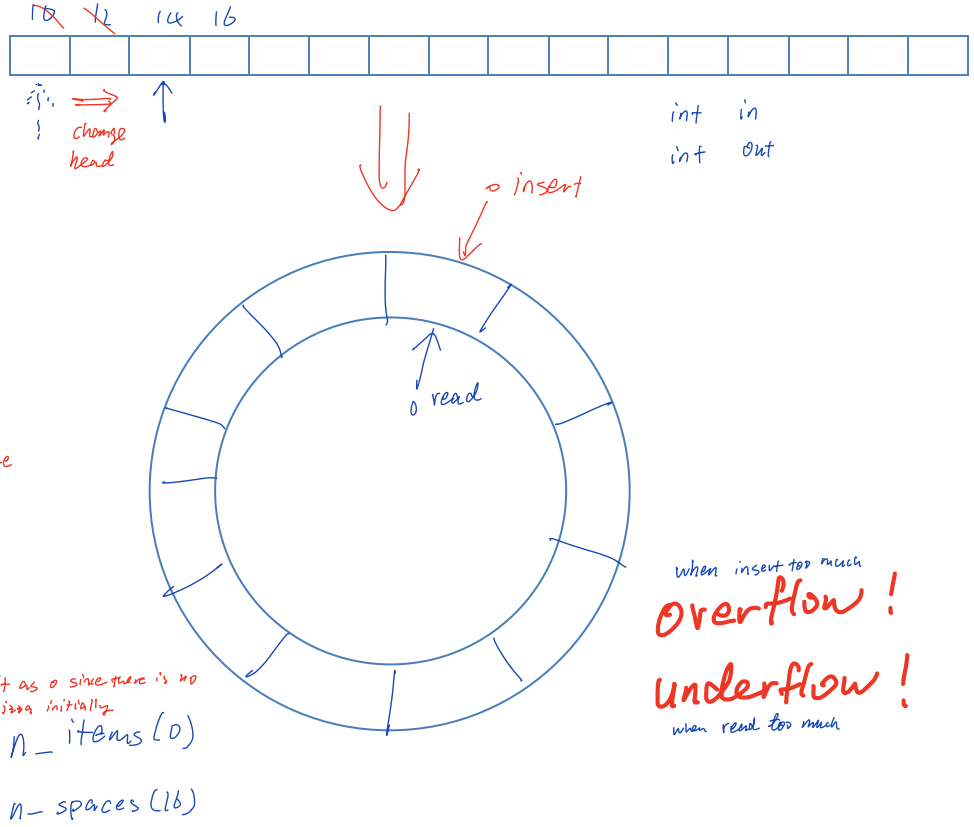
4. How do I use counting semaphores?

sem_init (&s, 0, 8) → # pizza

sem_wait (&s) → "eat slice" → will block

sem_post (&s) → "slice ++" → won't block

5. What is a fixed ring buffer? Why would I use it?



6. Producer Consumer Case Study:
Use counting semaphores to implement a fixed ring buffer

```
pthread_mutex_t m;

  // (Not OSX!)

sem_t  n_items , n_spaces

void init() {
  sem_init( &n_item      ,  0,  0  );
  sem_init( &n-spaces    ,  0,  16 );
  pthread_mutex_init( &m , NULL);
}

void sync_enqueue(work_t *work) {

sem_wait(n-space)
ring [(in++) & 15] = work
                %16
sem_post(n_items)

}
work_t* sync_dequeue(){

sem_wait (n_items)
result = ring [ (out++) & 15]
sem_post ( n-space )
```

work-t* ring
int in, int out
lock
unlock
fail when int overflow
lock
unlock

7. Quick quiz
i) How many threads can be executing line 8 or 14 at a time? Why?
ii) What have I made? (Missing code? + Better function names?

```
01  pthread_mutex_t m = PTHREAD_MUTEX_INITIALIZER;
02  pthread_cond_t cv1 = PTHREAD_COND_INITIALIZER;
03  int  mystery = 5;
04
05  void  A?() { // Waits if count would become -ve
06    p_m_lock(&m)
07    while(mystery == 0) p_cond_wait(&cv1, &m);
08    mystery --;
09    p_m_unlock(&m);
10  }
11  void B?() {
12     p_m_lock(&m);
13     mystery ++;
14     if( _____________ ) p_cond_broadcast(&cv1);
15     p_m_unlock(&m);
16  }
```