

Too Much Milk With Locks

Both threads:

```
std::mutex mutex;
```

```
...
```

```
mutex.lock();  
if (milk == 0) {  
    buy_milk();  
}  
mutex.unlock();
```

Producer/Consumer, v1

```
class Pipe {
    Pipe() : count(0), nextPut(0), nextGet(0) {}
    void put(char c);
    char get();

    std::mutex mutex;
    char buffer[SIZE];
    int count;
    int nextPut;
    int nextGet;
};

void Pipe::put(char c) {
    mutex.lock();
    count++;
    buffer[nextPut] = c;
    nextPut++;
    if (nextPut == SIZE) {
        nextPut = 0;
    }
    mutex.unlock();
}
```

```
char Pipe::get() {
    char c;
    mutex.lock();
    count--;
    c = buffer[nextGet];
    nextGet++;
    if (nextGet == SIZE) {
        nextGet = 0;
    }
    mutex.unlock();
    return c;
}
```

Producer/Consumer, v2

```
class Pipe {
    Pipe() : count(0), nextPut(0), nextGet(0) {}
    void put(char c);
    char get();

    std::mutex mutex;
    char buffer[SIZE];
    int count;
    int nextPut;
    int nextGet;
};

void Pipe::put(char c) {
    mutex.lock();
    while (count == SIZE) {
        mutex.unlock();
        mutex.lock();
    }
    count++;
    buffer[nextPut] = c;
    nextPut++;
    if (nextPut == SIZE) {
        nextPut = 0;
    }
    mutex.unlock();
}
```

```
char Pipe::get() {
    char c;
    mutex.lock();
    while (count == 0) {
        mutex.unlock();
        mutex.lock();
    }
    count--;
    c = buffer[nextGet];
    nextGet++;
    if (nextGet == SIZE) {
        nextGet = 0;
    }
    mutex.unlock();
    return c;
}
```

Producer/Consumer, v3

```
class Pipe {
    Pipe() : count(0), nextPut(0), nextGet(0) {}
    void put(char c);
    char get();

    std::mutex mutex;
    std::condition_variable charAdded, charRemoved;
    char buffer[SIZE];
    int count;
    int nextPut;
    int nextGet;
};

void Pipe::put(char c) {
    mutex.lock();
    while (count == SIZE) {
        charRemoved.wait(mutex);
    }
    count++;
    buffer[nextPut] = c;
    nextPut++;
    if (nextPut == SIZE) {
        nextPut = 0;
    }
    charAdded.notify_one();
    mutex.unlock();
}
```

```
char Pipe::get() {
    char c;
    mutex.lock();
    while (count == 0) {
        charAdded.wait(mutex);
    }
    count--;
    c = buffer[nextGet];
    nextGet++;
    if (nextGet == SIZE) {
        nextGet = 0;
    }
    charRemoved.notify_one();
    mutex.unlock();
    return c;
}
```

