

# Chapter 1

# Process Management

## 1.1. Process Scheduling

## 1.2. Process Synchronization

### 1.2.1. Producer-Consumer Problem

```
1 - // Shared bounded buffer
2 - class Buffer {
3 -     int[] items;
4 -     int size;
5 -     int count;
6 -     int in;
7 -     int out;
8 -
9 -     // Constructor
10 -    void Buffer(int capacity) {
11 -        size = capacity;
12 -        items = new int[size];
13 -        count = 0;
14 -        in = 0;
15 -        out = 0;
16 -    }
17 -
18 -    // Add an item to the buffer (producer)
19 -    void put(int value) {
20 -        while (count == size) {
21 -            wait();      // buffer full
22 -        }
23 -
24 -        items[in] = value;
```

```
25 -            in = (in + 1) % size;
26 -            count = count + 1;
27 -
28 -            notify();      // wake up consumer
29 -        }
30 -
31 -        // Remove an item from the buffer (consumer)
32 -        int get() {
33 -            while (count == 0) {
34 -                wait();      // buffer empty
35 -            }
36 -
37 -            int value = items[out];
38 -            out = (out + 1) % size;
39 -            count = count - 1;
40 -
41 -            notify();      // wake up producer
42 -            return value;
43 -        }
44 -    }
45 -
46 -    // Producer thread
47 -    class Producer {
48 -        Buffer buffer;
49 -
50 -        void Producer(Buffer b) {
51 -            buffer = b;
52 -        }
53 -
54 -        void run() {
55 -            int x = 0;
56 -
57 -            while (true) {
58 -                buffer.put(x);
59 -                println("Produced: " + x);
60 -                x = x + 1;
61 -            }
62 -        }
63 -    }
64 -
65 -    // Consumer thread
66 -    class Consumer {
67 -        Buffer buffer;
68 -
```

```
69 -     void Consumer(Buffer b) {
70 -         buffer = b;
71 -     }
72 -
73 -     void run() {
74 -         while (true) {
75 -             int v = buffer.get();
76 -             println("Consumed: " + v);
77 -         }
78 -     }
79 - }
80 -
81 - // Program entry point
82 - void main() {
83 -     Buffer buf = new Buffer(5);
84 -
85 -     Producer p = new Producer(buf);
86 -     Consumer c = new Consumer(buf);
87 -
88 -     startThread(p);
89 -     startThread(c);
90 - }
```