第21讲 进程的并发控制 硬件实现方法



Approaches of Mutual Exclusion

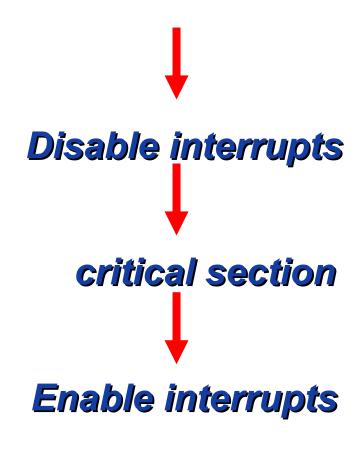
- Software Approaches
- Hardware Support
- Semaphores
- Monitors
- Message Passing



- Interrupt Disabling
 - A process runs until it invokes an operatingsystem service or until it is interrupted.
 - Disabling interrupts guarantees mutual exclusion.
- The price of this approach is high.
- Multiprocessing
 - Disabling interrupts on one processor will not guarantee mutual exclusion.



Mutual Exclusion by Interrupt Disabling





- Special Machine Instructions
 - Performed in a single instruction cycle.
 - Not subject to interference from other instructions.(避免冲突)
 - Reading and writing
 - Reading and testing



Test and Set Instruction

```
function testset (var i:integer): boolean;
 begin
 if i = 0 then
   begin
    i := 1;
    testset := true;
   end
 else testset :=false;
 end.
```



```
program mutualexclusion;
const n=...; /* 进程数 */
var bolt:integer;
procedure P(i:integer);
begin
 repeat
repeat {nothing} until testset
  (bolt);
  < 临界区 >;
  bolt :=0;
  < 其余部分 >
 forever
end;
```

```
begin /* 主程序 */
 bolt :=0;
 parbegin
  P(1);
  P(2);
  P(n)
 parend
end.
```

Exchange Instruction

```
procedure exchange ( var r :register; var m :memory );
var temp;
begin
  temp := m;
  m := r;
  r := temp;
end.
```



```
program mutualexclusion;
const n=...; /* 进程数 */
var bolt:integer;
procedure P(i:integer);
var key:integer;
begin
 repeat
  key:=1;
    repeat exchange(key,bolt) until
  key=0;
  < 临界区 >;
  bolt := 0;
  <其余部分>
 forever
end;
```

```
begin /* 主程序 */
bolt :=0;
parbegin
P(1);
P(2);
...
P(n)
parend
end.
```



Mutual Exclusion Machine Instructions

Advantages

- Applicable to any number of processes on either a single processor or multiple processors sharing main memory.
- It is simple and therefore easy to verify.
- It can be used to support multiple critical sections.



Mutual Exclusion Machine Instructions

Disadvantages

- Busy-waiting is employed.
- Starvation is possible.
 - when a process leaves a critical section and more than one process is waiting.
- Deadlock is possible.
 - If a low priority process has the critical region and a higher priority process needs, the higher priority process will obtain the processor to wait for the critical region.

