

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | max | | | allocation | | | need | | | available | | |
|  | A | B | C | A | B | C | A | B | C | A | B | C |
| P1 | 5 | 5 | 9 | 2 | 1 | 2 | 3 | 4 | 7 | 2 | 3 | 3 |
| P2 | 5 | 3 | 6 | 4 | 0 | 2 | 1 | 3 | 4 |  |  |  |
| P3 | 4 | 0 | 11 | 4 | 0 | 5 | 0 | 0 | 6 |  |  |  |
| P4 | 4 | 2 | 5 | 2 | 0 | 4 | 2 | 2 | 1 |  |  |  |
| P5 | 4 | 2 | 4 | 3 | 1 | 4 | 1 | 1 | 0 |  |  |  |

解：

1）

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work | | | need | | | allocation | | | Work&allocation | | | finish |
|  | A | B | C | A | B | C | A | B | C | A | B | C |
| P4 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 0 | 4 | 4 | 3 | 7 | true |
| P2 | 4 | 3 | 7 | 1 | 3 | 4 | 4 | 0 | 2 | 8 | 3 | 9 | true |
| P3 | 8 | 3 | 9 | 0 | 0 | 6 | 4 | 0 | 5 | 12 | 3 | 14 | true |
| P5 | 12 | 3 | 14 | 2 | 2 | 1 | 3 | 1 | 4 | 15 | 4 | 18 | true |
| P1 | 15 | 4 | 18 | 3 | 4 | 7 | 2 | 1 | 2 | 17 | 5 | 20 | true |

T0时刻为安全状态，安全序列为：P4-->P2-->P3-->P5-->P1

2）T0时刻P2:Request2(0,3,4)，用银行家算法进行检查：

Request2(0,3,4)<=Need2(1,3,4)

Request2(0,3,4)>Available(2,3,3)

P2等待

3）在2）的基础上，P4:Request4(2,0,1)，用银行家算法进行检查

Request4(2,0,1)<=Need4(2,2,1)

Request2(2,0,1)<=Available(2,3,3)

系统先假定可以为P4分配资源，并修改表格值，由此形成的资源变化情况如下图：

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | max | | | allocation | | | need | | | available | | |
|  | A | B | C | A | B | C | A | B | C | A | B | C |
| P1 | 5 | 5 | 9 | 2 | 1 | 2 | 3 | 4 | 7 | 2 | 3 | 3 |
|  |  |  |  |  |  |  |  |  |  | 0 | 3 | 2 |
| P2 | 5 | 3 | 6 | 4 | 0 | 2 | 1 | 3 | 4 |  |  |  |
| P3 | 4 | 0 | 11 | 4 | 0 | 5 | 0 | 0 | 6 |  |  |  |
| P4 | 4 | 2 | 5 | 2 | 0 | 4 | 2 | 2 | 1 |  |  |  |
|  |  |  |  | 4 | 0 | 5 | 0 | 2 | 0 |  |  |  |
| P5 | 4 | 2 | 4 | 3 | 1 | 4 | 1 | 1 | 0 |  |  |  |

再利用安全性算法检查此时系统是否安全

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work | | | need | | | allocation | | | Work&allocation | | | finish |
|  | A | B | C | A | B | C | A | B | C | A | B | C |
| P4 | 0 | 3 | 2 | 0 | 2 | 0 | 4 | 0 | 5 | 4 | 3 | 7 | true |
| P2 | 4 | 3 | 7 | 1 | 3 | 4 | 4 | 0 | 2 | 8 | 3 | 9 | true |
| P3 | 8 | 3 | 9 | 0 | 0 | 6 | 4 | 0 | 5 | 12 | 3 | 14 | true |
| P5 | 12 | 3 | 14 | 2 | 2 | 1 | 3 | 1 | 4 | 15 | 4 | 18 | true |
| P1 | 15 | 4 | 18 | 3 | 4 | 7 | 2 | 1 | 2 | 17 | 5 | 20 | true |

得到安全序列：P4-->P2-->P3-->P5-->P1

此时处于安全状态，可以进行分配。

4）在3）的基础上，P1:Request1(0,2,0)，用银行家算法进行检查

Request1(0,2,0)<=Need1(3,4,7)

Request1(0,2,0)<=Available(0,3,2)

系统先假定可以为P1分配资源，并修改表格值，由此形成的资源变化情况如下图：

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | max | | | allocation | | | need | | | available | | |
|  | A | B | C | A | B | C | A | B | C | A | B | C |
| P1 | 5 | 5 | 9 | 2 | 1 | 2 | 3 | 4 | 7 | 2 | 3 | 3 |
|  |  |  |  | 2 | 3 | 2 | 3 | 2 | 7 | 0 | 3 | 2 |
|  |  |  |  |  |  |  |  |  |  | 0 | 1 | 2 |
| P2 | 5 | 3 | 6 | 4 | 0 | 2 | 1 | 3 | 4 |  |  |  |
| P3 | 4 | 0 | 11 | 4 | 0 | 5 | 0 | 0 | 6 |  |  |  |
| P4 | 4 | 2 | 5 | 2 | 0 | 4 | 2 | 2 | 1 |  |  |  |
|  |  |  |  | 4 | 0 | 5 | 0 | 2 | 0 |  |  |  |
| P5 | 4 | 2 | 4 | 3 | 1 | 4 | 1 | 1 | 0 |  |  |  |

再利用安全性算法检查此时系统是否安全

当前的Available(0,1,2)无法满足任何一个进程的need，无法找到安全序列，所以无法分配。