蓝色部分为建立信号灯。
绿色部分为进程 A。
红石部分为进程 B。
同一类颜色变深表示函数调用的逐层深入。

```
main()
{
        int S1=1;
        int S2=1;
        cobegin
                PA();
                PB();
        coend
}
```

```
PA()
{
        P(S1);*
        P(S2);
        ...
        V(S1);
        V(S2);
}
```

```
PB()
{
        P(S2);
        P(S1);
        ...
        V(S1);
        V(S2);
}
```

*语句之后进程调度。

```
display your statememts, memory ID:0
0     ~ int 10
0     ~ sysfun:冒泡排序 ！
0     ~ ST:数组起始地址  (ST)>=7!
0     ~ LEN:排序串长度 ！
0     ~ I:位置 a[i]指针 ！
0     ~ J:位置 a[i+1]指针 ！
0     ~ T:交换存储单元 ！
0     ~ S:每轮终结单元 ！
0     ~ ED:数组结束地址 ！
0     ~  传参区  0~1
0     ~  系统程序数据  2~6
0     LOC ST 0
0     LOC LEN 1
0     LOC I 2
0     LOC J 3
0     LOC T 4
0     LOC S 5
0     LOC ED 6
0     MOV ED ST
1     ADD ED LEN
2     IMSUB ED 1
3     MOV I ST
4     MOV J ST
```

```
5     INC J $
6     MOV S ED
7     CMP @I @J
8     JA 12 $
9     ~ 交换前后单元 ！
9     MOV T @I
10    MOV @I @J
11    MOV @J T
12    INC I $
13    INC J $
14    CMP I S
15    JB 7 $
16    ~ 下一轮排序 ！
16    MOV I ST
17    MOV J ST
18    INC J $
19    IMSUB S 1
20    IMCMP S ST
21    JNE 7 $
22    ~ 排序结束 中断返回
22    IRET 0 $
23    END $ $
end edit
display your statememts, memory ID:0
0     ~ int 11
0     ~ 数组求和 ！
0     ~ ST(>=5) 起始地址
0     ~ LEN 数组长度
0     ~ SUM 将和加到 SUM
0     ~ I 数组元素指针
0     ~ N 计数器
0     ~ 传参区 0~2
0     ~ 系统程序数据 3~4
0     LOC ST 0
0     LOC LEN 1
0     LOC SUM 2
0     LOC I 3
0     LOC N 4
0     ASN N 0
1     MOV I ST
2     ADD SUM @I
3     INC I $
4     INC N $
5     CMP N LEN
6     JB 2 $
7     IRET 0 $
8     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 12
0     ~ 读系统共享 ！
0     ~ ST:systemshare 起始地址
```

```
0     ~ LEN  读取长度
0     ~  传参区  0~1
0     ~  系统程序数据  无
0     LOC ST 0
0     LOC LEN 1
0     SYSR ST LEN
1     IRET 0 $
2     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 13
0     ~  写到系统共享 ！
0     ~ ST:systemshare  起始地址
0     ~ LEN  写长度
0     ~  传参区  0~1
0     ~  系统程序数据  无
0     LOC ST 0
0     LOC LEN 1
0     SYSW ST LEN
1     IRET 0 $
2     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 14
0     ~  挂起进程 ！
0     ~  传参区  无
0     ~  系统程序数据  无
0     IRET 1 $
1     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 15
0     ~  唤醒进程 ！
0     ~ COM:被唤醒进程  community
0     ~ QUE  进程所在队列
0     ~  传参区  0~1
0     ~  系统程序数据  无
0     ~  不允许被打断 ！
0     LOC COM 0
0     LOC QUE 1
0     CLI $ $
1     WAKE COM QUE
2     IRET 0 $
3     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 16
0     ~ P 操作 ！
0     ~ SEMAPHORE  信号灯地址
0     ~ LEN  读写长度为 1
```

```
0     ~ VALUE  信号灯的值
0     ~  只适用于  数据段长度 40
0     ~  传参区  0
0     ~  系统程序数据  1
0     LOC SEMAPHORE 0
0     LOC LEN 1
0     LOC VALUE 39
0     ~  不允许被打断  !
0     CLI $ $
1     IMMOV LEN 1
2     ~  读信号灯  !
2     SYSR SEMAPHORE LEN
3     ~  信号灯值  减 1
3     IMSUB VALUE 1
4     ~  回写信号灯  !
4     SYSW SEMAPHORE LEN
5     ~  判断是否挂起  !
5     IMCMP VALUE 0
6     JB 8 $
7     ~ VALUE>=0  不挂起
7     IRET 0 $
8     ~ VALUE<0  挂起
8     IRET 1 $
9     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 17
0     ~ V 操作  !
0     ~ SEMAPHORE  信号灯地址
0     ~ PQUE P 操作队列
0     ~ LEN  读写长度为 1
0     ~ VALUE  信号灯的值
0     ~  只适用于  数据段长度 40
0     ~  传参区  0
0     ~  系统程序数据  1
0     LOC SEMAPHORE 0
0     LOC LEN 1
0     ~ QUE 与 LEN  共享一个单元
0     LOC PQUE 1
0     LOC VALUE 39
0     ~  不允许被打断  !
0     CLI $ $
1     ~  保存 PQUE !
1     IMMOV LEN 1
2     ~  读信号灯  !
2     SYSR SEMAPHORE LEN
3     ~  信号灯值  减 1
3     INC VALUE $
4     ~  回写信号灯  !
4     SYSW SEMAPHORE LEN
```

```
5     ~ 判断是否 需要唤醒进程
5     IMCMP VALUE 0
6     JA 9 $
7     ~ 唤醒进程 !
7     IMMOV PQUE 6
8     INT 15 $
9     IRET 0 $
10    END $ $
end edit
display your statememts, memory ID:0
0     ~ int 18
0     ~ 创建信号灯 !
0     ~ SEMAPHORE 信号灯地址
0     ~ VALUE 信号灯的值
0     ~ LEN 读写长度为 1
0     ~ 只适用于 数据段长度 40
0     ~ 传参区 0~1
0     ~ 系统程序数据 1
0     LOC SEMAPHORE 0
0     ~ VALUE 与 LEN 共享一个单元
0     LOC VALUE 1
0     LOC LEN 1
0     ~ 不允许被打断 !
0     CLI $ $
1     MOV 39 VALUE
2     IMMOV LEN 1
3     INT 13 $
4     IRET 0 $
5     END $ $
end edit
display your statememts, memory ID:0
0     ~ int 19
0     ~ 停顿 模拟进程调度
0     ~ 传参区 无
0     ~ 系统程序数据 无
0     IRET 2 $
1     END $ $
end edit
process ID:50 project:DeadlockS.prj
display your statememts, memory ID:0
0     m 0 1
1     m 1 1
2     int 18 $
3     m 0 2
4     m 1 1
5     int 18 $
6     end $ $
end edit
process ID:51 project:DeadlockA.prj
display your statememts, memory ID:0
0     ~ P(S1) !
```

```
0     set 0 1
1     m 0 1
2     int 16 $
3     ~ 模拟: 系统调度发生
3     int 19 $
4     ~ P(S2) !
4     set 0 2
5     m 0 2
6     int 16 $
7     ~ V(S1) !
7     m 0 1
8     int 17 $
9     ~ V(S2) !
9     m 0 2
10    int 17 $
11    end $ $
end edit
process ID:52 project:DeadlockB.prj
display your statememts, memory ID:0
0     ~ P(S2) !
0     set 0 2
1     m 0 2
2     int 16 $
3     ~ P(S1) !
3     set 0 1
4     m 0 1
5     int 16 $
6     ~ V(S1) !
6     m 0 1
7     int 17 $
8     ~ V(S2) !
8     m 0 2
9     int 17 $
10    end $ $
end edit
D105    process ID:50    dispatcher::swap2: process swaps to run, RES=170, Normal
D101    process ID:50, processor ID:100, instruction row:2    interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105    caller process ID:50, system call NO:8    dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052   system function ID:8    sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105    process ID:50, pause cause:8    dispatcher::swap2: process swaps to wait, RES=172, Normal
D105    process ID:8    dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105    process ID:8    dispatcher::swap2: process swaps to run, RES=170, Normal
D101    process ID:8, processor ID:100, instruction row:3    interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105    caller process ID:8, system call NO:3    dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052   system function ID:3    sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105    process ID:8, pause cause:3    dispatcher::swap2: process swaps to wait, RES=172, Normal
D105    process ID:3    dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
```

D105 process ID:3 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:3 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:3 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:3 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:3, caller process ID:8 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:8 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:8 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:8, caller process ID:50 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:50 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:50 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:50, processor ID:100, instruction row:5 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:50, system call NO:8 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:8 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:50, pause cause:8 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:8 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:8 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:8, processor ID:100, instruction row:3 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:8, system call NO:3 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:3 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:8, pause cause:3 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:3 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:3 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:3 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:3 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:3 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:3, caller process ID:8 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:8 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:8 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:8, caller process ID:50 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:50 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:50 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:50 interpreter::exer: process execute completed, RES=23, Normal
D105 process ID:50 dispatcher::swap2: a process finished, RES=177, Normal
D105 process ID:51 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:51, processor ID:100, instruction row:2 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:51, system call NO:6 dispatcher::swap2: a system call happened,

RES=173, Normal(Sub)
D1052 system function ID:6 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:51, pause cause:6 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: read system share, RES=181, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:6, caller process ID:51 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:51 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:51 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:51, processor ID:100, instruction row:3 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:51, system call NO:9 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:9 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:51, pause cause:9 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:9 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:9 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:9, caller process ID:51 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:51, pause cause:9 dispatcher::swap2: process swaps from wait to ready, RES=175, Normal
D105 process ID:52 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:52, processor ID:100, instruction row:2 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:52, system call NO:6 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:6 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:52, pause cause:6 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: read system share, RES=181, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:6, caller process ID:52 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:52 dispatcher::swap2: insert back to the head of ready queue, RES=188,

Normal(Sub)
D105 process ID:52 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:52, processor ID:100, instruction row:5 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:52, system call NO:6 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:6 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:52, pause cause:6 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: read system share, RES=181, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:6, caller process ID:52 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:6, suspended process ID:52 dispatcher::swap2: a process suspended, RES=185, Normal
D105 process ID:51 dispatcher::swap2: process swaps to run, RES=170, Normal
D101 process ID:51, processor ID:100, instruction row:6 interpreter::exer: interrupt occured, RES=20, Normal(Sub)
D105 caller process ID:51, system call NO:6 dispatcher::swap2: a system call happened, RES=173, Normal(Sub)
D1052 system function ID:6 sysList::copy: a system function is copied, RES=90, Normal(Sub)
D105 process ID:51, pause cause:6 dispatcher::swap2: process swaps to wait, RES=172, Normal
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: read system share, RES=181, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 process ID:6 dispatcher::swap2: write system share, RES=182, Normal(Sub)
D105 process ID:6 dispatcher::swap2: insert back to the head of ready queue, RES=188, Normal(Sub)
D105 process ID:6 dispatcher::swap2: process swaps to run, RES=170, Normal
D105 system function ID:6, caller process ID:51 dispatcher::swap2: a system function completed, RES=174, Normal(Sub)
D105 process ID:6, suspended process ID:51 dispatcher::swap2: a process suspended, RES=185, Normal
D20 pcb's process ID:0 pcbList::enQueue: list is empty, RES=130, Warning
D105 interpreter ID:101, processor ID:100 dispatcher::swap2: swap is completed, RES=179, Normal(Sub)
process ID:50
memory ID:1
0 2
1 1
2 0

```
3      0
4      0
5      0
6      0
7      0
8      0
9      0
10     0
11     0
12     0
13     0
14     0
15     0
16     0
17     0
18     0
19     0
20     0
21     0
22     0
23     0
24     0
25     0
26     0
27     0
28     0
29     0
30     0
31     0
32     0
33     0
34     0
35     0
36     0
37     0
38     0
39     1
execute times:8
D1053      queue::deQueue: queue is empty, RES=61, Warning
  queue::deQueue: queue is empty, RES=61, Warning
Press any key to continue
```

2011-12-03