嵌入式实验——ucOS-II多任务

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1.实验目的

在ucOS-II上的多任务调度实验。

2.实验内容

在pc上的ucOS-II移植版本上实现三个周期性任务的调度。

3.任务之间没有相关性的实验过程

3.1 在struct OS_TCB中添加变量

```
INT32U compTime;  // 完成任务还需要的时间
INT32U period;  // 周期
INT32U fullCompTime; // 总共需要的时间
```

3.2 在main.c中添加任务函数

```
static void periodicTask(void *p_arg);

static void periodicTask(void *p_arg) {

  INT32S *p = (INT32S *) p_arg;
```

```
  OSTCBCur->compTime = p[0];
  OSTCBCur->period = p[1];
  OSTCBCur->fullCompTime = p[0];

  INT32S start;
  INT32S end;
  INT32S toDelay;

  start = 0;

  OS_TRACE_INIT(); // Initialize the uC/OS-II Trace recorder while (DEF TRUE)
  {

    while (OSTCBCur->compTime > 0) 1

    {

      //Do nothing

    }

    // 获得计数器的当前值
    end = OSTimeGet();
    // 计算任务需要延迟的时间
    toDelay = OSTCBCur->period - (end - start);
    toDelay = toDelay < 0 ? 0 : toDelay;
    start += (OSTCBCur->period);

    // 更新完成任务需要的时间
    OSTCBCur->compTime = OSTCBCur->fullCompTime;

    // 将任务延迟一段时间
    OSTimeDly(toDelay);

  }
}
```

3.3 调用任务

在main.c中添加创建任务代码。

根据RMS静态优先级调度算法。任务的周期越短，优先级越高。因此要在代码里面手动将周期最短的设置为优先级最高的，即排在最前面。

需要屏蔽原有部分创建任务的代码。

```
static  OS_STK  TaskStk[3][APP_CFG_STARTUP_TASK_STK_SIZE];
```

```
INT32S limits[][2] = { //computation , wait time
  { 0, 0 },//Prio0
  { 1, 4 },//Prio1
  { 2, 5 },//Prio2
  { 2, 10 }//Prio3

  };

// 创建任务
OSTaskCreate(periodicTask, (void*)limits[1], &TaskStk[0][APP_CFG_STARTUP_TASK_STK_SIZE
- 1u], 1);
  OSTaskCreate(periodicTask, (void*)limits[2], &TaskStk[1]
[APP_CFG_STARTUP_TASK_STK_SIZE - 1u], 2);
  OSTaskCreate(periodicTask, (void*)limits[3], &TaskStk[2]
[APP_CFG_STARTUP_TASK_STK_SIZE - 1u], 3);
```

3.4 输入输出

在os_core.c里面的OS_Sched()和OSIntExit()方法加入输出。

```
// OS Sched()
printf("%u", OSTime);
printf("     Complete     ");
printf("%d", OSPrioCur);
printf("     ");
printf("%d", OSTCBHighRdy->OSTCBPrio);
printf("\n");

// OSIntExit ()
//
if (OSPrioCur != OSTCBHighRdy->OSTCBPrio) {
      printf("%u", OSTime);
      printf("     Preempt     ");
      printf("%d", OSPrioCur);
      printf("     ");
      printf("%d", OSTCBHighRdy->OSTCBPrio);
      printf("\n");
}
```

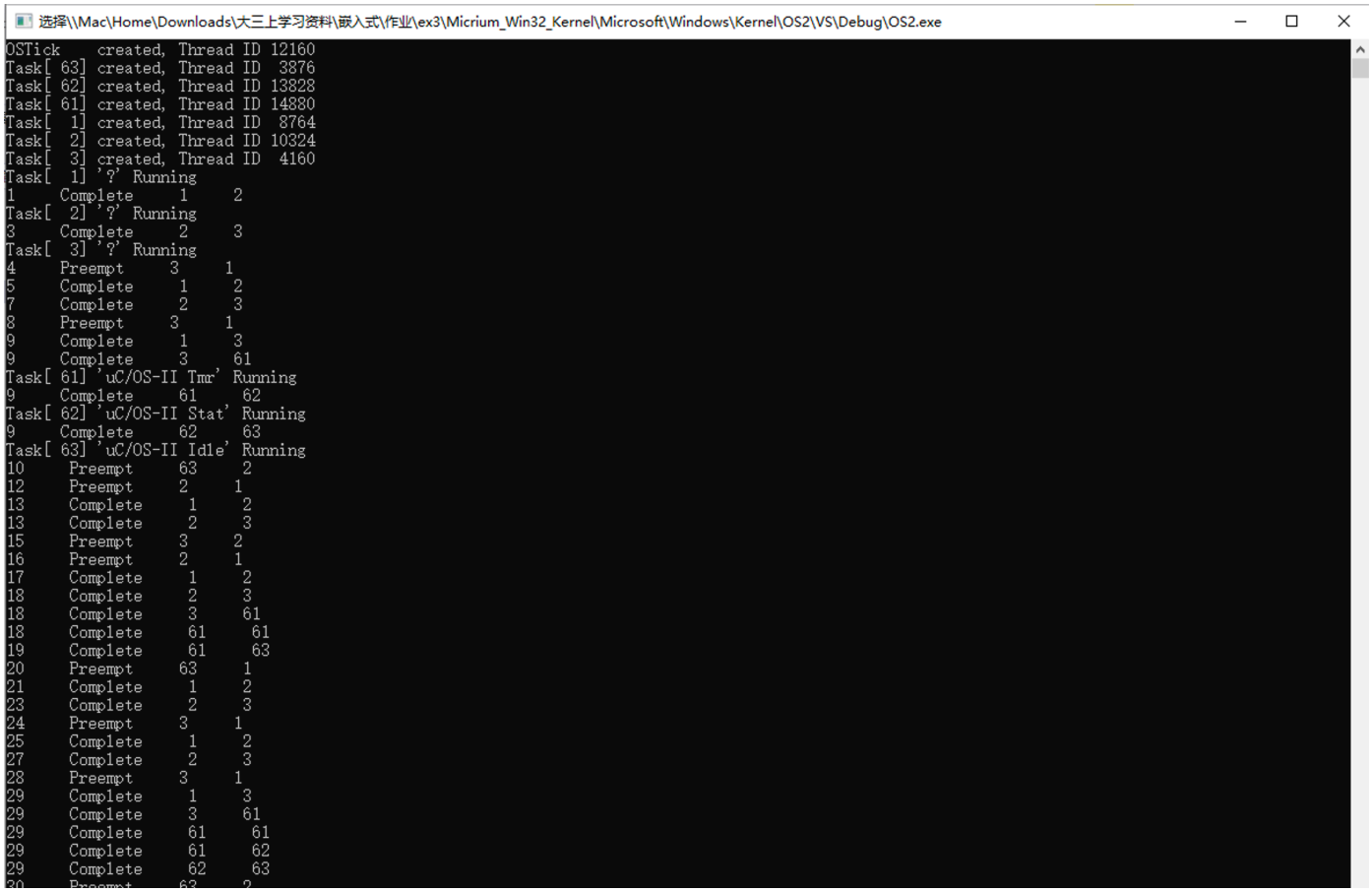
3.5 计数

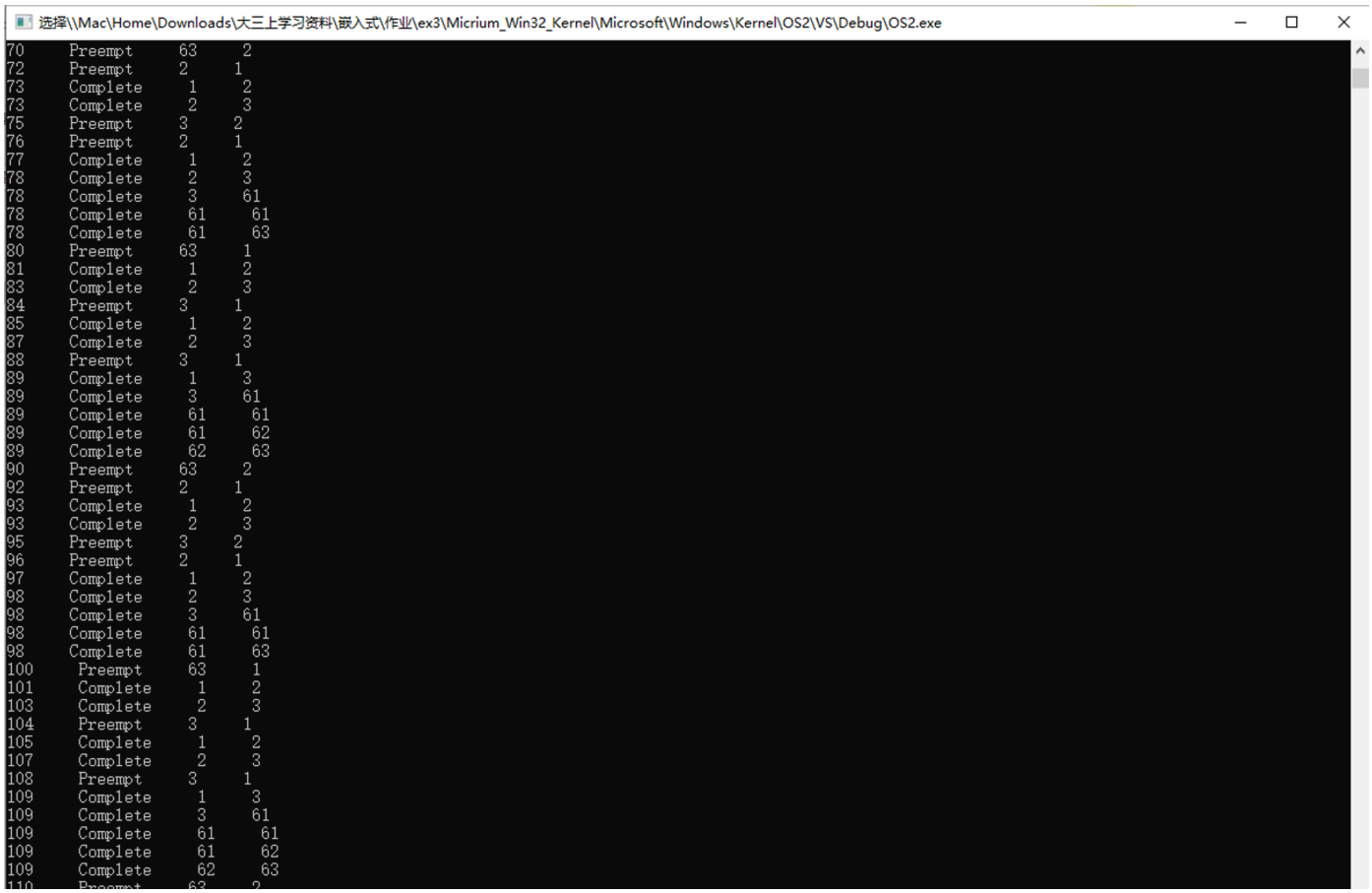
在os_core.c里面的OSTimeTick()方法加入computation的计数。

```
OSTCBCur->compTime--; // 在每个时钟节拍中减少任务完成还需要的时间
```

3.6 实验结果:

见下图。


选择\\Mac\Home\Downloads\大三上学习资料\嵌入式\作业\ex3\Micrium_Win32_Kernel\Microsoft\Windows\Kernel\OS2\VS\Debug\OS2.exe
OSTick   created, Thread ID 12160
Task[63] created, Thread ID 3876
Task[62] created, Thread ID 13828
Task[61] created, Thread ID 14880
Task[1] created, Thread ID 8764
Task[2] created, Thread ID 10324
Task[3] created, Thread ID 4160
Task[1] '?' Running
1   Complete   1   2
Task[2] '?' Running
3   Complete   2   3
Task[3] '?' Running
4   Preempt   3   1
5   Complete   1   2
7   Complete   2   3
8   Preempt   3   1
9   Complete   1   3
9   Complete   3   61
Task[61] 'uC/OS-II Tmr' Running
9   Complete   61   62
Task[62] 'uC/OS-II Stat' Running
9   Complete   62   63
Task[63] 'uC/OS-II Idle' Running
10   Preempt   63   2
12   Preempt   2   1
13   Complete   1   2
13   Complete   2   3
15   Preempt   3   2
16   Preempt   2   1
17   Complete   1   2
18   Complete   2   3
18   Complete   3   61
18   Complete   61   61
19   Complete   61   63
20   Preempt   63   1
21   Complete   1   2
23   Complete   2   3
24   Preempt   3   1
25   Complete   1   2
27   Complete   2   3
28   Preempt   3   1
29   Complete   1   3
29   Complete   3   61
29   Complete   61   61
29   Complete   61   62
29   Complete   62   63


选择\\Mac\Home\Downloads\大三上学习资料\嵌入式\作业\ex3\Micrium_Win32_Kernel\Microsoft\Windows\Kernel\OS2\VS\Debug\OS2.exe
70   Preempt   63   2
72   Preempt   2   1
73   Complete   1   2
73   Complete   2   3
75   Preempt   3   2
76   Preempt   2   1
77   Complete   1   2
78   Complete   2   3
78   Complete   3   61
78   Complete   61   61
78   Complete   61   63
80   Preempt   63   1
81   Complete   1   2
83   Complete   2   3
84   Preempt   3   1
85   Complete   1   2
87   Complete   2   3
88   Preempt   3   1
89   Complete   1   3
89   Complete   3   61
89   Complete   61   61
89   Complete   61   62
89   Complete   62   63
90   Preempt   63   2
92   Preempt   2   1
93   Complete   1   2
93   Complete   2   3
95   Preempt   3   2
96   Preempt   2   1
97   Complete   1   2
98   Complete   2   3
98   Complete   3   61
98   Complete   61   61
98   Complete   61   63
100   Preempt   63   1
101   Complete   1   2
103   Complete   2   3
104   Preempt   3   1
105   Complete   1   2
107   Complete   2   3
108   Preempt   3   1
109   Complete   1   3
109   Complete   3   61
109   Complete   61   61
109   Complete   61   62
109   Complete   62   63

4.任务之间有数据相关性的实验过程

4.1 在struct OS_TCB中添加变量

```
INT32U compTime;  // 完成任务还需要的时间
INT32U period;  // 周期
INT32U fullCompTime; // 总共需要的时间
```

4.2 在main.c中添加任务函数

```
static void periodicTask2(void *p_arg);

static void periodicTask2(void *p_arg) {

  INT32S *p = (INT32S *)p_arg;
  OSTCBCur->compTime = p[0];
  OSTCBCur->period = p[1];
  OSTCBCur->fullCompTime = p[0];

  INT8U err;
  INT32S start;
  INT32S end;
  INT32S toDelay;

  start = 0;

  OS_TRACE_INIT(); // Initialize the uC/OS-II Trace recorder while (DEF TRUE)
  while (DEF_TRUE) {
    // 请求互斥信号量
    OSMutexPend(pevent, 0, &err);

    while (OSTCBCur->compTime > 0) {

      //Do nothing

    }

    end = OSTimeGet();
    toDelay = OSTCBCur->period - (end - start);
    toDelay = toDelay < 0 ? 0 : toDelay;
    start += (OSTCBCur->period);

    OSTCBCur->compTime = OSTCBCur->fullCompTime; // reset the computation

    OSTimeDly(toDelay); // delay and wait (fullCompTime - period) times }

    // 归还信号量
```

```
    OSMutexPost(pevent);
  }
}
```

4.3 调用任务

1. 在main.c中添加创建任务代码。
2. 根据RMS静态优先级调度算法。任务的周期越短，优先级越高。因此要在代码里面手动将周期最短的设置为优先级最高的，即排在最前面。
3. 需要屏蔽原有部分创建任务的代码。
4. 使用互斥信号量

```
static  OS_STK  TaskStk[3][APP_CFG_STARTUP_TASK_STK_SIZE];
OS_EVENT* pevent;

INT32S limits[][2] = { //computation , wait time
  { 0, 0 },//Prio0
  { 1, 4 },//Prio1
  { 2, 5 },//Prio2
  { 2, 10 }//Prio3

  };

INT8U error;
  // 创建互斥信号量
  pevent = OSMutexCreate(0,&error);
  OSTaskCreate(periodicTask2, (void*)limits[1], &TaskStk[0]
[APP_CFG_STARTUP_TASK_STK_SIZE - 1u], 1);
  OSTaskCreate(periodicTask, (void*)limits[2], &TaskStk[1]
[APP_CFG_STARTUP_TASK_STK_SIZE - 1u], 2);
  OSTaskCreate(periodicTask2, (void*)limits[3], &TaskStk[2]
[APP_CFG_STARTUP_TASK_STK_SIZE - 1u], 3);
```

4.4 输入输出

在os_core.c里面的OS_Sched()和OSIntExit()方法加入输出。

```
// OS Sched()
printf("%u", OSTime);
printf("     Complete     ");
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printf("%d", OSTCBHighRdy->OSTCBPrio);
printf("\n");

// OSIntExit ()
//
if (OSPrioCur != OSTCBHighRdy->OSTCBPrio) {
```

```
        printf("%u", OSTime);
        printf("     Preempt      ");
        printf("%d", OSPrioCur);
        printf("     ");
        printf("%d", OSTCBHighRdy->OSTCBPrio);
        printf("\n");
}
```

4.5 计数

在os_core.c里面的OSTimeTick()方法加入computation的计数。

```
OSTCBCur->compTime--; // 在每个时钟节拍中减少任务完成还需要的时间
```

4.6 实验结果

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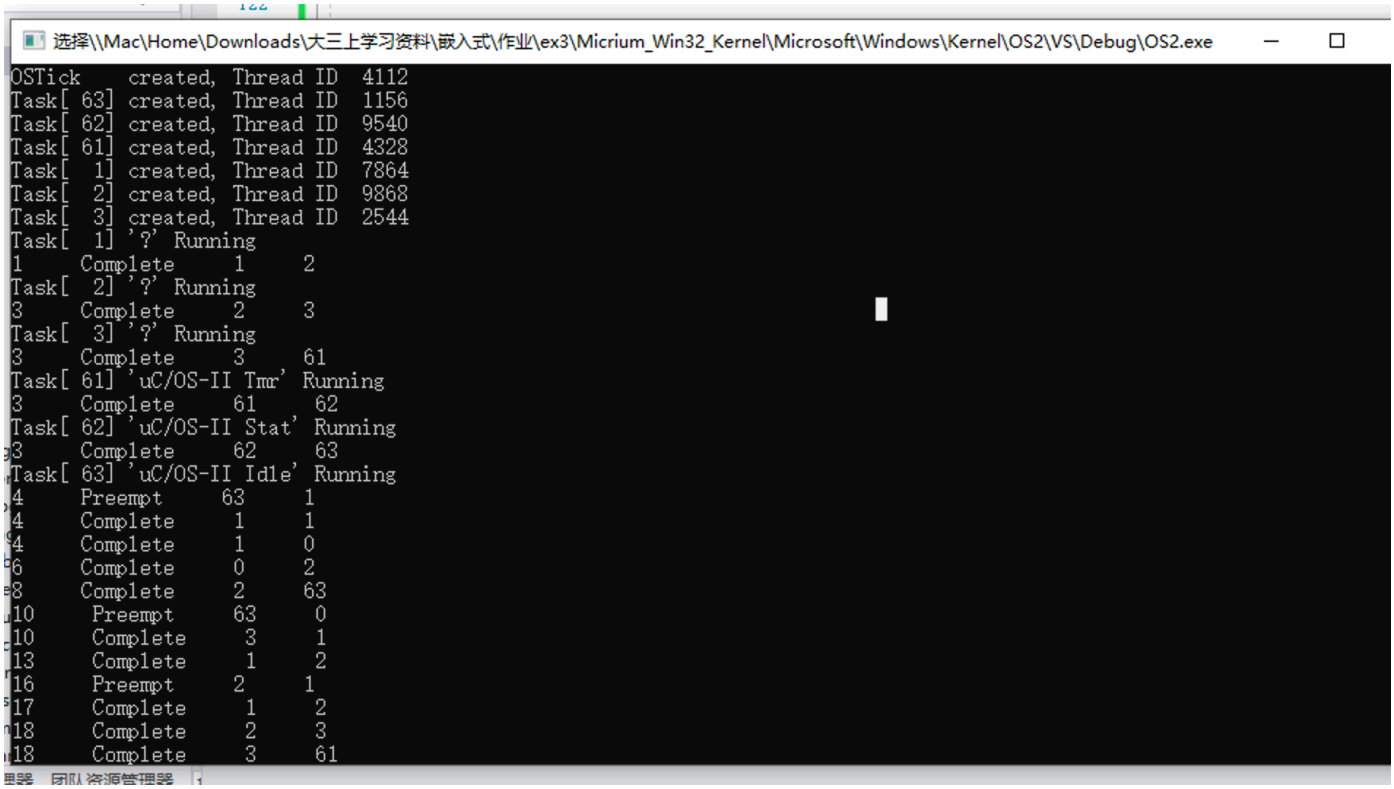

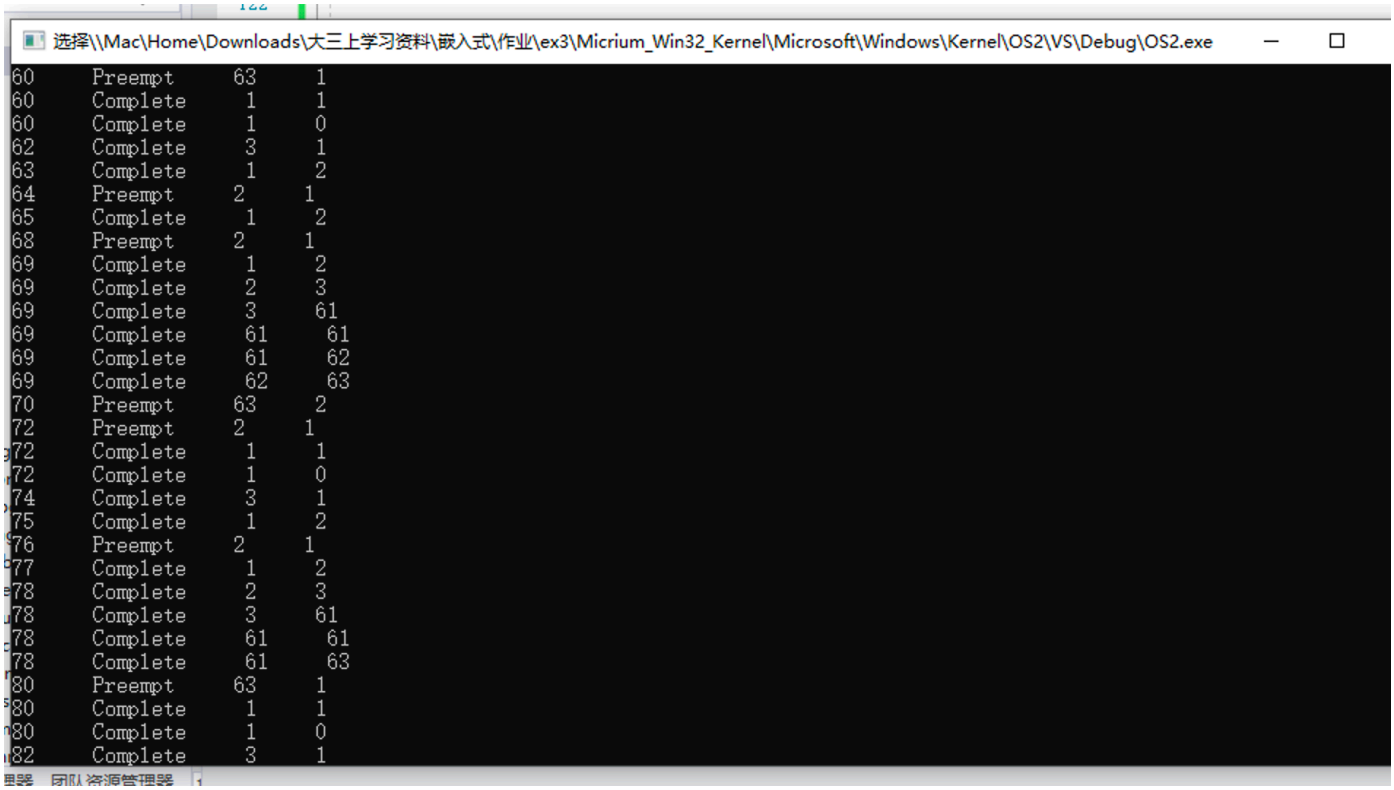
选择\\Mac\Home\Downloads\大三上学习资料\嵌入式\作业\ex3\Micrium_Win32_Kernel\Microsoft\Windows\Kernel\OS2\VS\Debug\OS2.exe
60 Preempt 63 1
60 Complete 1 1
60 Complete 1 0
62 Complete 3 1
63 Complete 1 2
64 Preempt 2 1
65 Complete 1 2
68 Preempt 2 1
69 Complete 1 2
69 Complete 2 3
69 Complete 3 61
69 Complete 61 61
69 Complete 61 62
69 Complete 62 63
70 Preempt 63 2
72 Preempt 2 1
72 Complete 1 1
72 Complete 1 0
74 Complete 3 1
75 Complete 1 2
76 Preempt 2 1
77 Complete 1 2
78 Complete 2 3
78 Complete 3 61
78 Complete 61 61
78 Complete 61 63
80 Preempt 63 1
80 Complete 1 1
80 Complete 1 0
82 Complete 3 1