P103 Review Questions（8th edition）

2.3. What is multiprogramming?

2.10. What is multithreading?

P103 Problems（8th edition）

2.2. An I/O-bound program is one that, if run alone, would spend more time waiting for I/O than using the processor. A processor-bound program is the opposite. Suppose a short-term scheduling algorithm favors those programs that have used little processor time in the recent past. Explain why this algorithm favors I/O-bound programs and yet does not permanently deny processor time to processor-bound programs.

2.4. What is the purpose of system calls, and how do system calls relate to the OS and to the concept of dual-mode (kernel-mode and user-mode) operation?

2.6. A multiprocessor with eight processors has 20 attached tape drives. There is a large number of jobs submitted to the system that each require a maximum of four tape drives to complete execution. Assume that each job starts running with only three tape drives for a long period before requiring the fourth tape drive for a short period toward the end of its operation. Also assume an endless supply of such jobs.

  a. Assume the scheduler in the OS will not start a job unless there are four tape drives available. When a job is started, four drives are assigned immediately and are not released until the job finishes. What is the maximum number of jobs that can be in progress at once? What are the maximum and minimum number of tape drives that may be left idle as a result of this policy?

  b. Suggest an alternative policy to improve tape drive utilization and at the same time avoid system deadlock. What is the maximum number of jobs that can be in progress at once? What are the bounds on the number of idling tape drives?

Extra 1

有三个作业 A、B、C，它们分别单独运行时的 CPU 和 I/O 占用时间如下图所示。
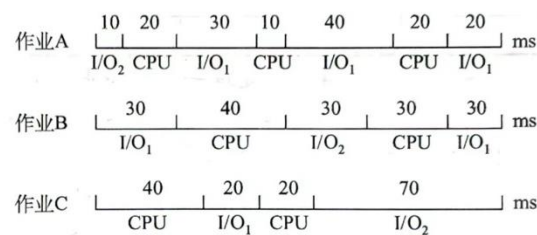
现在请考虑三个作业同时开始执行。系统中的资源有一个 CPU 和两台输入/输出设备（I/O$_1$ 和 I/O$_2$）同时运行。三个作业的优先级为 A 最高、B 次之、C 最低，一旦低优先级的进程开始占用 CPU，高优先级进程也要等待到其结束后方可占用 CPU，请回答下面的问题：
1）最早结束的作业是哪个？
2）最后结束的作业是哪个？
3）计算这段时间 CPU 的利用率（三个作业全部结束为止）。

Extra 2

假定要在一台处理器上执行下表所示的作业，且假定这些作业在时刻 0 以 1、2、3、4、5 的顺序到达。说明分别使用 FCFS、RR（时间片＝1）、SJF 及非剥夺式优先级调度算法时，这些作业的执行情况（优先级的高低顺序依次为 1 到 5）。

针对上述每种调度算法，给出平均周转时间和平均带权周转时间。

作业	执行时间	优先级
1	10	3
2	1	1
3	2	3
4	1	4
5	5	2