Assignment 2

1. What complications could arise in a time-sharing/multitasking system if two processes require access to the same file at the same time? Are there cases in which the file manager should grant such requests? Are there cases in which the file manager should deny such requests? (15 points)

2. Suppose a multiprogramming operating system is allotting time slices of 50 milliseconds. If it normally takes 8 milliseconds to position a disk's read/write head over the desired track and another 17 milliseconds for the desired data to rotate around to the read/write head, how much of a program's time slice can be spent waiting for a read operation from a disk to take place? If the machine is capable of executing ten instructions each nanosecond, how many instructions can be executed during this waiting period? (This is why when a process performs an operation with a peripheral device, a multiprogramming system terminates that process's time slice and allows another process to run while the first process is waiting for the services of the peripheral device.) (15 points)

3. A process is said to be I/O-bound if it requires a lot of I/O operations, whereas a process that consists of mostly computations within the CPU/memory system is said to be compute-bound. If both a compute-bound process and an I/O-bound process are waiting for a time slice, which should be given priority? Why?(15 points)

4. Would greater throughput be achieved by a system running two processes in a multiprogramming environment if both processes were I/O-bound or if one were I/O-bound and the other were compute bound? Why? (15 points)

5. Students who want to enroll in Model Railroading II at the local university are required to obtain permission from the instructor and pay a laboratory fee. The two requirements are fulfilled independently in either order and at different locations on campus. Enrollment is limited to twenty students; this limit is maintained by both the instructor, who will grant permission to only twenty students, and the financial office, which will allow only twenty students to pay the laboratory fee. Suppose that this registration system has resulted in nineteen students having successfully registered for the course, but with the final space being claimed by two students—one who has only obtained

permission from the instructor and another who has only paid the fee. Which requirement for deadlock is removed by each of the following solutions to the problem?

a. Both students are allowed in the course.

b. The class size is reduced to nineteen, so neither of the two students is allowed to register for the course.

c. The competing students are both denied entry to the class and a third student is given the twentieth space.

d. It is decided that the only requirement for entry into the course is the payment of the fee. Thus the student who has paid the fee gets into the course, and entry is denied to the other student.

(4*5=20 points)

6. A process that is waiting for a time slice is said to suffer starvation if it is never given a time slice.

a. The pavement in the middle of an intersection can be considered as a nonshareable resource for which cars approaching the intersection compete. A traffic light rather than an operating system is used to control the allocation of the resource. If the light is able to sense the amount of traffic arriving from each direction and is programmed to give the green light to the heavier traffic, the lighter traffic might suffer from starvation. How is starvation avoided?

b. In what sense can a process starve if the dispatcher always assigns time slices according to a priority system in which the priority of each process remains fixed? (Hint: What is the priority of the process that just completed its time slice in comparison to the processes that are waiting, and consequently, which routine gets the next time slice?) How, would you guess, do many operating systems avoid this problem?

(2*10=20 points)