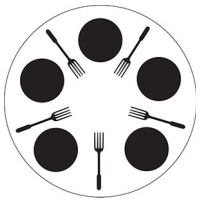
# Sheet 6

**I** Solve the following *Review Problems* from *Computer Science: An Overview*:

- **3.1**
  List four components of a typical operating system (kernel).
- **3.3**
  Suppose three items R, S, and T are placed in a queue in that order. Then one item is removed from the queue before a fourth item, X, is placed in the queue. Then one item is removed from the queue, the items Y and Z are placed in the queue, and then the queue is emptied by removing one item at a time. List all the items in the order in which they were removed.
- **3.5**
  What is a multitasking operating system?
- **3.8**
  a) What is the role of the user interface of an operating system?
  b) What is the role of the kernel of an operating system?
- **3.14**
  Suppose a computer contained 512 MB of main memory, and an operating system needed to create a virtual memory of twice that size using pages of 2 KB. How many pages would be required?
- **3.16**
  What is the distinction between application software and system software? Give an example of each.
- **3.18**
  Summarize the booting process.
- **3.19**
  Why is the booting process necessary?
- **3.21**
  Suppose a multiprogramming operating system allocated time slices of 10 milliseconds and the machine executed an average of five instructions per nanosecond. How many instructions could be executed in a single time slice?
- **3.27**
  Write a set of directions that tells an operating system's dispatcher what to do when a process's time slice is over.
- **3.28**
  What information is contained in the state of a process?
- **3.33**
  Explain an important use for the test-and-set instruction found in many machine languages. Why is it important for the entire test-and-set process to be implemented as a single instruction?
- **3.42**
  Five philosophers[1] are sitting at a round table. In front of each is a plate of spaghetti. There are five forks on the table, one between each plate. Each philosopher wants to alternate between thinking and eating. To eat, a philosopher requires possession of both the forks that are adjacent to the philosopher's plate. Identify the possibilities of deadlock and starvation that are present in the dining philosophers problem



- **3.43**
  What problem arises as the lengths of the time slices in a multiprogramming system are made shorter and shorter? What about as they become longer and longer?

1 This is known as "*dining philosophers*" problem originally proposed by *E. W. Dijkstra*.

**II** Answer the following questions:

**1.** In the context of *Operating Systems*, define the following:

*a)* *Program*
*b)* *Job*
*c)* *Process*
*d)* *Task*
*e)* *Batch Processing*
*f)* *Interactive Processing*
g) *Multiprogramming* (for *multitasking* or *time-sharing*)
*h)* *Semaphore*
*i)* *Deadlock*

**2.** What are the three conditions required for *deadlock*?