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*?