16.3 A system consists of 6 components connected as in Figure 16.3. Find the overall reliability of the system, given that the reliabilities of A, B, C, D, E, and F are, respectively, 0.95, 0.80, 0.90, 0.99, 0.90, and 0.85.
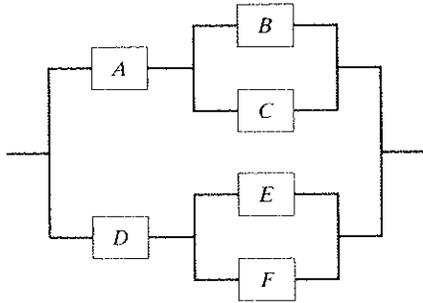

Figure 16.3 System for Exercise 16.3

16.4 Suppose that the flight of an aircraft is regarded as a system having the three main components A (aircraft), B (pilot), and C (airport). Suppose, furthermore, that component B can be regarded as a parallel subsystem consisting of B_1 (captain), B_2 (first officer), and B_3 (flight engineer); and C is a parallel subsystem consisting of C_1 (scheduled airport) and C_2 (alternate airport). Under given flight conditions, the reliabilities of components A, B_1, B_2, B_3, C_1, and C_2 (defined as the probabilities that they can contribute to the successful completion of the scheduled flight) are, respectively, 0.9999, 0.9995, 0.999, 0.20, 0.95, and 0.85.

(a) What is the reliability of the system?

(b) What is the effect on system reliability of having a flight engineer who is also a trained pilot, so that the reliability of B_3 is increased from 0.20 to 0.99?

(c) If the flight crew did not have a first officer, what then would be the effect of increasing the reliability of B_3 from 0.20 to 0.99?

(d) What is the effect of adding a second alternate landing point, C_3, with reliability 0.80?

16.7 An integrated-circuit chip has a constant failure rate of 0.02 per thousand hours.

(a) What is the probability that it will operate satisfactorily for at least 20,000 hours?

(b) What is the 5,000-hour reliability of a component consisting of 4 such chips connected in series?

16.8 After burn-in, the lifetime of a solar cell is modeled as an exponential distribution with failure rate $\alpha = 0.0005$ failures per day.

(a) What is the probability that the cell will fail within the first 365 days that it is in operation?