1. Computer keyboard failures are due to faulty electrical contacts (12%), or mechanical defects (88%). Mechanical defects are related to loose keys (27%), or improper assembly (73%). Electrical contact defects are caused by defective wires (35%), improper connections (13%), or poorly welded wires (52%).
   (a) Find the probability that a failure is due to loose keys.
   (b) Find the probability that a failure is due to improperly connected or poorly welded wires.

2. A lot of 100 semiconductor chips contains 20 that are defective.
   (a) Two are selected, at random, without replacement, from the lot. Determine the probability that the second chip selected is defective.

3. The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that devices fail independently. What is the probability that the circuit operates?

![Circuit Diagram](image)

4. The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that devices fail independently. What is the probability that the circuit operates?

![Circuit Diagram](image)

5. If $P(A|B) = 1$, must $A = B$? Draw a Venn diagram to explain your answer.
6. The following circuit operates if and only if there is a path of functional devices from left to right. The probability that each device functions is as shown. Assume that the probability that a device is functional does not depend on whether or not other devices are functional. What is the probability that the circuit operates?

7. The following circuit operates if and only if there is a path of functional devices from left to right. The probability that each device functions is as shown. Assume that the probability that a device functions does not depend on whether or not other devices are functional. What is the probability that the circuit operates?

8. Customers are used to evaluate preliminary product designs. In the past, 95% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products.

(a) What is the probability that a product attains a good review?
(b) If a new design attains a good review, what is the probability that it will be a highly successful product?
(c) If a product does not attain a good review, what is the probability that it will be a highly successful product?
9. Semiconductor lasers used in optical storage products require higher power levels for write operations than for read operations. High-power-level operations lower the useful life of the laser.

Lasers in products used for backup of higher speed magnetic disks primarily write, and the probability that the useful life exceeds five years is 0.95. Lasers that are in products that are used for main storage spend approximately an equal amount of time reading and writing, and the probability that the useful life exceeds five years is 0.995. Now, 25% of the products from a manufacturer are used for backup and 75% of the products are used for main storage.

Let $A$ denote the event that a laser’s useful life exceeds five years, and let $B$ denote the event that a laser is in a product that is used for backup.

Use a tree diagram to determine the following:
(a) $P(B)$  
(b) $P(A|B)$  
(c) $P(A|B')$  
(d) $P(A \cap B)$  
(e) $P(A \cap B')$  
(f) $P(A)$

(g) What is the probability that the useful life of a laser exceeds five years?
(h) What is the probability that a laser that failed before five years came from a product used for backup?

10. The following circuit operates if and only if there is a path of functional devices from left to right. Assume devices fail independently and that the probability of failure of each device is as shown. What is the probability that the circuit operates?