

Bachelor in Computer Science and Engineering

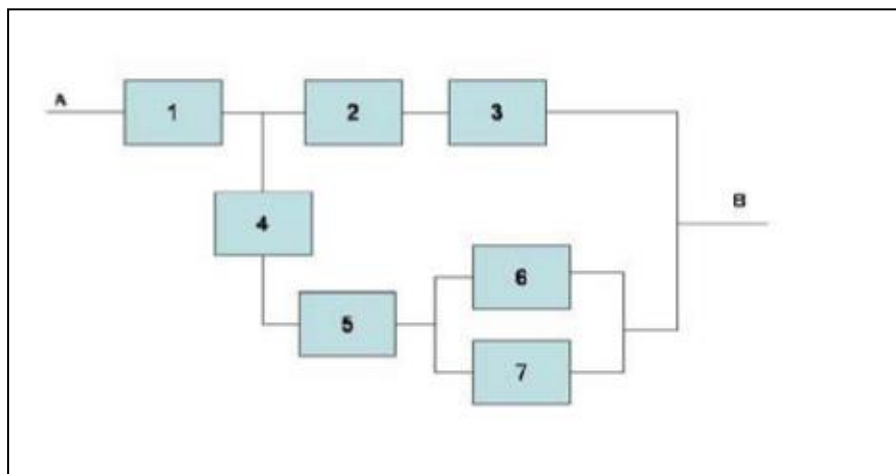
Statistics Problems

III Probability

1. The probability that a component fails in a given period of time is 0,01. Its status (damaged, working) is checked by means of a test such that, when the component is working, the probability that the test tells the opposite is 0,05, but if the component is damaged the test is not wrong. If the test says that the component is damaged, which is the probability that it is really damaged?
2. In a certain population 40% of its individuals has internet at home, 25% cable TV and 15% cable TV and internet. An individual is chosen randomly from this population.
 - a. If this individual has internet at home, which is the probability that he/she has also cable TV?
 - b. If he/she has cable TV, which is the probability that he/she does not have internet?
 - c. Which is the probability that he/she does not have internet neither cable TV?
3. The alignment between the rotor and the gearbox of wind turbines affects the performance of the system. 10% of wind turbines have clearly faulty alignments, 5% have slightly faulty alignments and the rest of the turbines are correctly aligned. During a year operating, the probability that a turbine with a clearly faulty alignment fails is 0,5; if the turbine has a slightly faulty alignment then the probability of failure is 0,3, and if the turbine is correctly aligned the probability of failure is 0,1. Taking into account year:
 - a. Which is the probability that a certain turbine chosen randomly fails?
 - b. If a failure has occurred which is the probability that the turbine had a clearly faulty alignment?
 - c. Consider a wind park with three independent turbines, which is the probability that at least one of them fails?
4. We want to check that a machine that produces CDs is working correctly, and it is known that the probability that the machine works correctly is 0,92. The procedure to check it is to select randomly 3 CDs produced during a certain day. It is known that the failure rate in manufacturing CDs is 5% when the machine is working correctly, but the failure rate reaches up to 30% when the machine is not

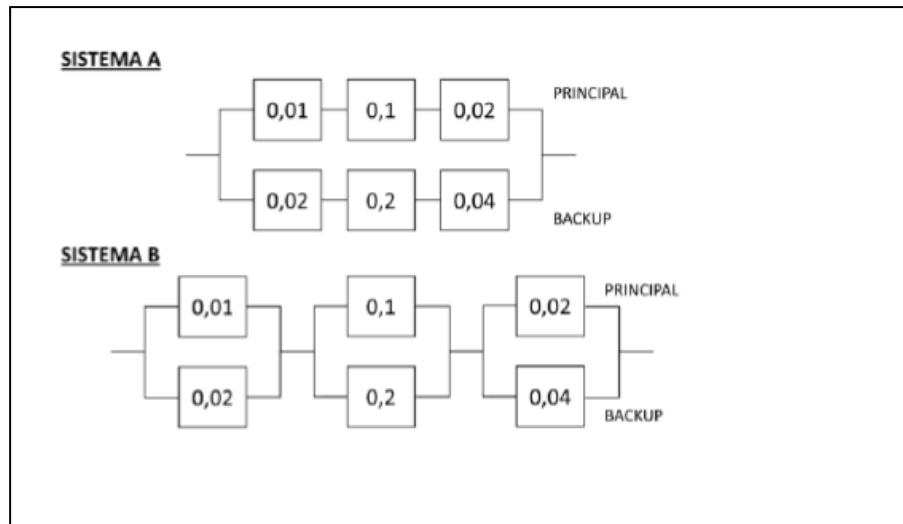
working correctly. The enterprise rules make perform a deep review whenever any of the 3 inspected CDs presents a failure. Answer the following questions:

- a. What is the probability to perform a deep inspection and the machine be working correctly?
 - b. Knowing that the 3 CDs have no failure, which is the probability that the machine is not working correctly?
5. In a casino in Madrid there are two slot machines. The probability of winning, when playing on machine A, is 0,1, and when playing on machine B is 0,2. A player does not know the probability of winning of each machine, therefore the probability to be chosen is the same for both machines. Knowing that the results of all games are independent, answer the following questions:
- a. If the game has been lost, which is the probability that the machine selected is machine B?
 - b. After loosing a game the player decides to bet again on the same machine. If the player loses again, which is the probability that the machine selected is machine B?
6. A component system is connected as shown in the figure below:

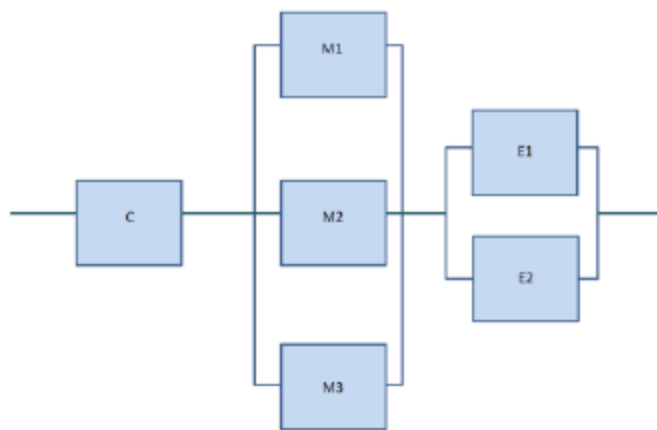


All components have the same probability of failure, equal to 0,01, and they fail independently of each other. The system works if it is possible to find a path between A and B with all components working. Which is the probability that the system works?

7. Systems A and B work whenever there is a path of working components connected from the left terminal to the right terminal. All components fail independently of each other and the probability of failure is shown in the figure below:
- a. Calculate the probability of failure for both systems and justify which is more reliable.
 - b. If all backup components are disconnected which system is more reliable? Why?



8. Suppose that an industrial process follows the scheme shown in the figure below:



According to this scheme, for a piece to be correctly produced it should undergo three different subprocesses: previous checking (C), mounting, which could be performed by means of three different types of machinery (M1, M2 or M3) and packaging, which can be done in cardboard boxes or in metal boxes (E1 or E2). Knowing that each one of these subprocesses is operative with probability 95% and are independent of each other:

- Find the probability that a piece randomly chosen has been produced correctly
- If subprocess E1 has been non operative during a certain period of time, which is the probability that a piece randomly chosen among the pieces produced during such period of time has been produced correctly?
- Knowing that a piece chosen randomly has not been produced correctly, which is the probability that subprocess E1 has not been operative when this piece was produced?

