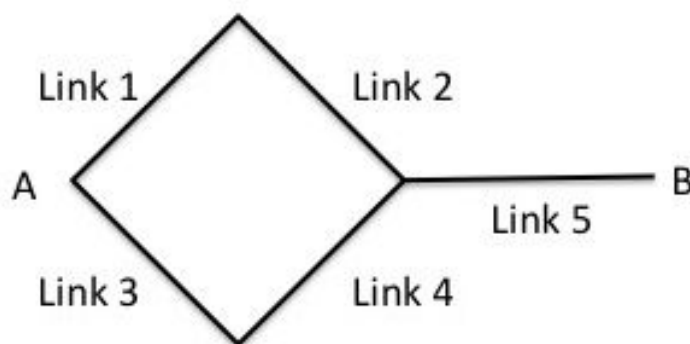


2. A reliability problem

Problem 2. A reliability problem

4.0/4.0 points (graded)

Consider the communication network shown in the figure below and suppose that each link can **fail with probability p** . Assume that failures of different links are independent.



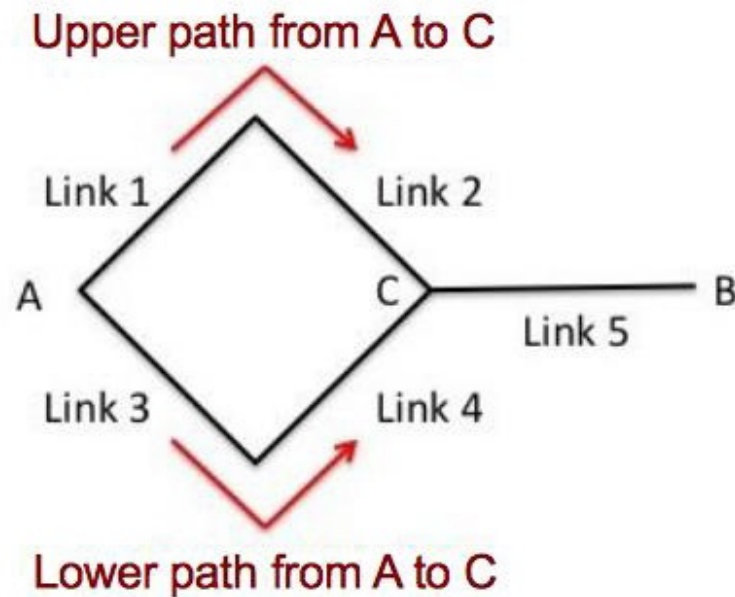
1. Assume that $p = 1/3$. Find the probability that there exists a path from A to B along which no link has failed. (Give a numerical answer.)

✓ Answer: 0.46091

2. Given that exactly one link in the network has failed, find the probability that there exists a path from A to B along which no link has failed. (Give a numerical answer.)

✓ Answer: 0.8

Solution:



Let E be the event that there exists an operational path from A to B . Note that the probability that the Upper path from A to C is operational is $(1 - p)^2$. So the probability that the Upper path fails is $1 - (1 - p)^2$. Similarly, the Lower path fails with probability $1 - (1 - p)^2$ as well.

1. For the event E to occur, that is, in order to have an operational path from A to B , two sub-events must occur: there must be an operational path from A to C , and Link 5 must be operational.

$$\begin{aligned}
 P(E) &= P(\text{there exists a path from } A \text{ to } C \text{ and Link 5 is operational}) \\
 &= (1 - P(\text{Upper path fails and Lower path fails})) \cdot P(\text{Link 5 is operational}) \\
 &= \left\{ 1 - \left[1 - (1 - p)^2 \right]^2 \right\} \cdot (1 - p).
 \end{aligned}$$

When $p = 1/3$, this gives us $P(E) \approx 0.46091$.

2. Since all links are equally likely to fail and since exactly one link has failed, each link has the same probability $1/5$ of being the one that failed. There will be no path from A to B only in the case where the link that failed is Link 5, which happens with probability $1/5$. Therefore, the desired probability is $1 - 1/5 = 4/5$.

提交

You have used 3 of 3 attempts

i Answers are displayed within the problem

讨论

显示讨论

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