



MITx: 6.041x Introduction to Probability - The Science of Uncertainty




Bookmarks


- ▶ Unit 0: Overview
- ▶ Entrance Survey
- ▶ Unit 1: Probability models and axioms
- ▼ Unit 2: Conditioning and independence

Unit overview

Lec. 2: Conditioning and Bayes' rule


Exercises 2 due Feb 17, 2016 at 23:59 UTC 

Lec. 3: Independence

Exercises 3 due Feb 17, 2016 at 23:59 UTC 

Solved problems

Problem Set 2

Problem Set 2 due Feb 17, 2016 at 23:59 UTC 

Unit 2: Conditioning and independence > Problem Set 2 > Problem 2 Vertical: A reliability problem

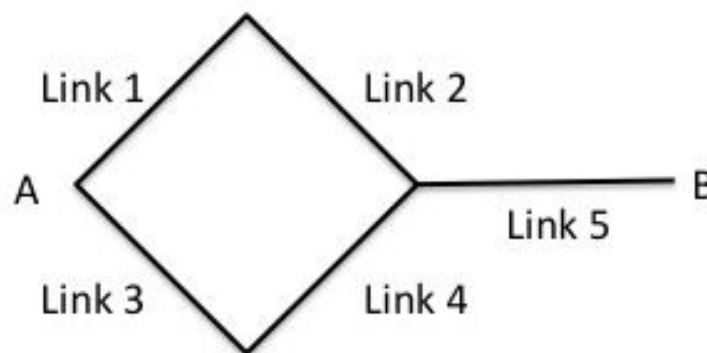


Bookmark

Problem 2: A reliability problem

(4/4 points)

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.)

0.4609053



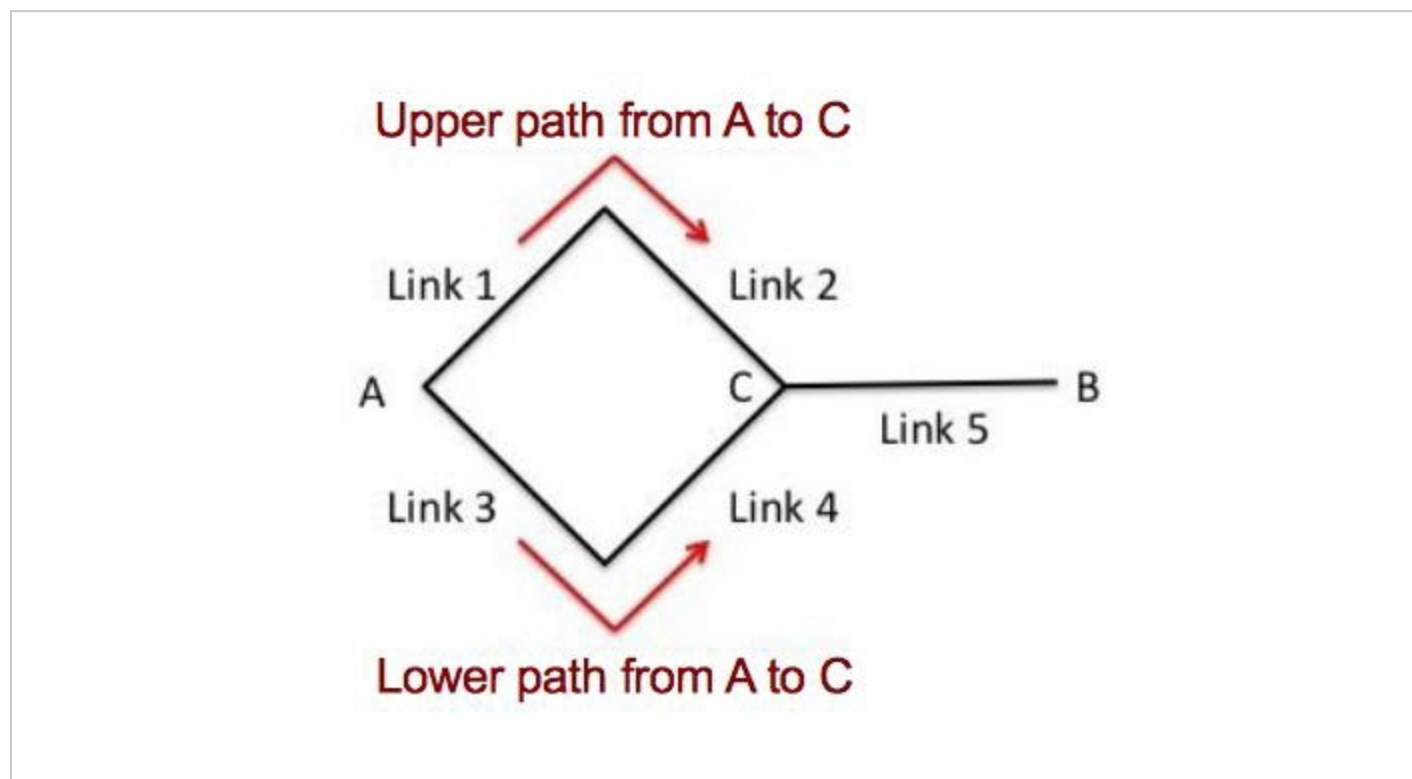
Answer: 0.46091

- ▶ Unit 3: Counting
- ▶ Unit 4: Discrete random variables
- ▶ Exam 1
- ▶ Unit 5: Continuous random variables
- ▶ Unit 6: Further topics on random variables
- ▶ Unit 7: Bayesian inference
- ▶ Exam 2
- ▶ Unit 8: Limit theorems and classical statistics
- ▶ Unit 9: Bernoulli and Poisson processes
- ▶ Unit 10: Markov chains
- ▶ Exit Survey

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

Answer:



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.

► Final Exam

1. We can break the problem down into two parts. In order for there to be an operational path from **A** to **B**, there must be an operational path from **A** to **C**, and Link 5 must be operational.

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

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

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 $1 - 1/5 = 4/5$.

You have used 2 of 2 submissions

DISCUSSION

Click "Show Discussion" below to see discussions on this problem.



© edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

