

MITx: 6.008.1x Computational Probability and Inference

Heli

Bookmarks

- **▶** Introduction
- Part 1: Probability and Inference
- Part 2: Inference in Graphical Models
- Part 3: Learning
   Probabilistic Models

Week 8: Introduction to Learning Probabilistic Models

Week 8: Introduction to
Parameter Learning Maximum Likelihood and
MAP Estimation

due Nov 10, 2016 03:30 IST

Week 8: Homework 6 due Nov 10, 2016 03:30 IST

Week 9: Parameter Learning - Naive Bayes Classification

Part 3: Learning Probabilistic Models > Week 10: Structure Learning - Trees > Exercise: The Chow-Liu Algorithm

## **Exercise: The Chow-Liu Algorithm**

☐ Bookmark this page

## **Exercise: The Chow-Liu Algorithm**

1/1 point (graded)

Consider four variables with the following empirical mutual information:

$\widehat{I}(X_i;X_j)$				
1	0.3415	0.2845	0.0003	0.0822
2	0.2845	0.3457	0.0005	0.0726
3	0.0003	0.0005	0.5852	0.0002
4	0.0822	0.2845 0.3457 0.0005 0.0726	0.0002	0.5948

Find the Chow-Liu tree of the four variables by specifying which edges are present in the tree.

 $\checkmark (1,2)$ 

**(1,3)** 

Week 9: Mini-project on Email Spam Detection

due Nov 17, 2016 03:30 IST

Week 10: Parameter
Learning - Finite Random
Variables and Trees

due Nov 24, 2016 03:30 IST

Week 10: Structure
Learning - Trees

due Nov 24, 2016 03:30 IST

Week 10: Homework 7 due Nov 24, 2016 03:30 IST **(1,4)** 

 $\checkmark$  (2,3)

 $\quad \ \square \ \ (2,4)$ 



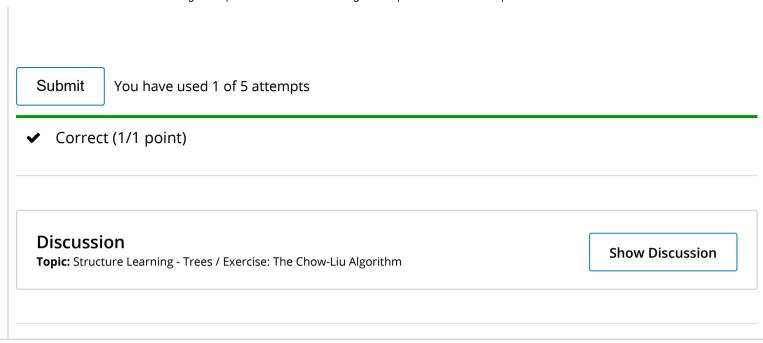
## **Solution:**

If we sort the mutual information values from the largest to the smallest, we get:

$$\hat{I}(X_1; X_2), \hat{I}(X_1; X_4), \hat{I}(X_2; X_4), \hat{I}(X_2; X_3), \hat{I}(X_1; X_3), \hat{I}(X_3; X_4).$$

Note that we only consider when  $\hat{I}(X_i;X_j)$  for i< j here because mutual information is symmetric and  $\hat{I}(X_i;X_i)$  is irrelevant. Then the Chow-Liu algorithm says that we begin with a fully disconnected graph and start adding edges with the largest empirical mutual information. Thus, we add edges (1,2) and (1,4). If the next edge (2,4) is added, the resulting graph has a cycle 1-2-4, so instead, we add (2,3). Since there are 4 variables, a tree over 4 nodes has 3 edges, so the algorithm terminates.

Thus, the edges in the tree are (1,2),(1,4),(2,3)



© All Rights Reserved



© 2016 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.

















