Exercise 1

Machine Learning I

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|  | 1A-1. |

Example of mixed distribution: You are throwing balls into the air. Let be the probability, that the -th ball hits the ground first and be the density of its exact displacement during the fall. The joint distribution expects to have finite and uncountably infinite many realizations.

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|  | 1A-2. |

Counterexample:  
  
Given , let be the results of two successive *independent* coin tosses.

Let

We now have:

But:

This can be further analyzed.

We have the following constraints:

Given the above restrictions , we analyze the validity of the relationship:

Solution: Transform the joint probability into

Excluding the degenerate case , this leads to:

The above only holds iff , which is generally not true, so conditional  
independence of A,B and A,C is not sufficient for transitivity.

Just imagine: If were always valid, we could not learn about by gathering data . In other words: More data would not make our estimates any better. This runs counter to most situations.

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|  | 1A-3. |

Definition of the events:

1. The negations   can be read as *not*.  
     
     
   with

Using the conditional independence of and independence of testing

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|  | 1A-4. |

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|  | 1A-5. |

Utilizing that if are independent.

If are discrete equivalent steps can be taken to prove the conjecture.