Introduction

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July 6, 2010

Introduction
Overview of Topics

Introduction

- Data mining is the search for patterns in large collections of data
- Pattern recognition is concerned with automatically finding patterns in data
- Machine learning is pattern recognition with concern for computational tractability

Example : Handwritten Digit Identification

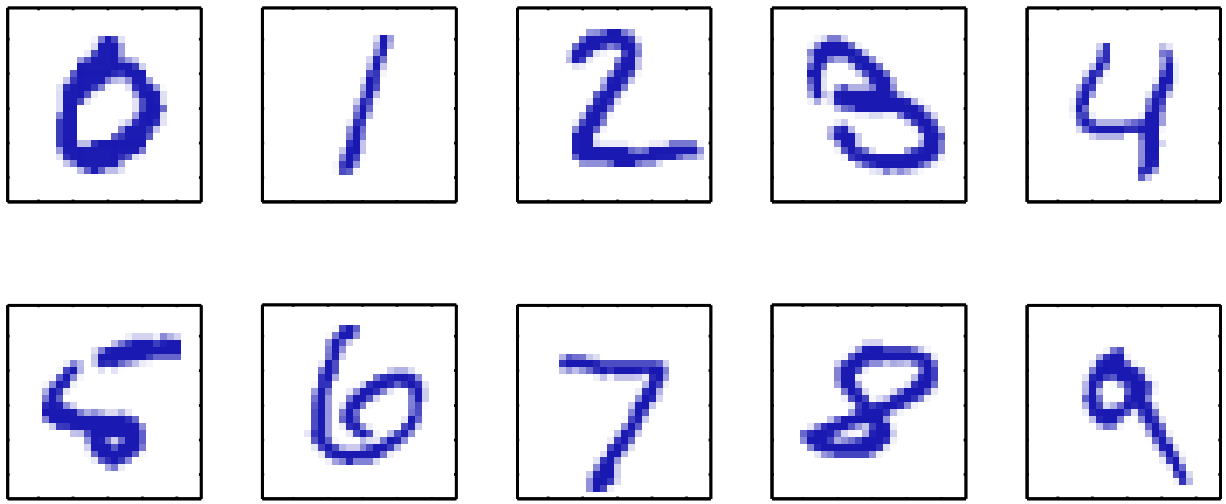


Figure: Hand written digits from the USPS

Approaches to Identifying Digits

Goal

- Build a machine that can identify digits automatically

Approaches

- Hand craft a set of rules that separate each digit from the next
- Set of rules invariably grows large and unwieldy and requires many "exceptions"
- "Learn" a set of models for each digit automatically from labeled training data.

Formalism

- Each digit is 28x28 pixel image
- Vectorized into a 784 entry vector $\mathbf{x}$

Machine learning approach

- Obtain a of N digits $\{\mathbf{x}_1, \ldots, \mathbf{x}_N\}$ called the *training set*.
- Label (by hand) the training set to produce a label or "target" $\mathbf{t}$ for each digit image $\mathbf{x}$
- Learn a function $\mathbf{y}(\mathbf{x})$ which takes an image $\mathbf{x}$ as input and returns an output in the same "format" as the target vector.

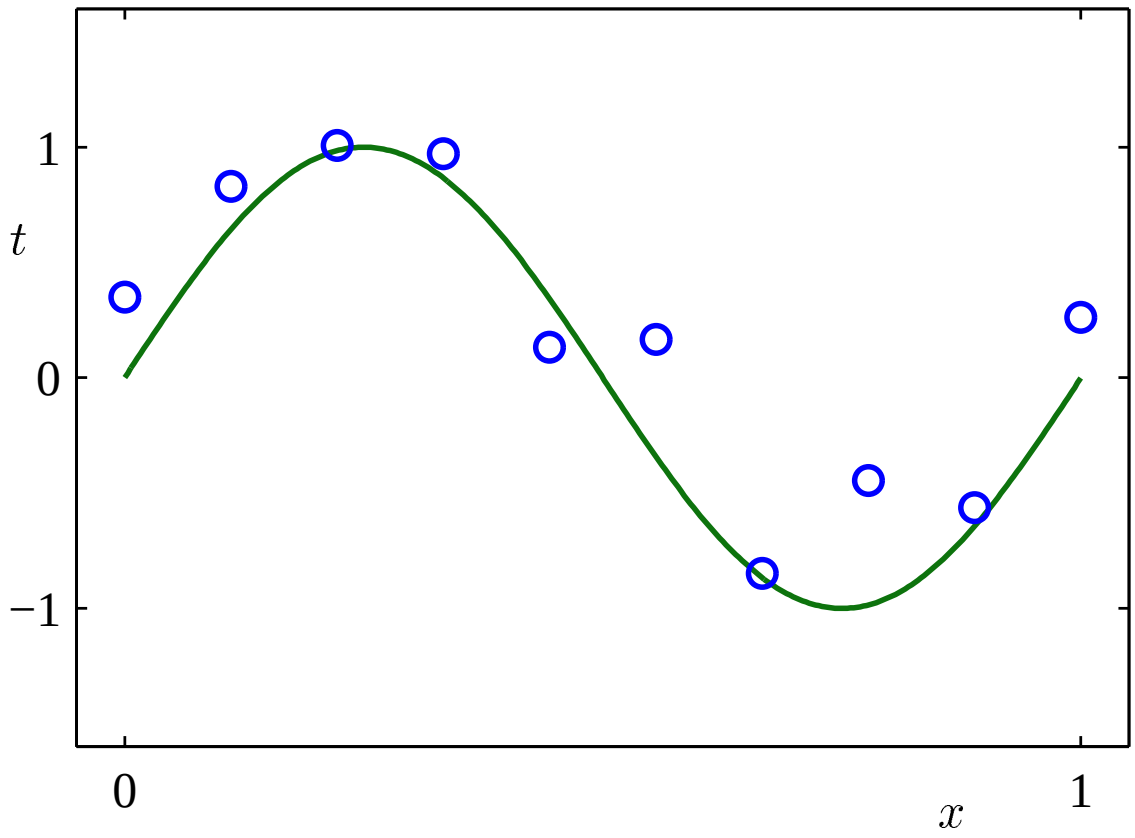


Figure: Chapter 1, Figure 2

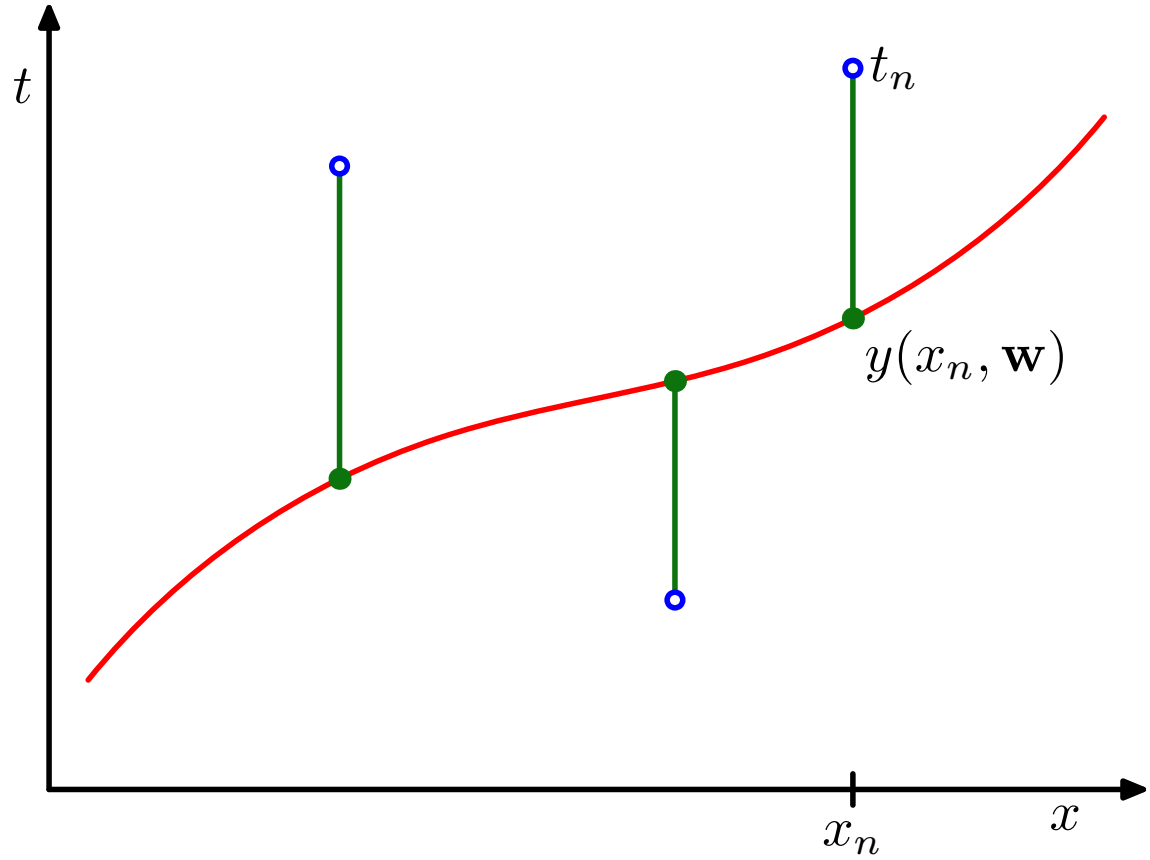


Figure: Chapter 1, Figure 3

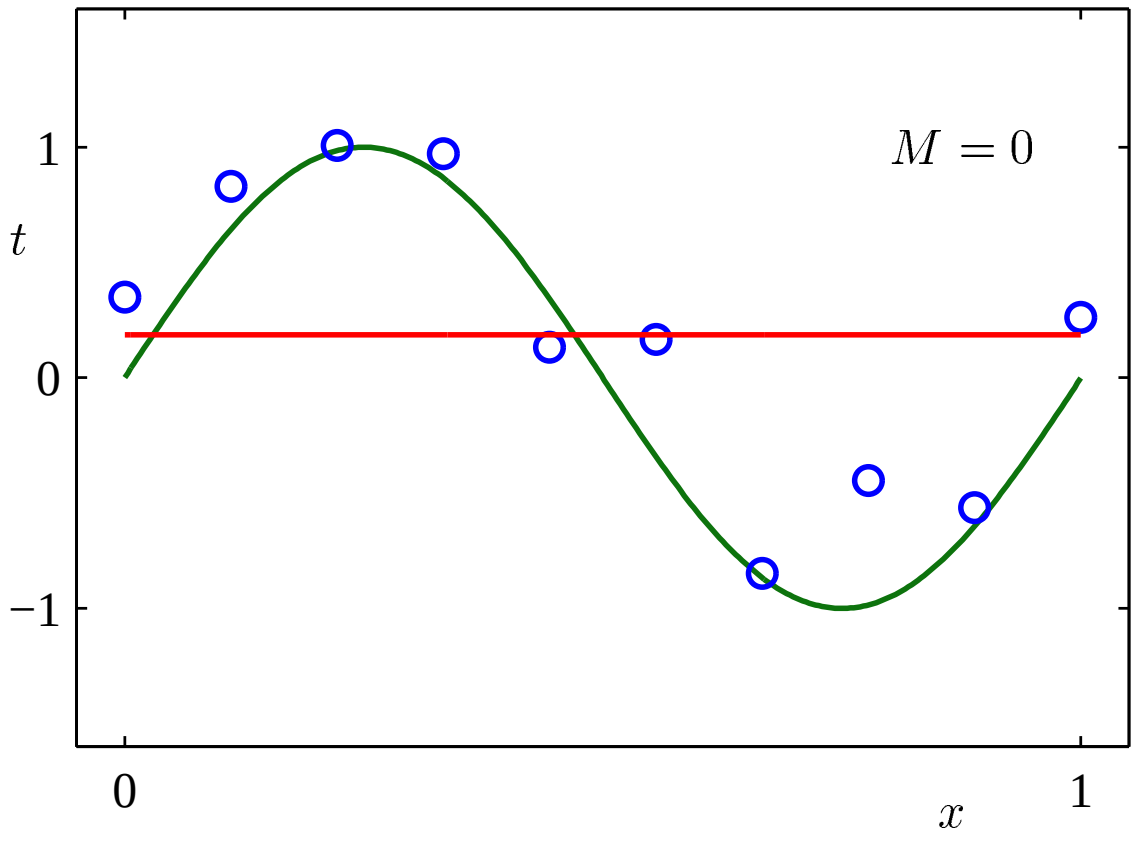


Figure: Chapter 1, Figure 4a

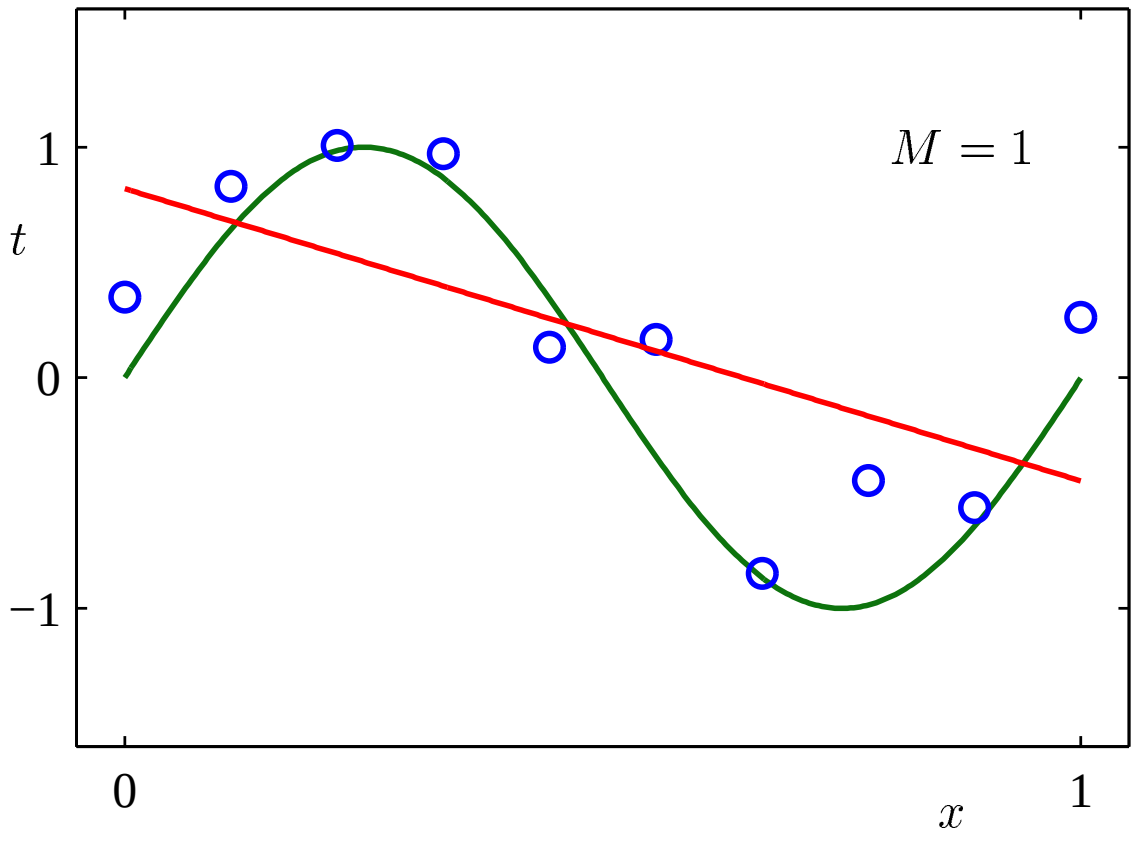


Figure: Chapter 1, Figure 4b

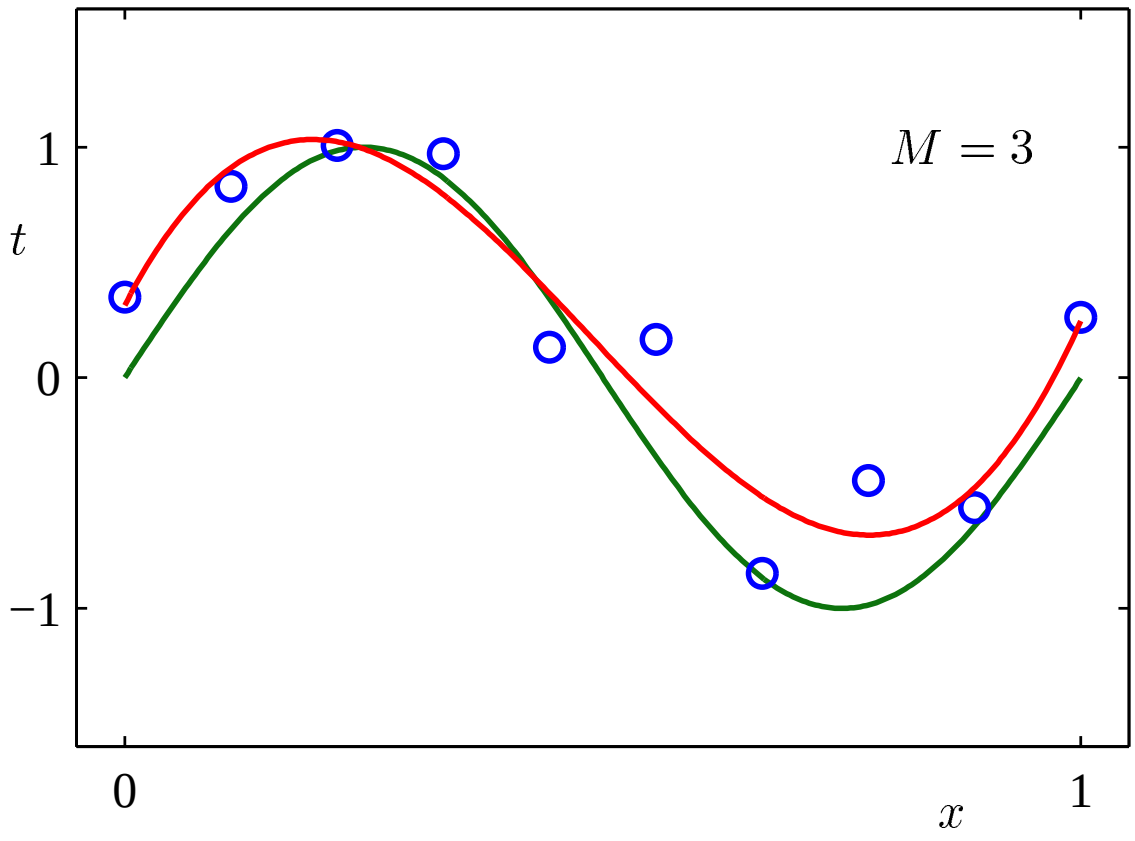


Figure: Chapter 1, Figure 4c

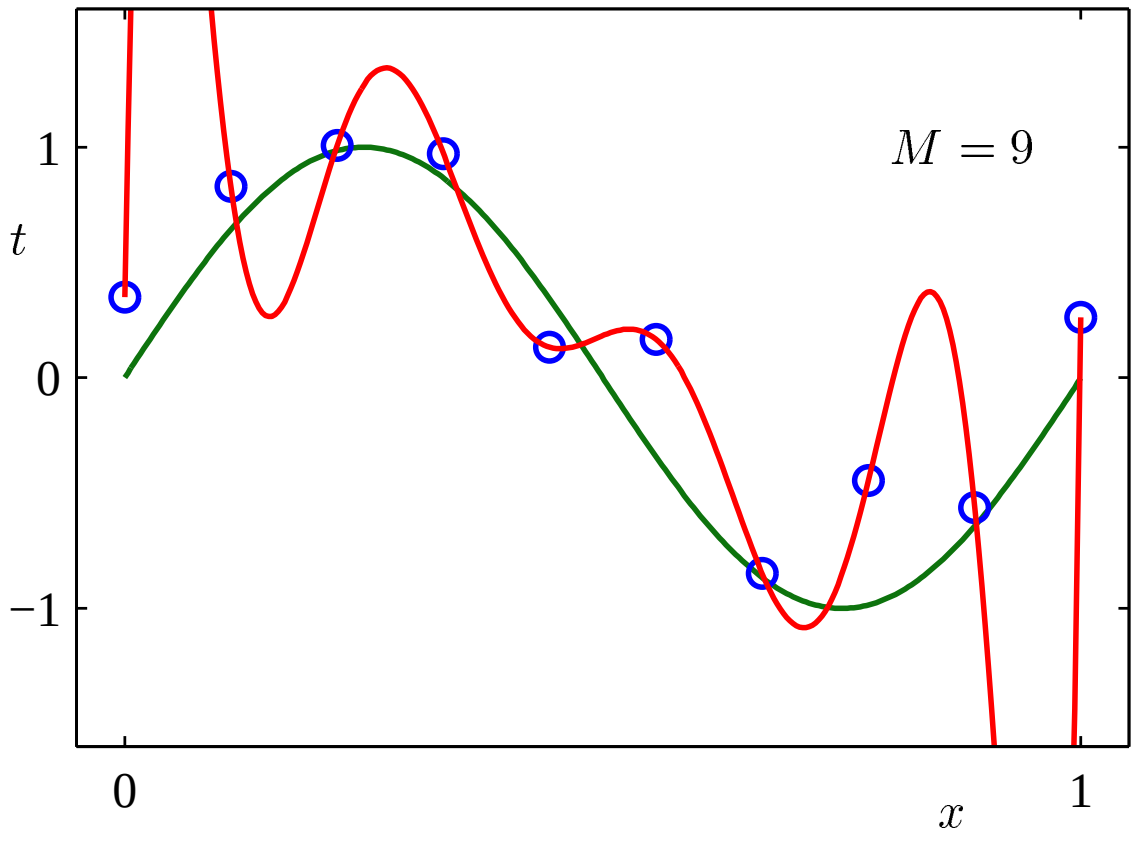


Figure: Chapter 1, Figure 4d

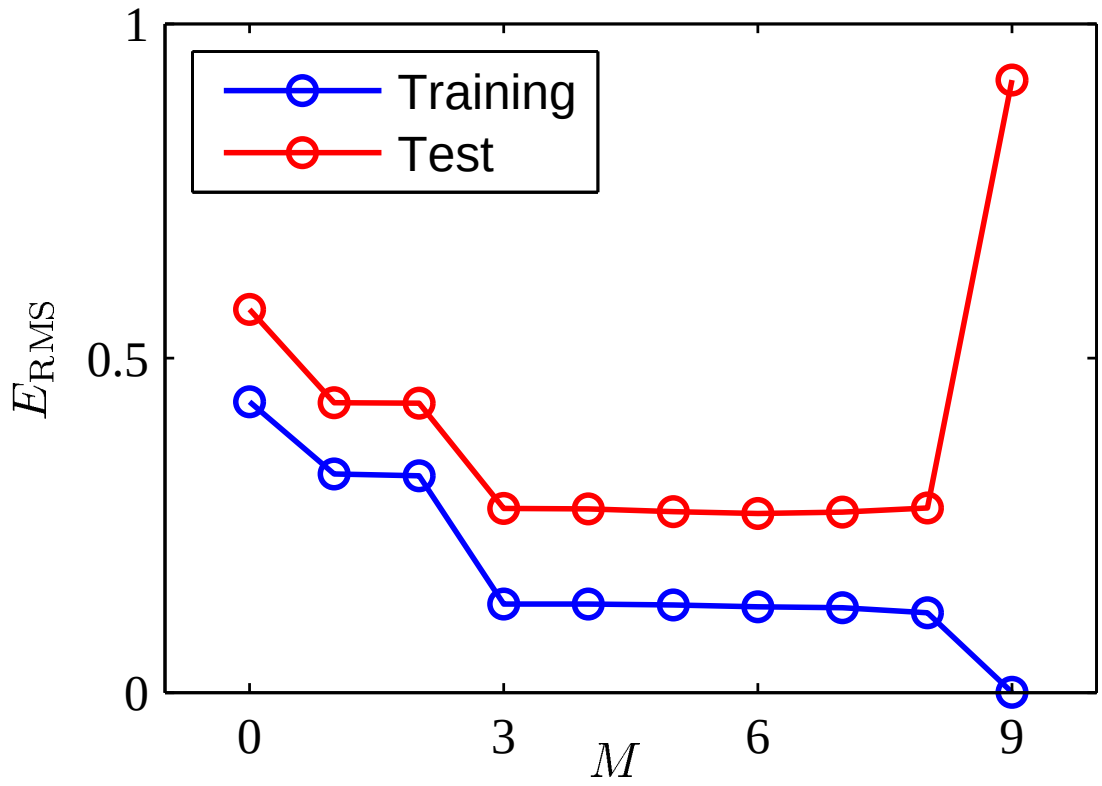


Figure: Chapter 1, Figure 5

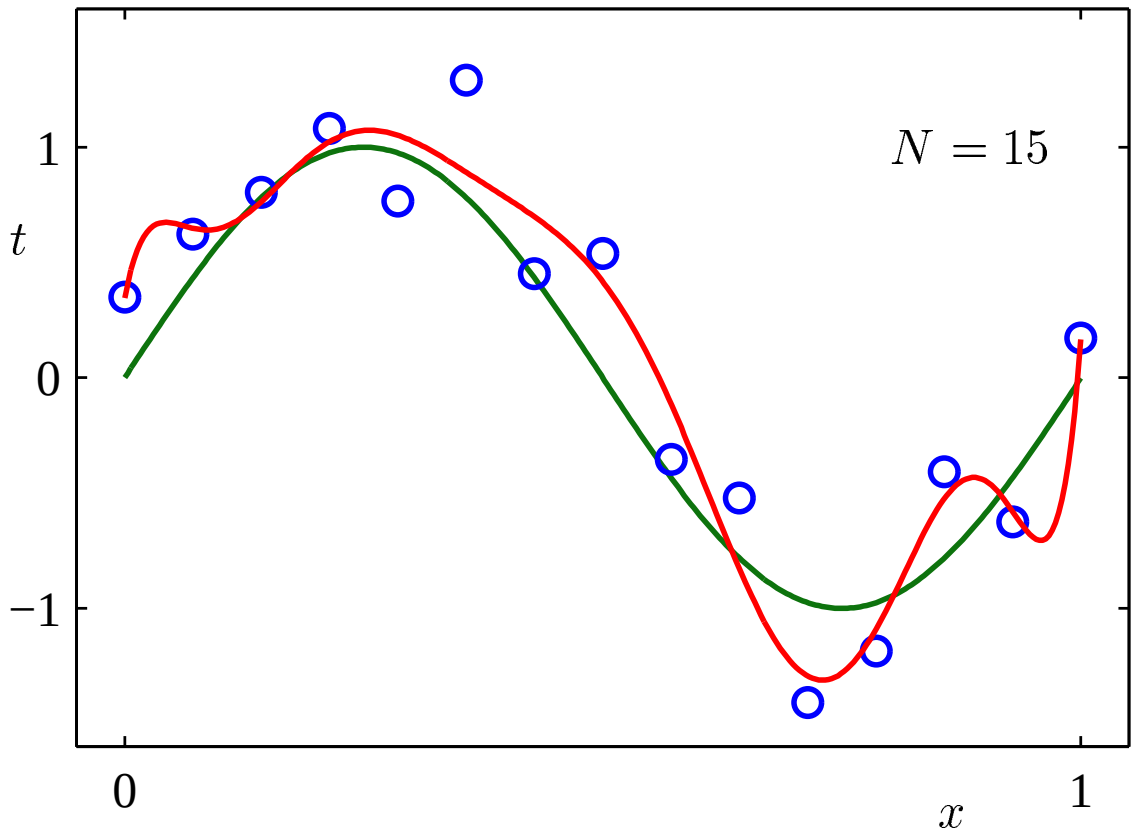


Figure: Chapter 1, Figure 6a

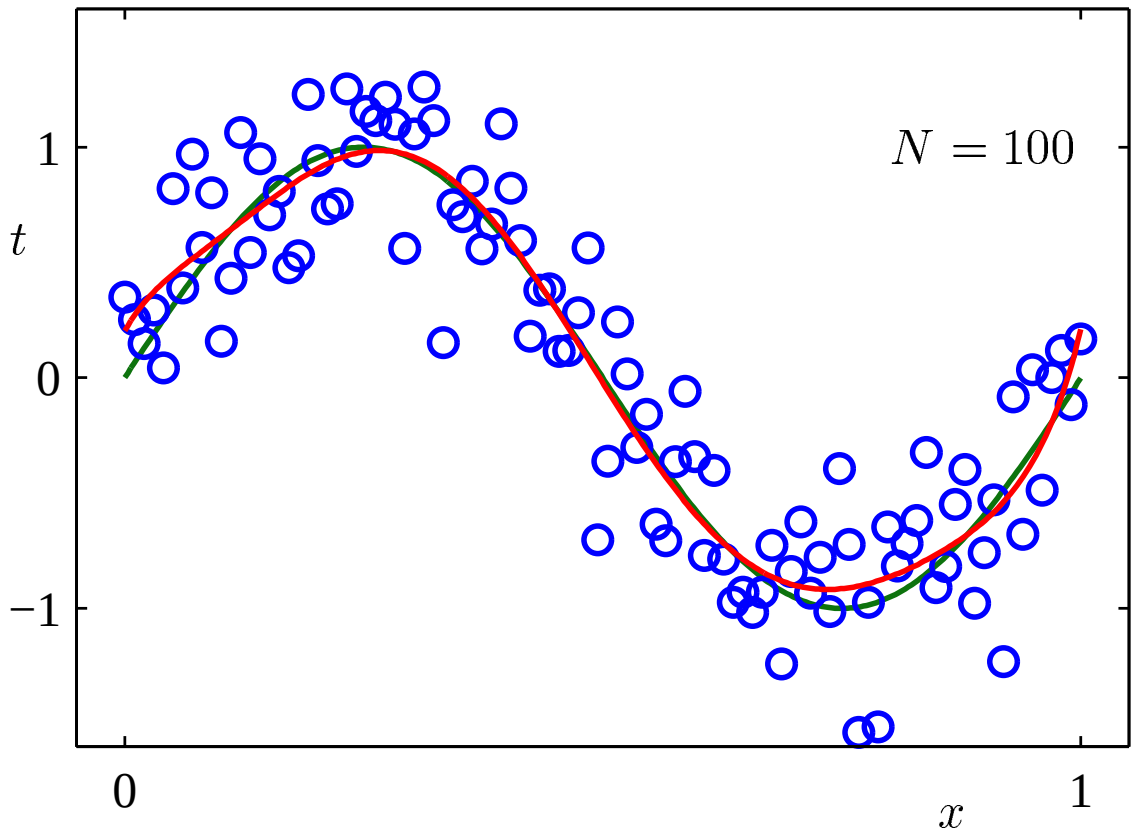


Figure: Chapter 1, Figure 6b

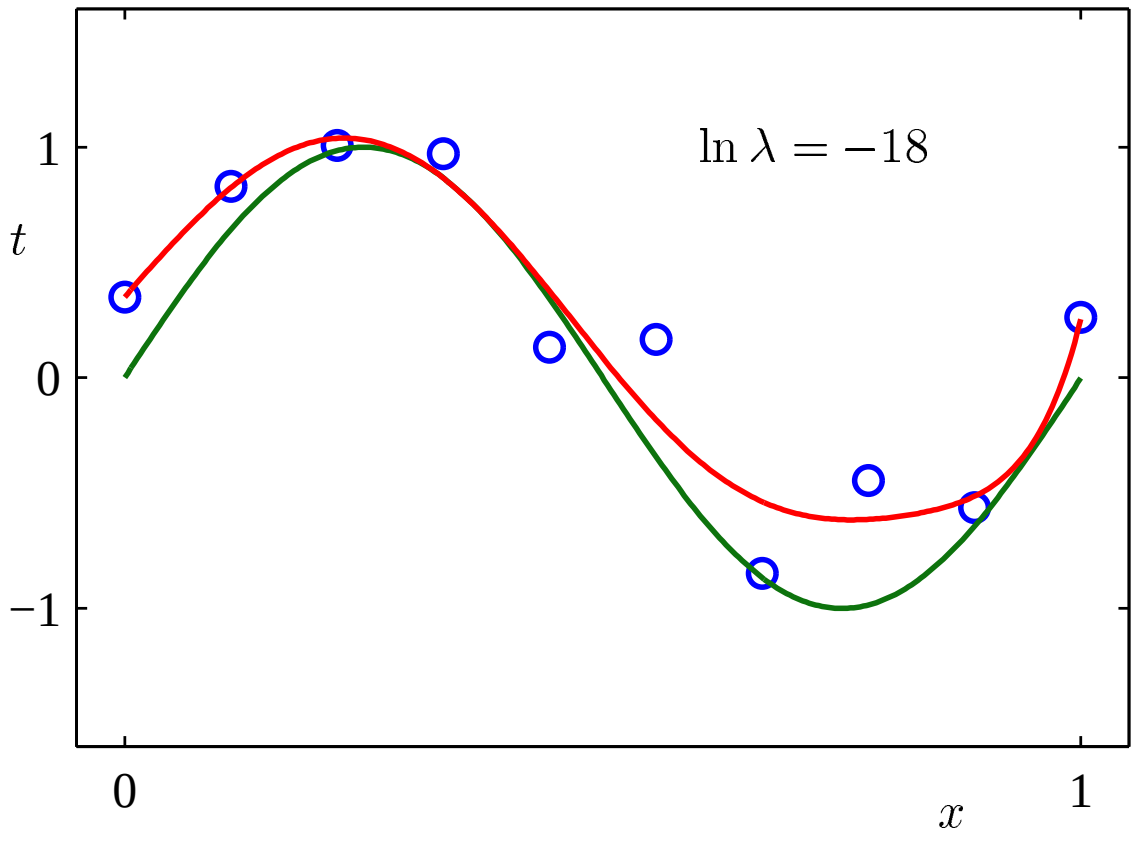


Figure: Chapter 1, Figure 7a

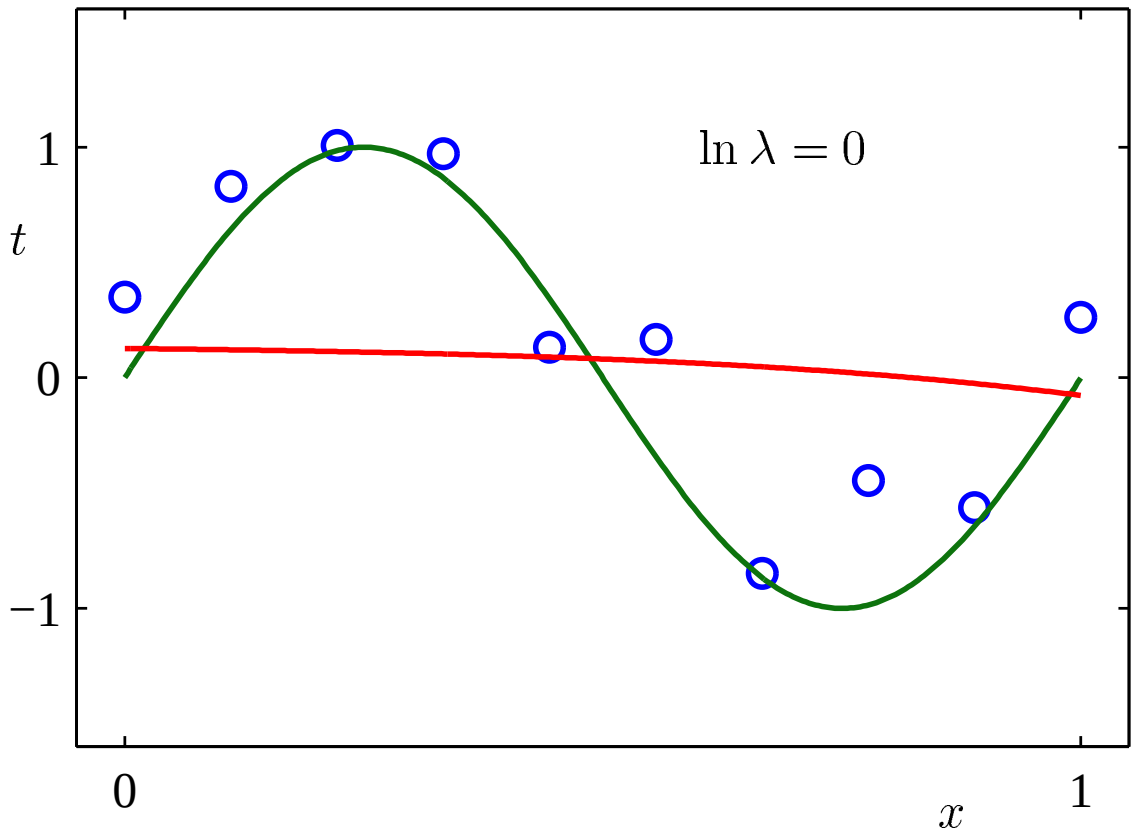
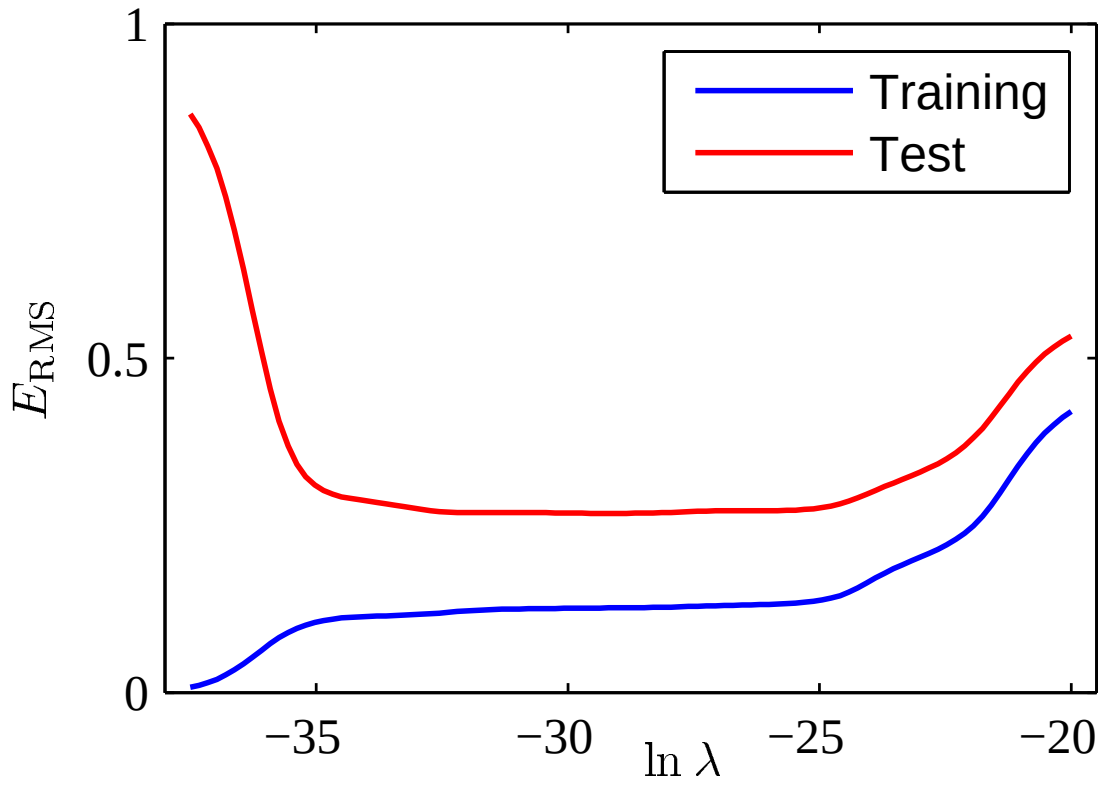


Figure: Chapter 1, Figure 7b



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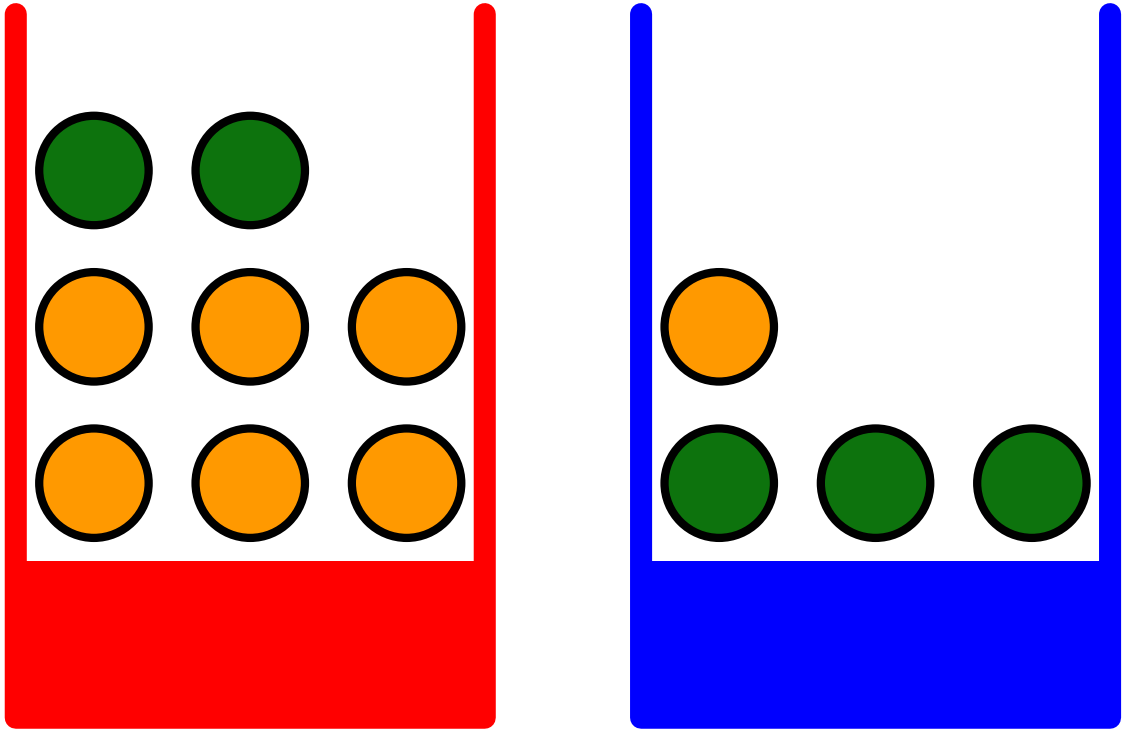

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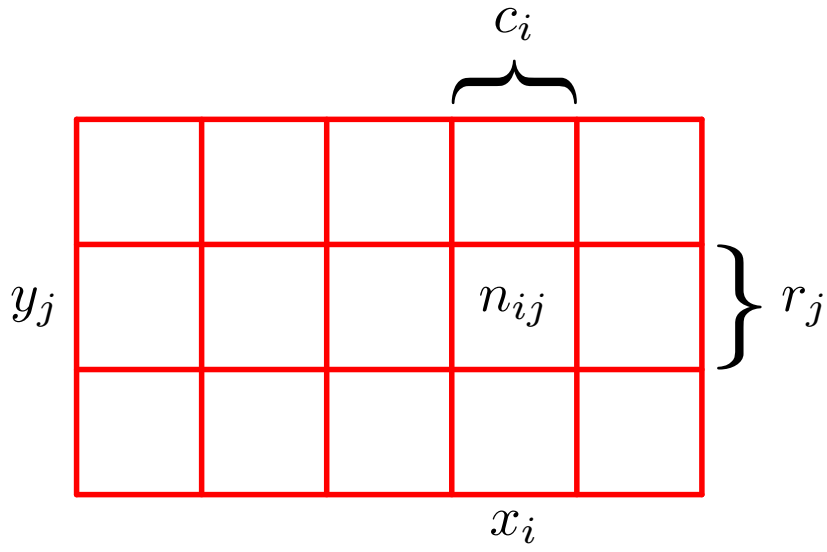

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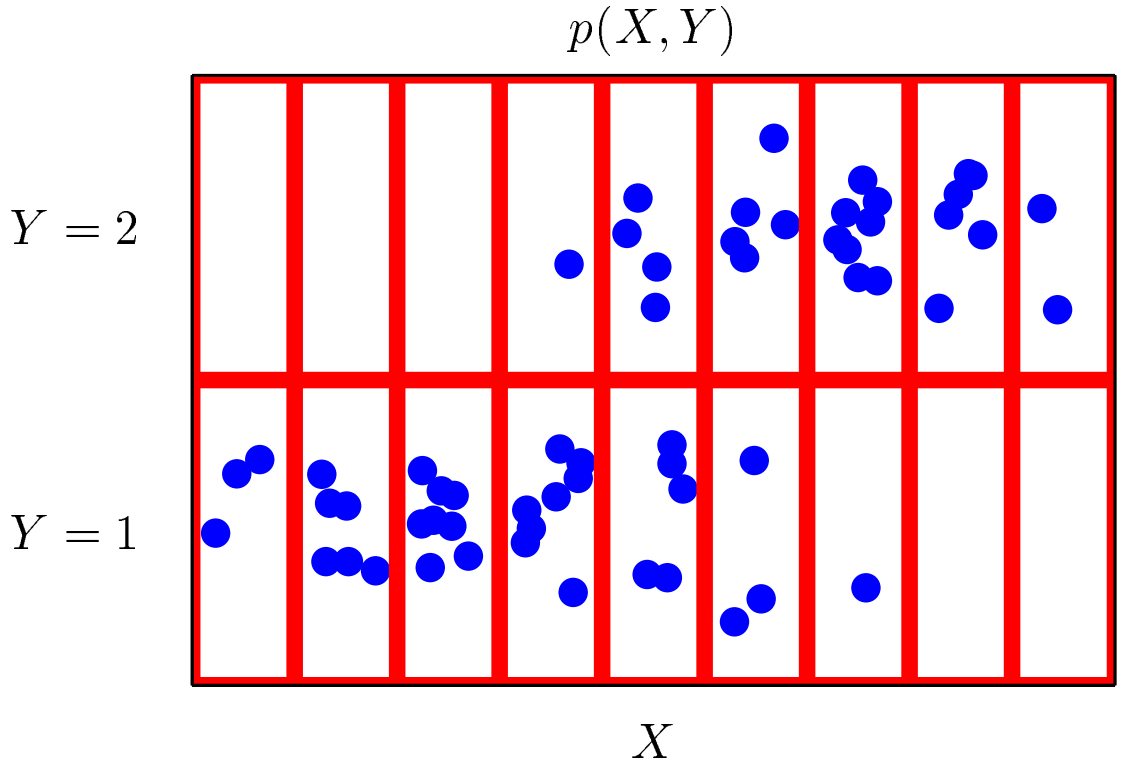


Figure: Chapter 1, Figure 11a

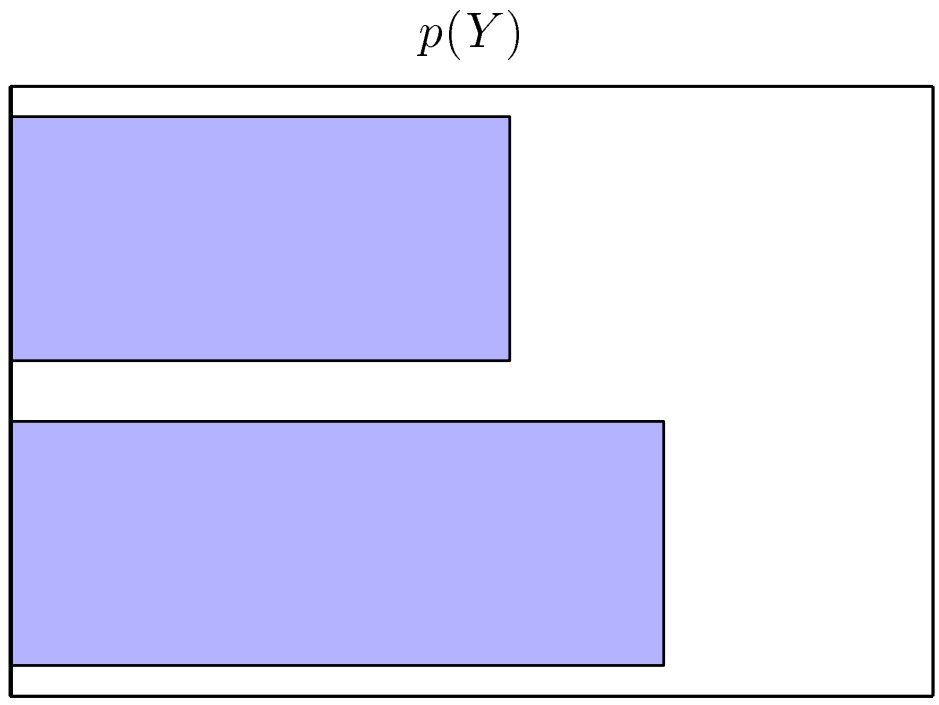


Figure: Chapter 1, Figure 11b

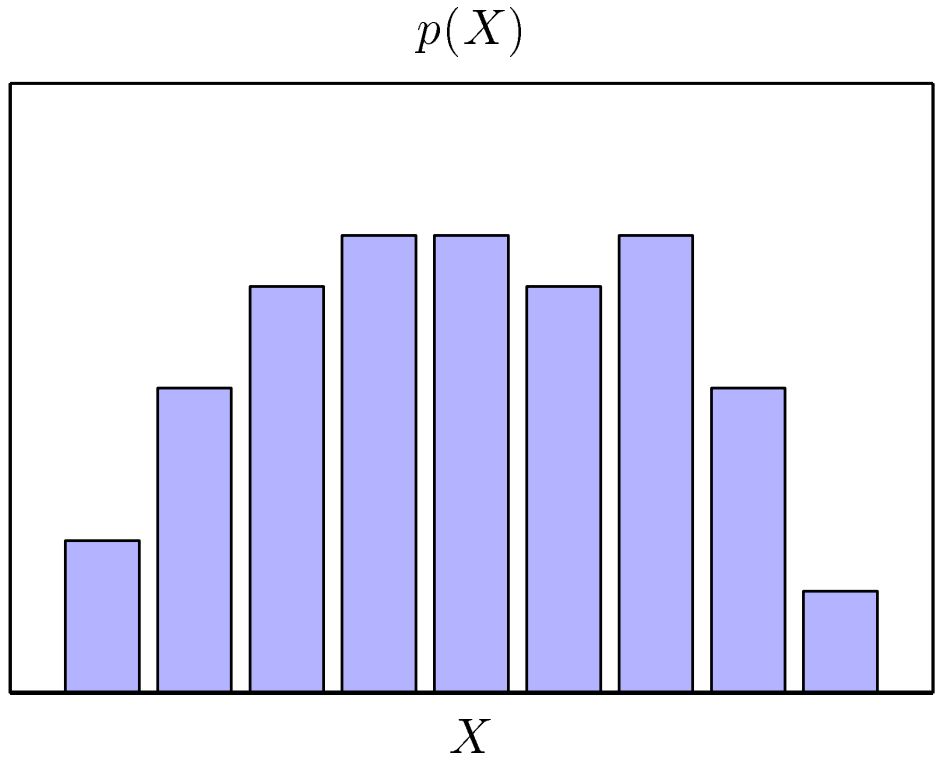


Figure: Chapter 1, Figure 11c

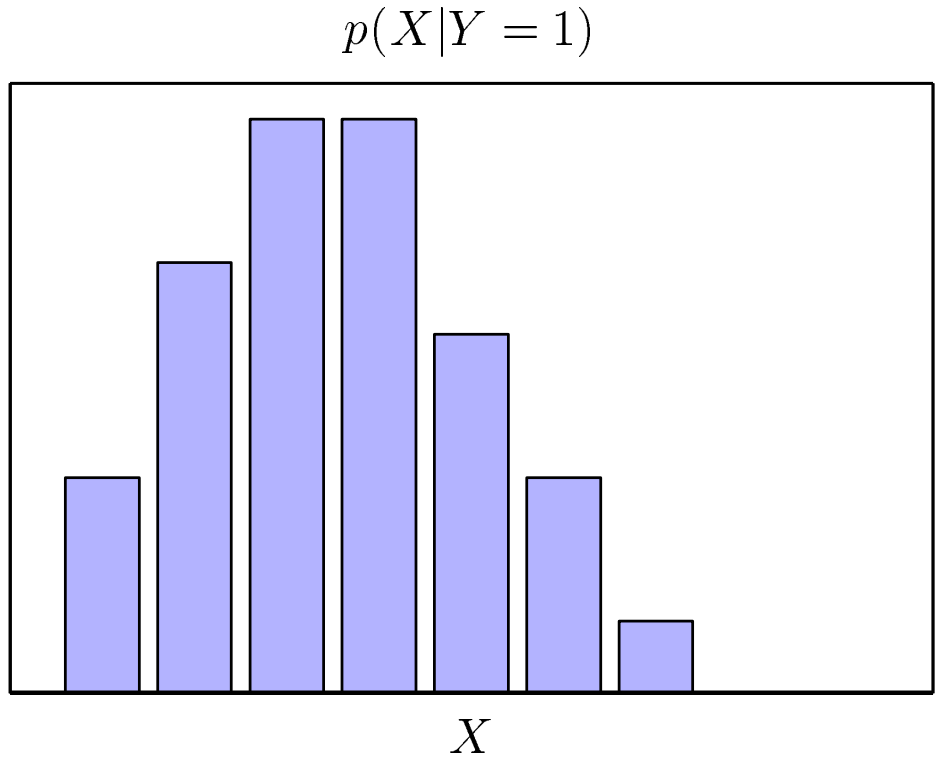
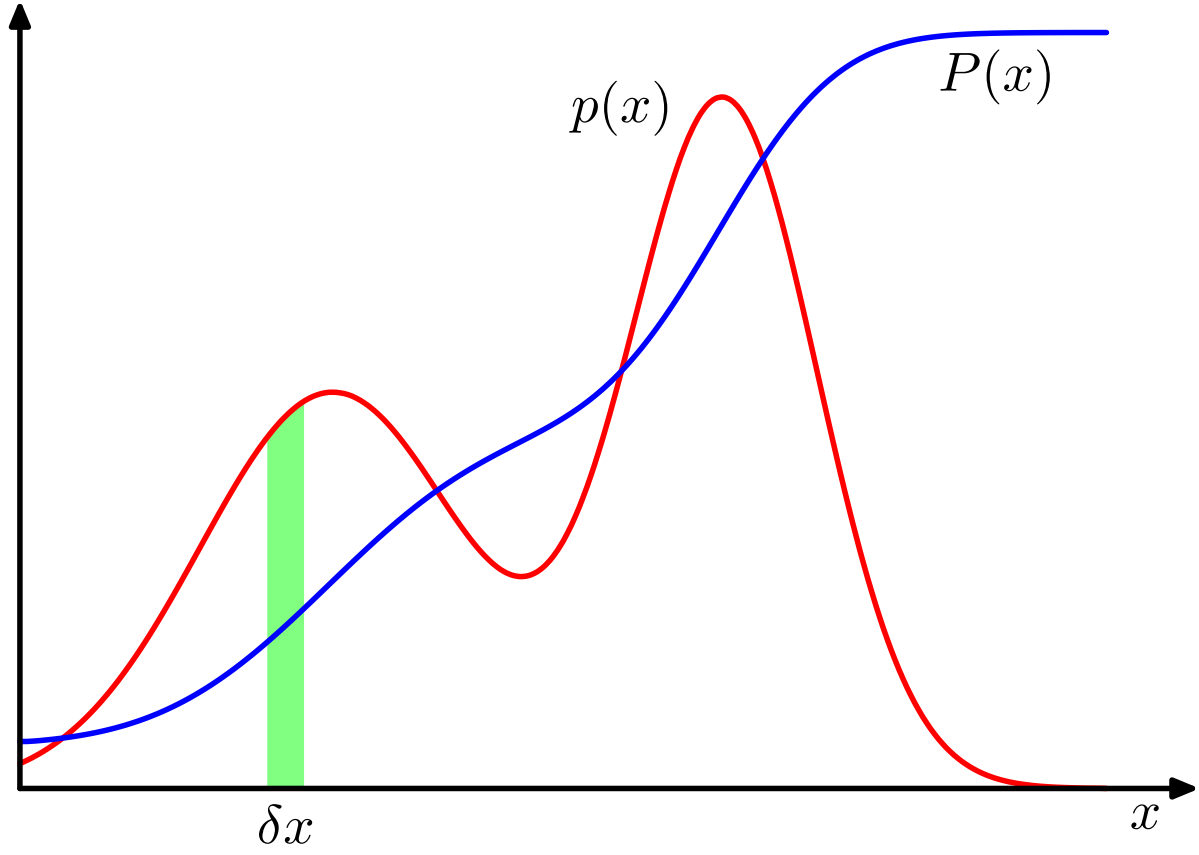


Figure: Chapter 1, Figure 11d



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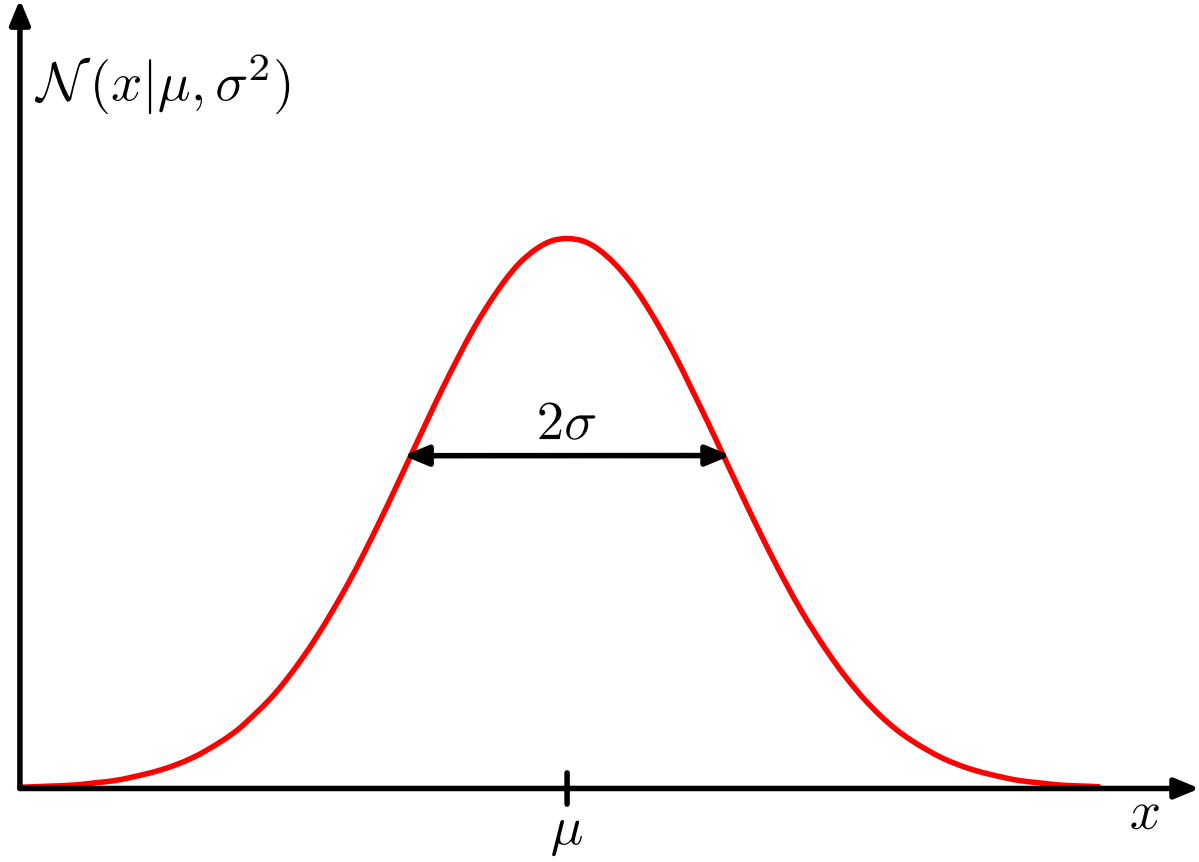

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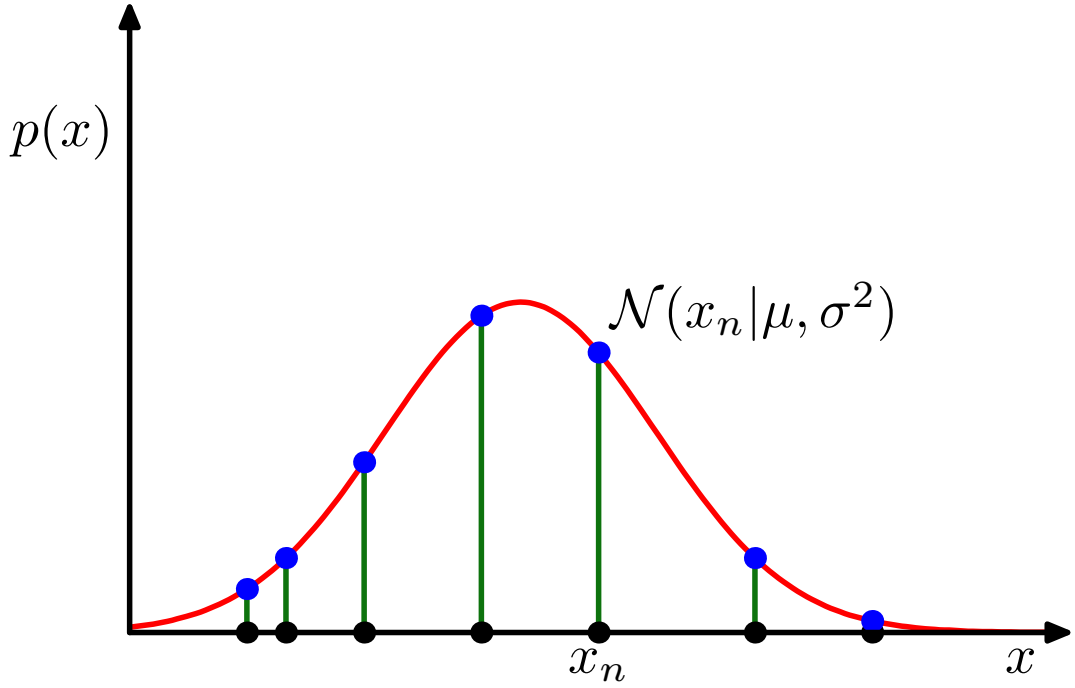

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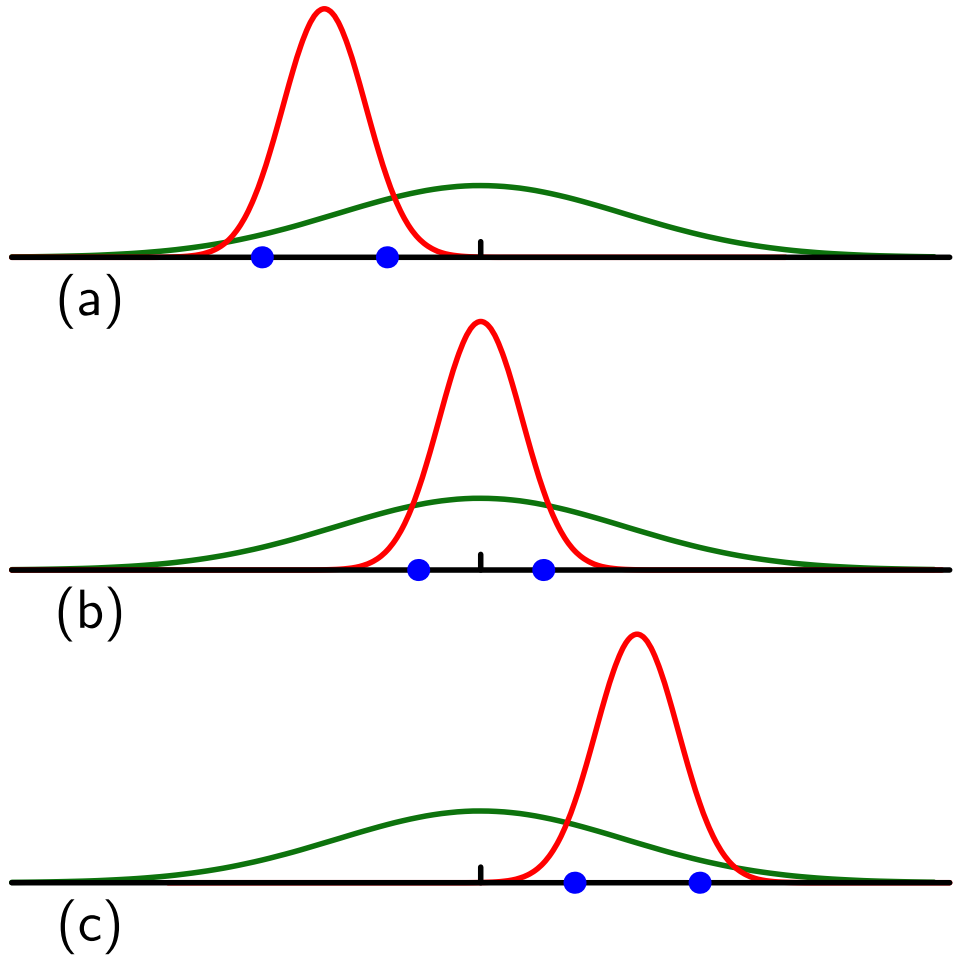

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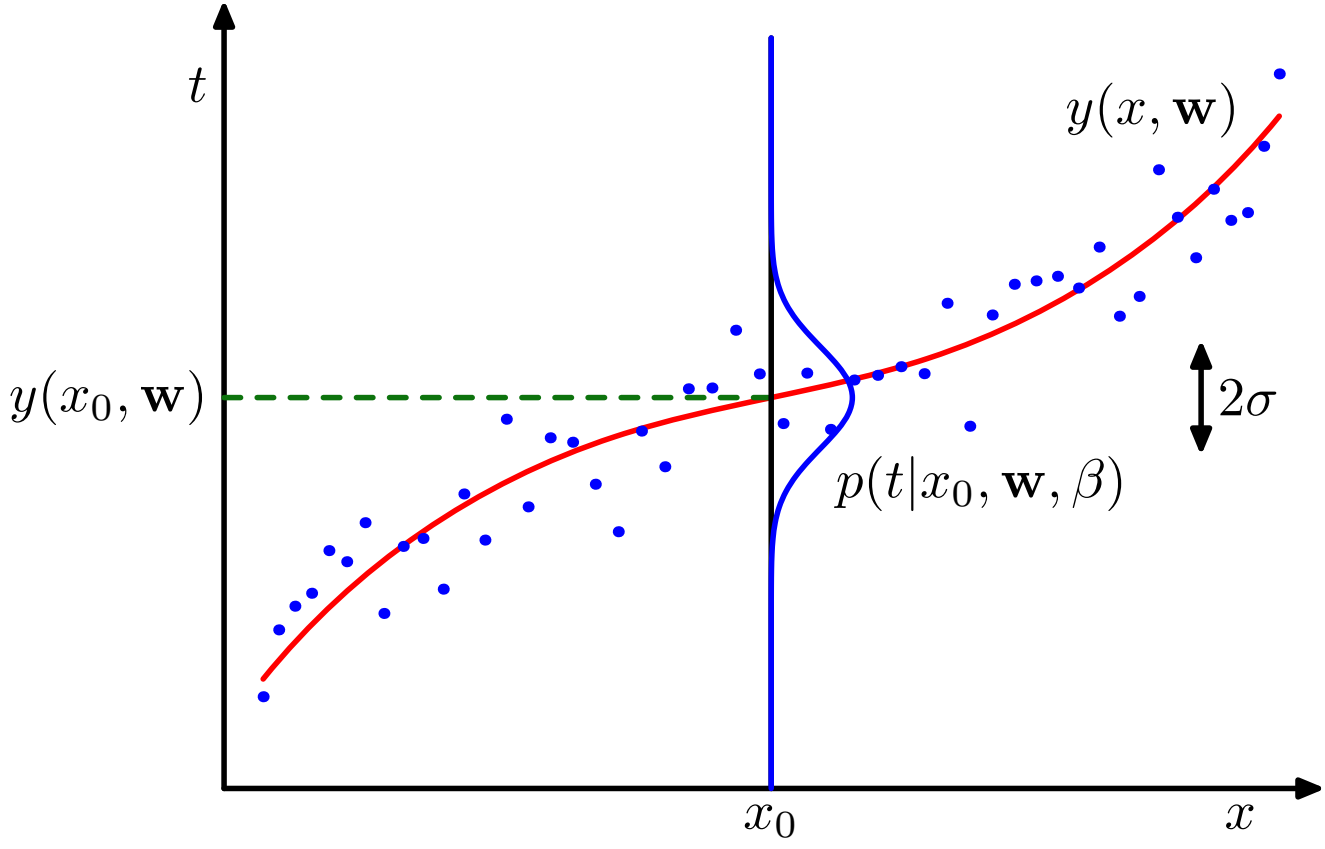

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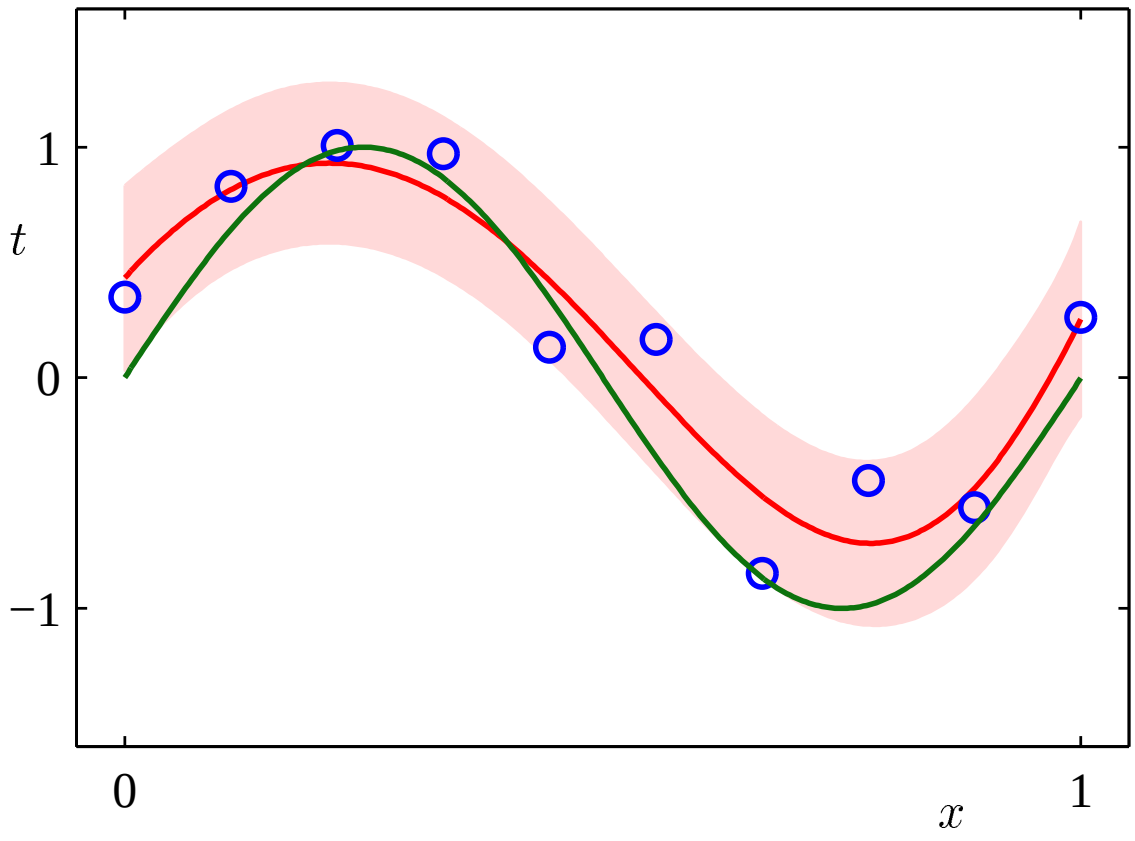

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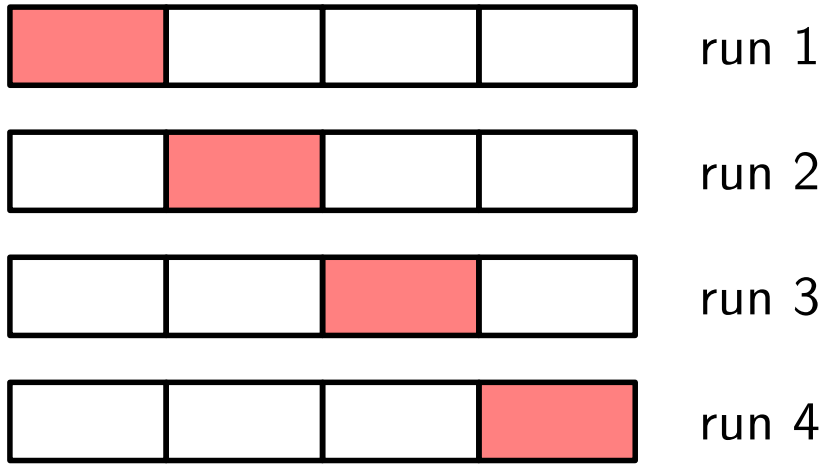

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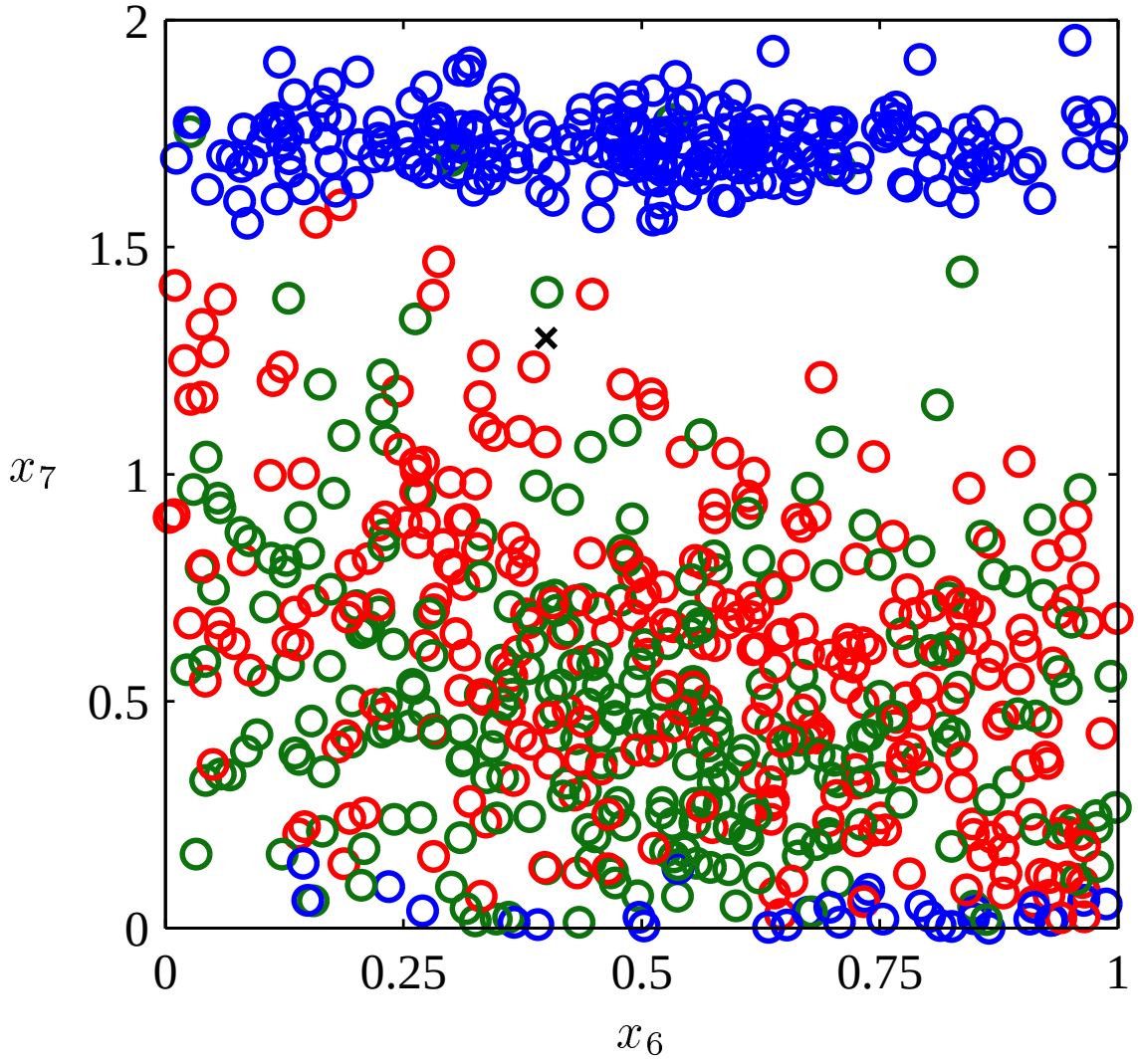

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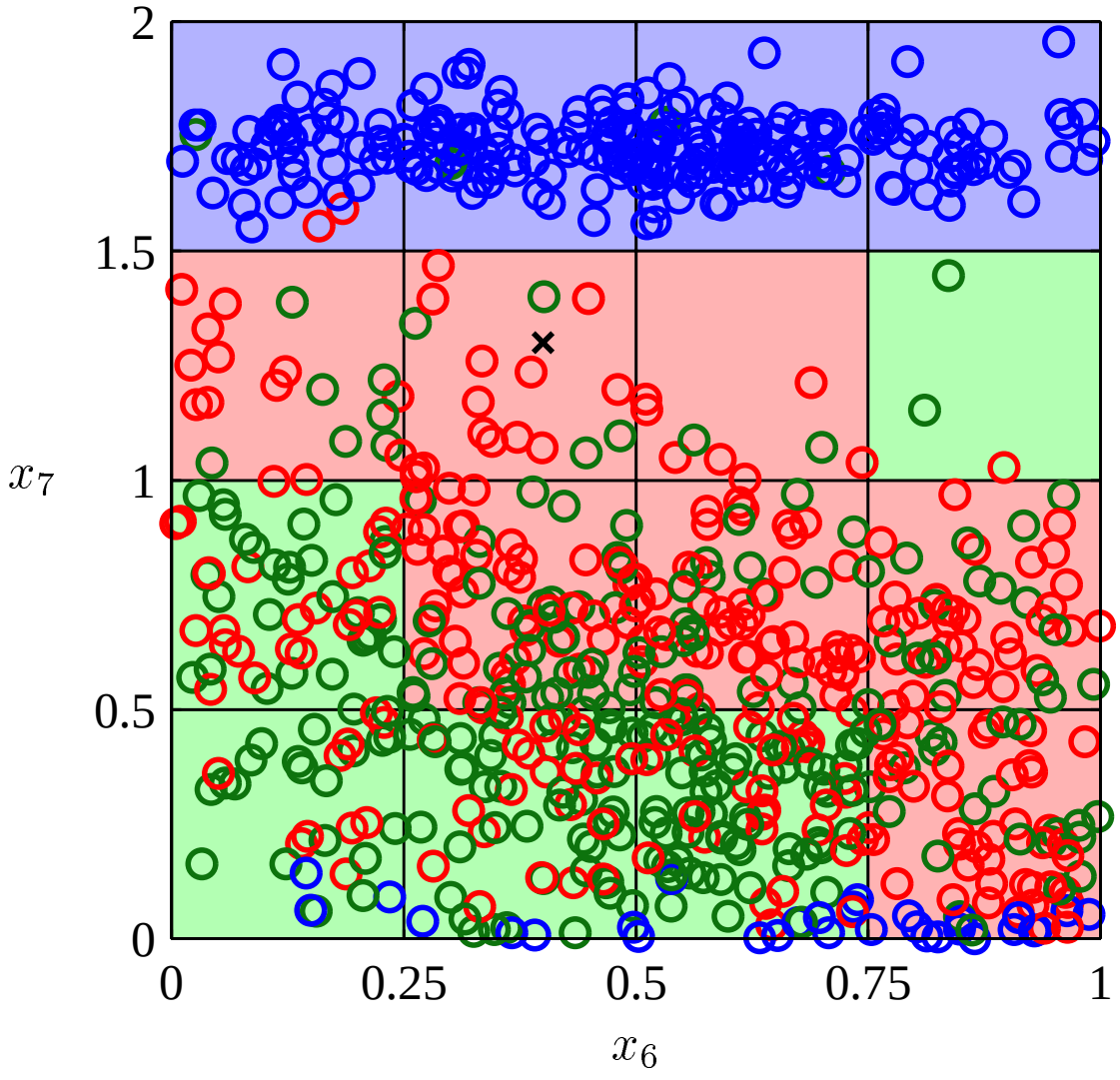

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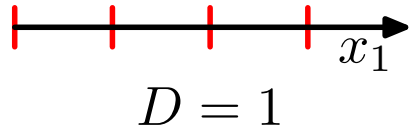

Figure: Chapter 1, Figure 21a

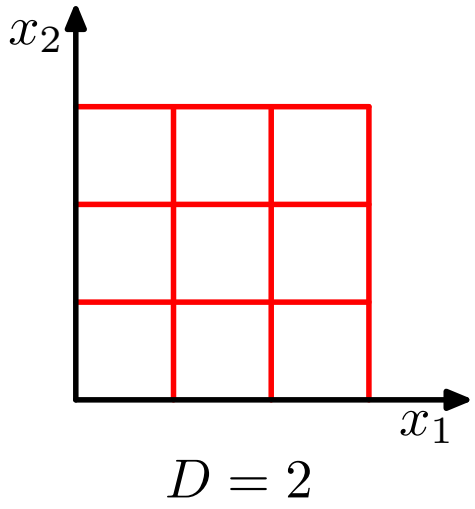

Figure: Chapter 1, Figure 21b

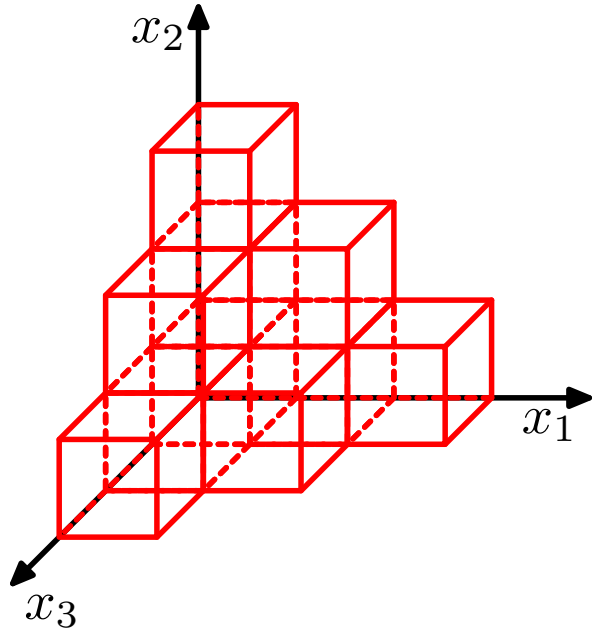

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Figure: Chapter 1, Figure 21c

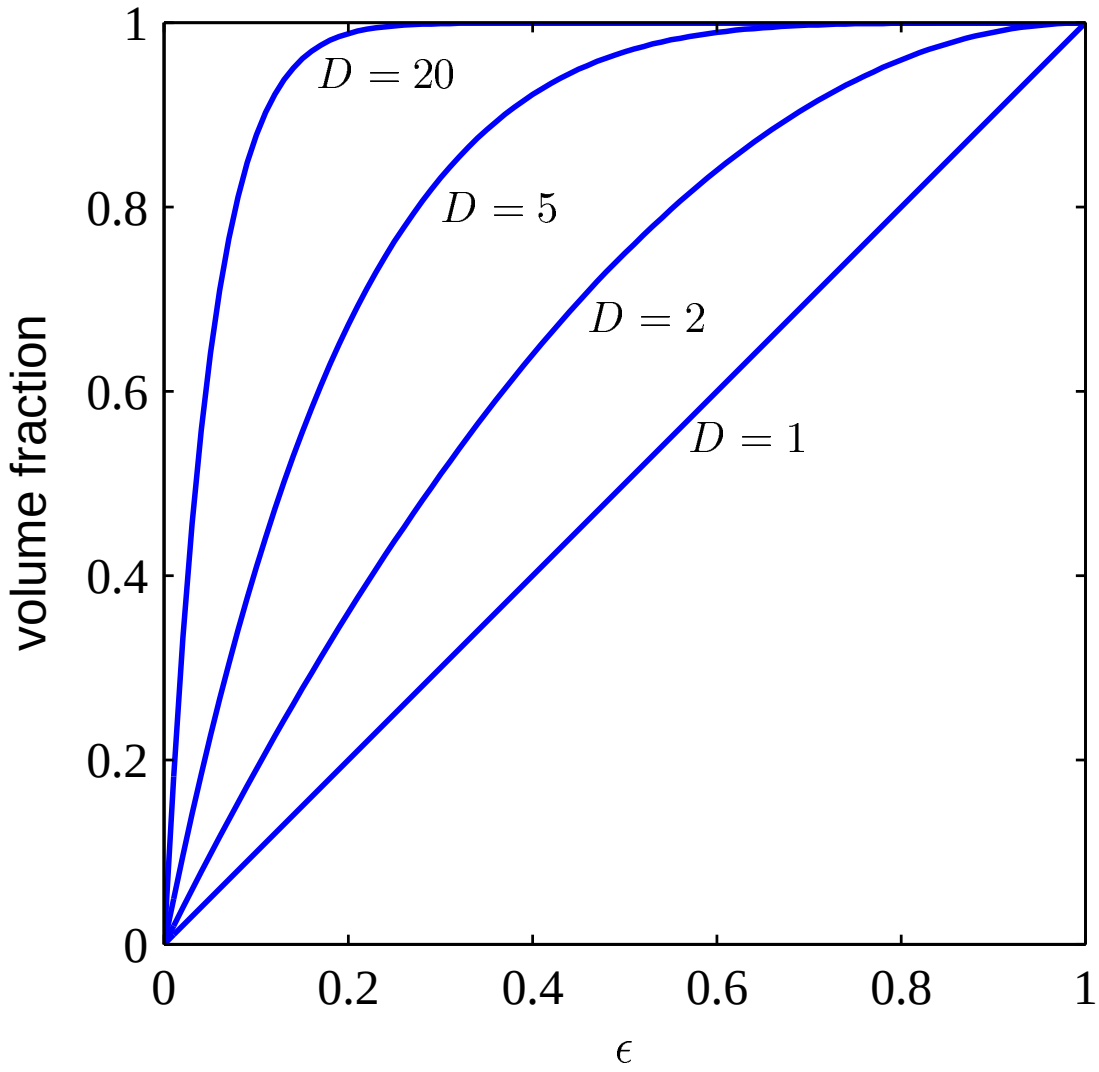
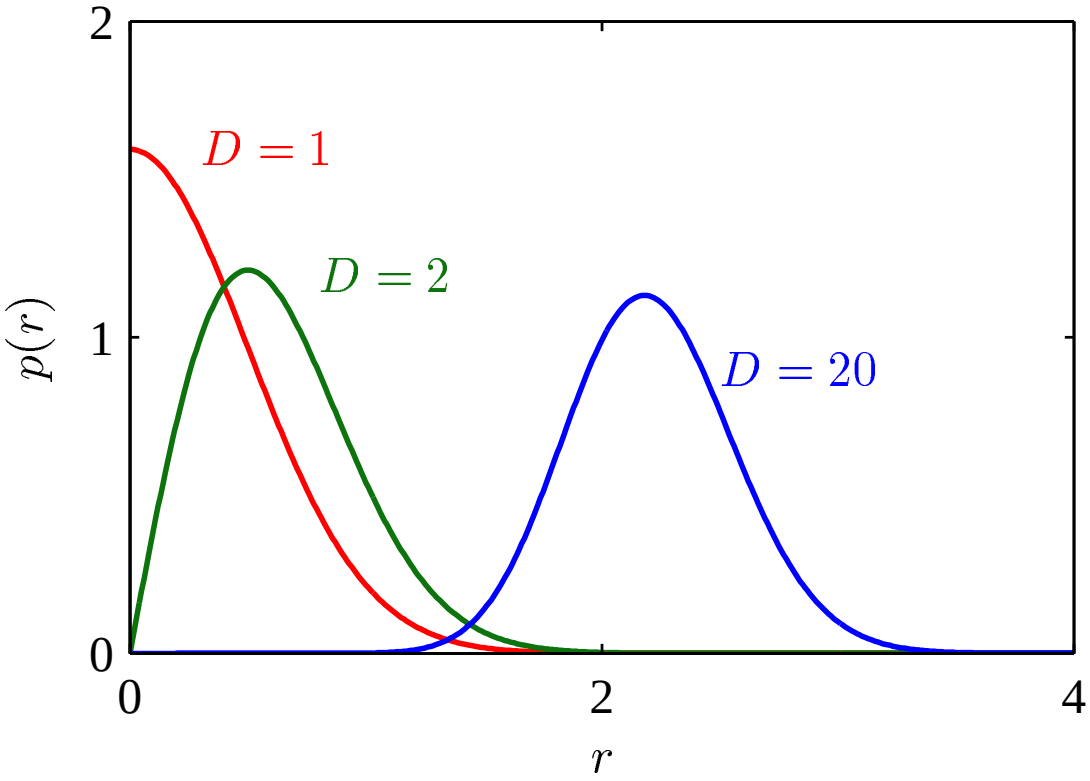


Figure: Chapter 1, Figure 22



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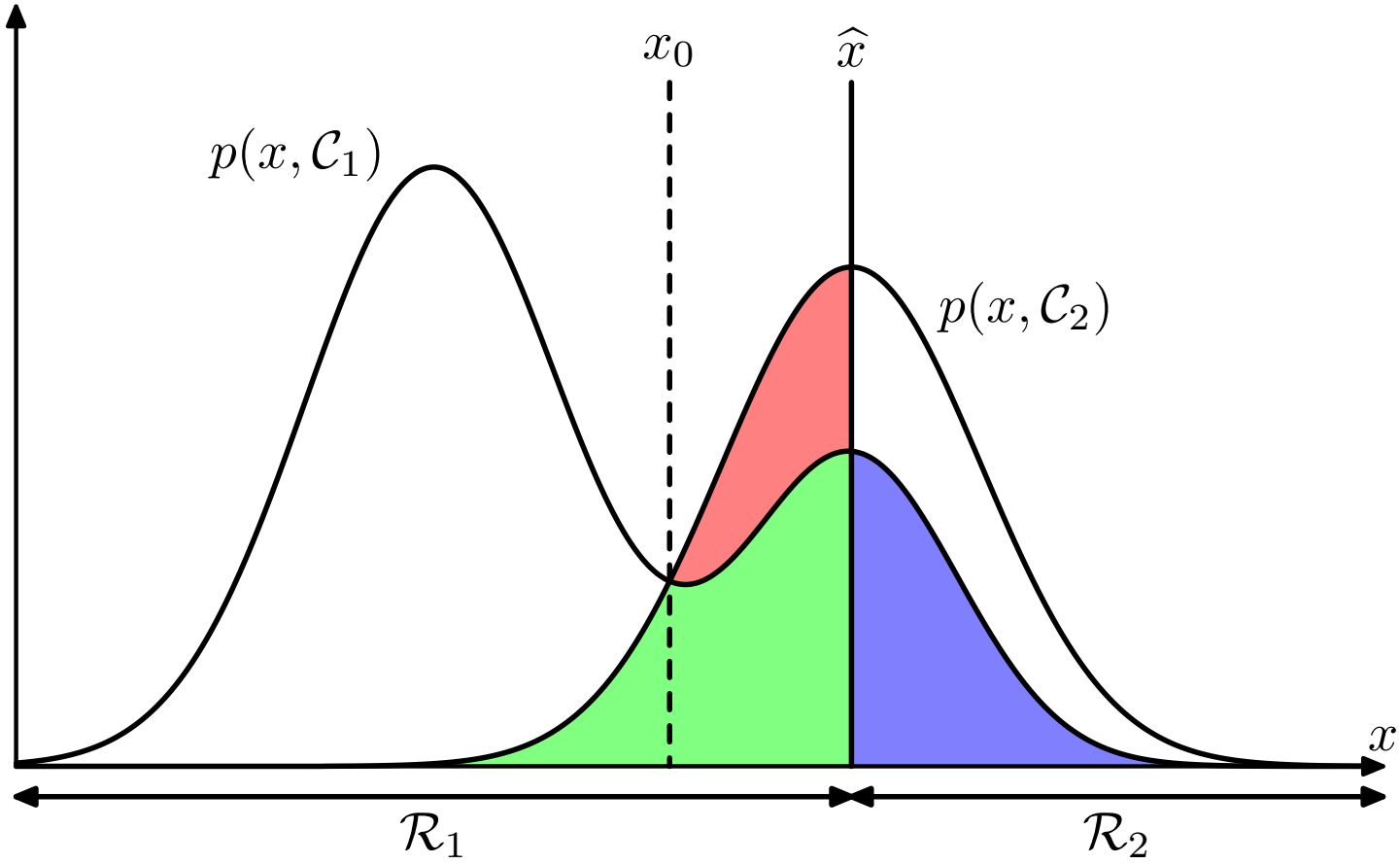

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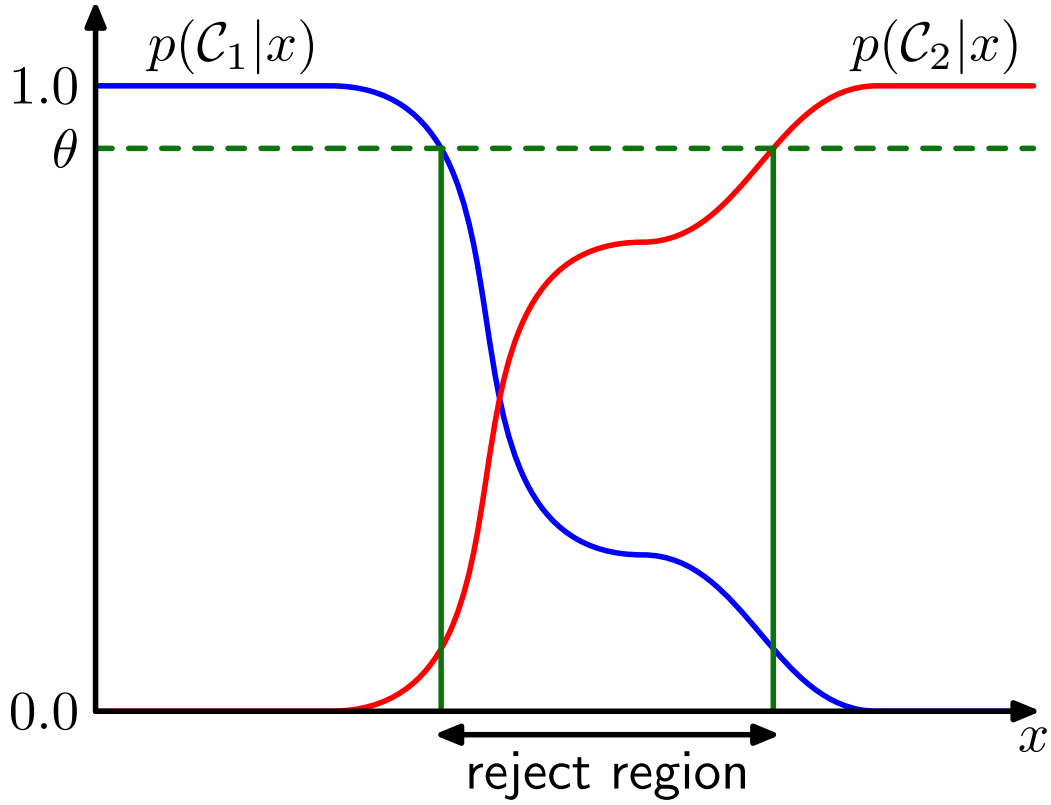

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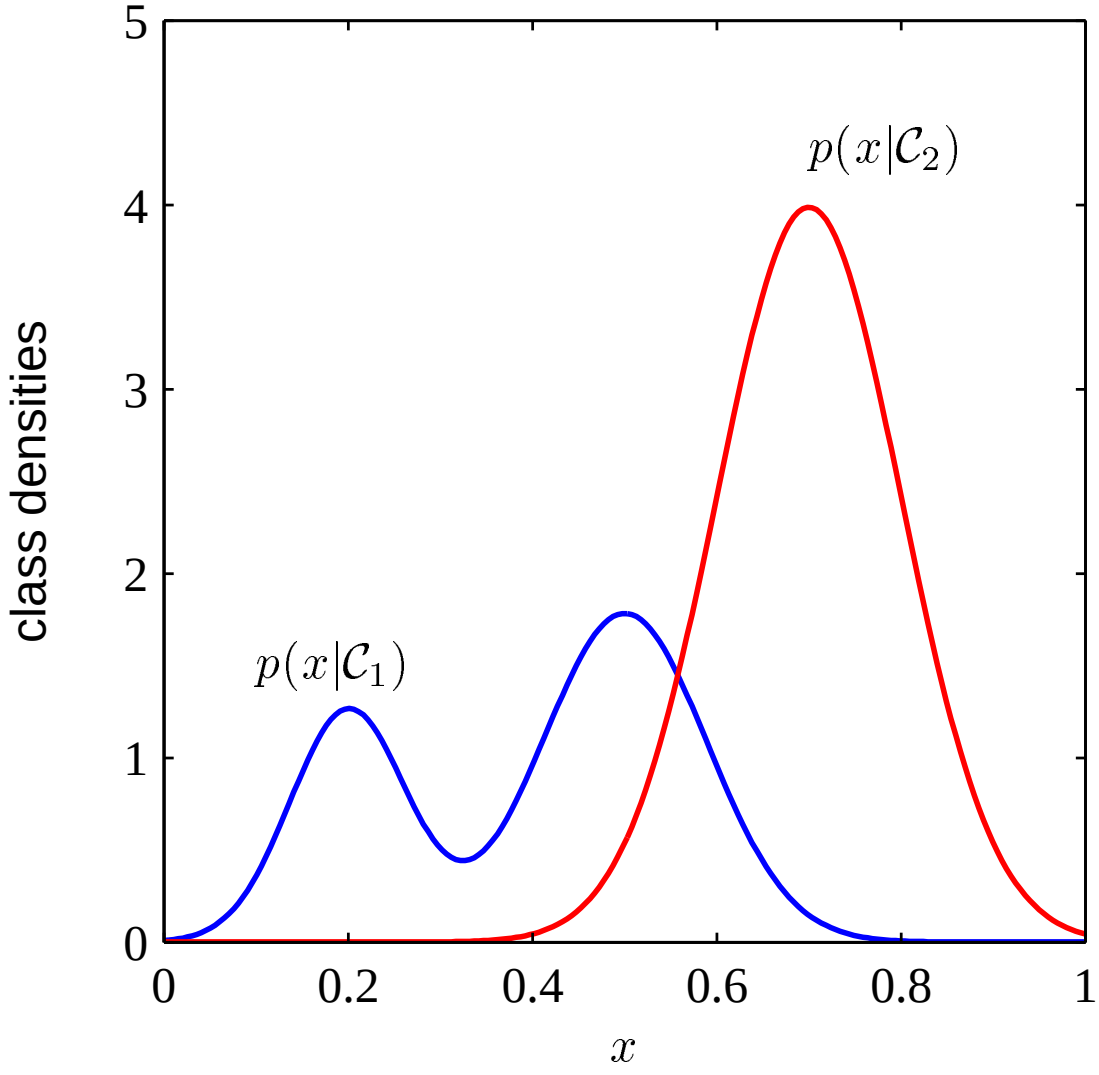

Figure: Chapter 1, Figure 27a

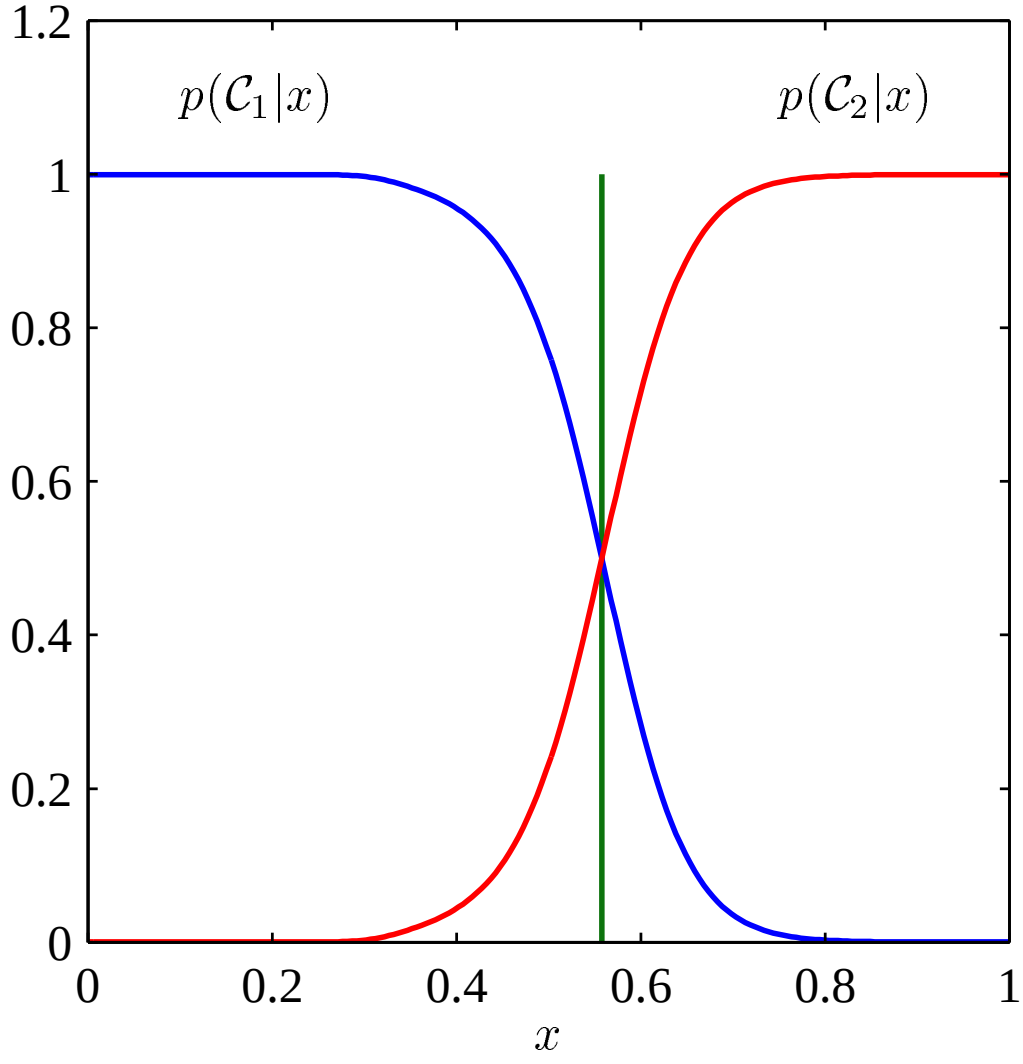

Figure: Chapter 1, Figure 27b

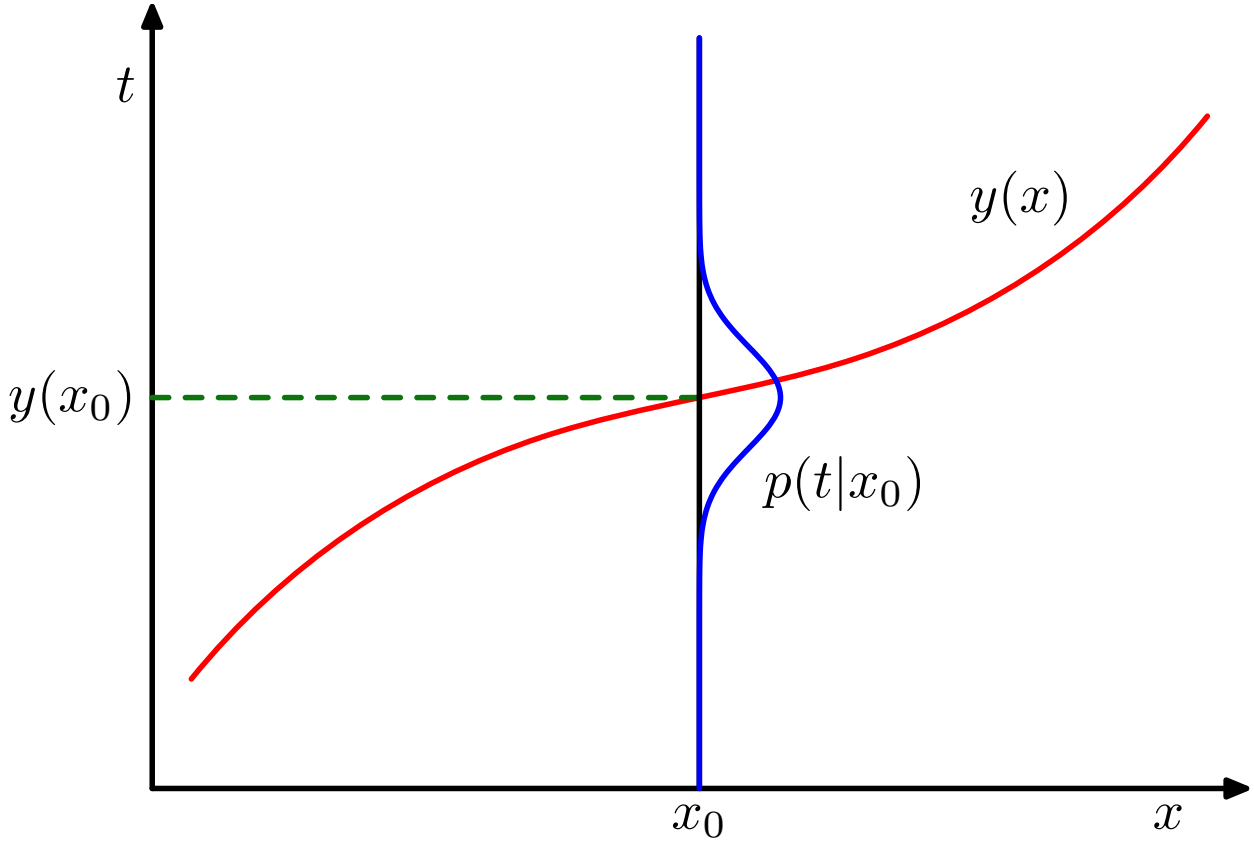

Figure: Chapter 1, Figure 28

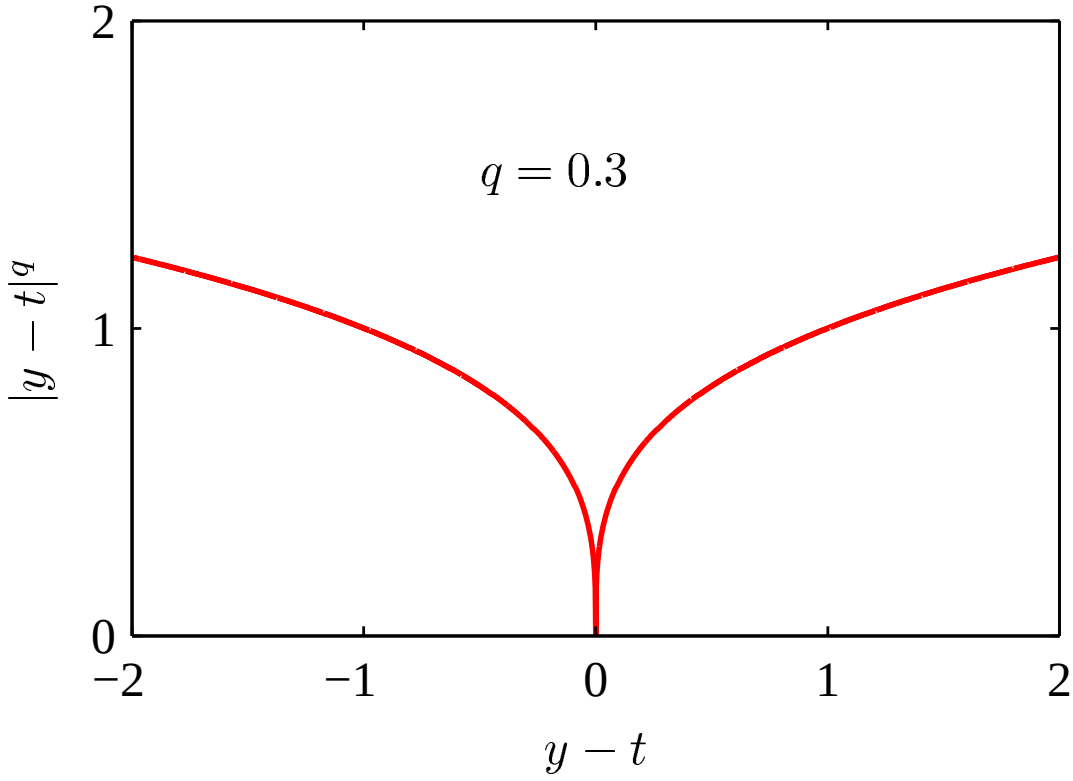

Figure: Chapter 1, Figure 29a

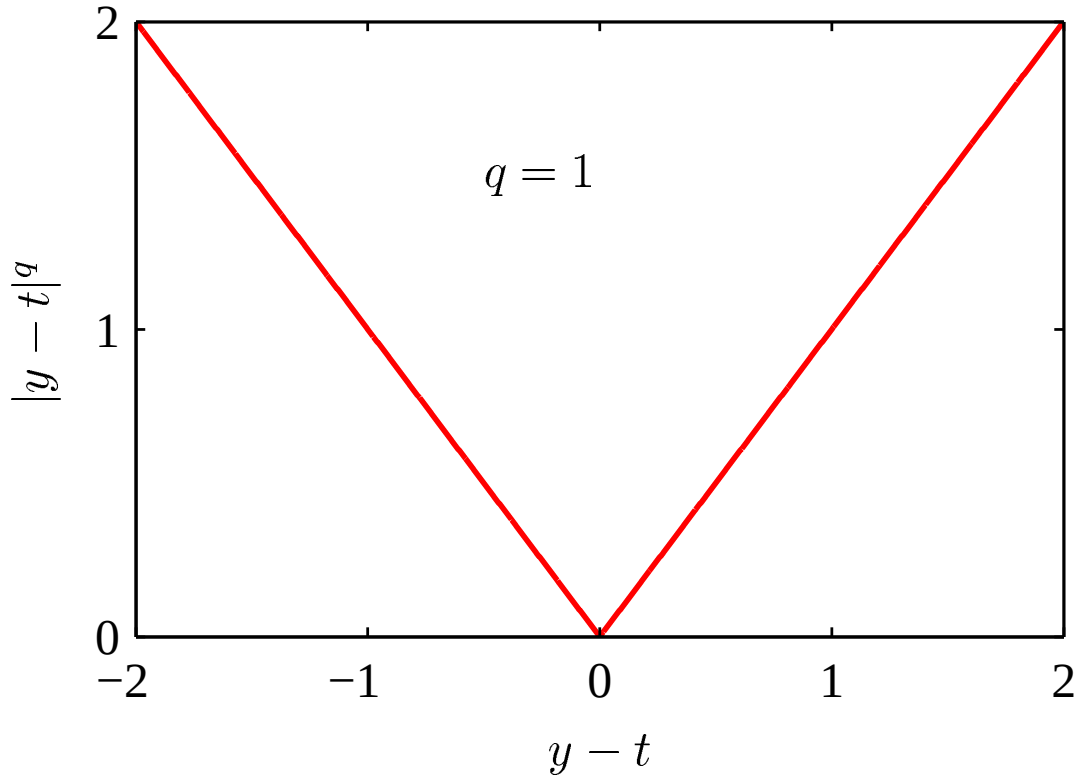

Figure: Chapter 1, Figure 29b

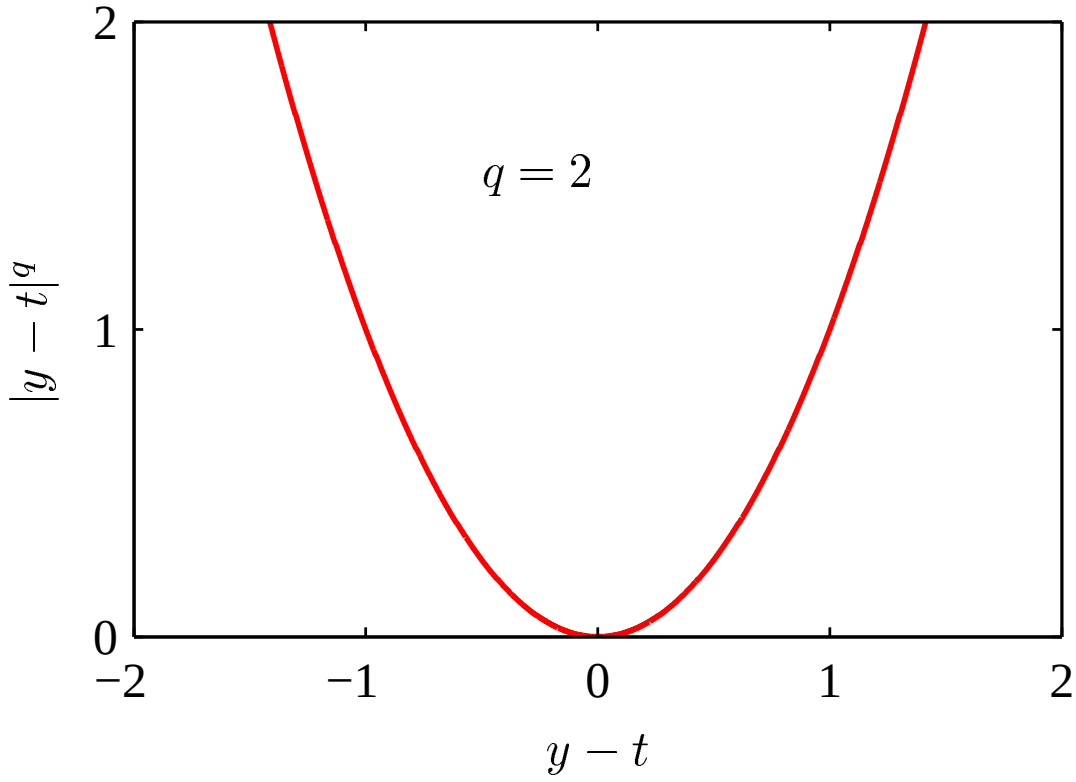

Figure: Chapter 1, Figure 29c

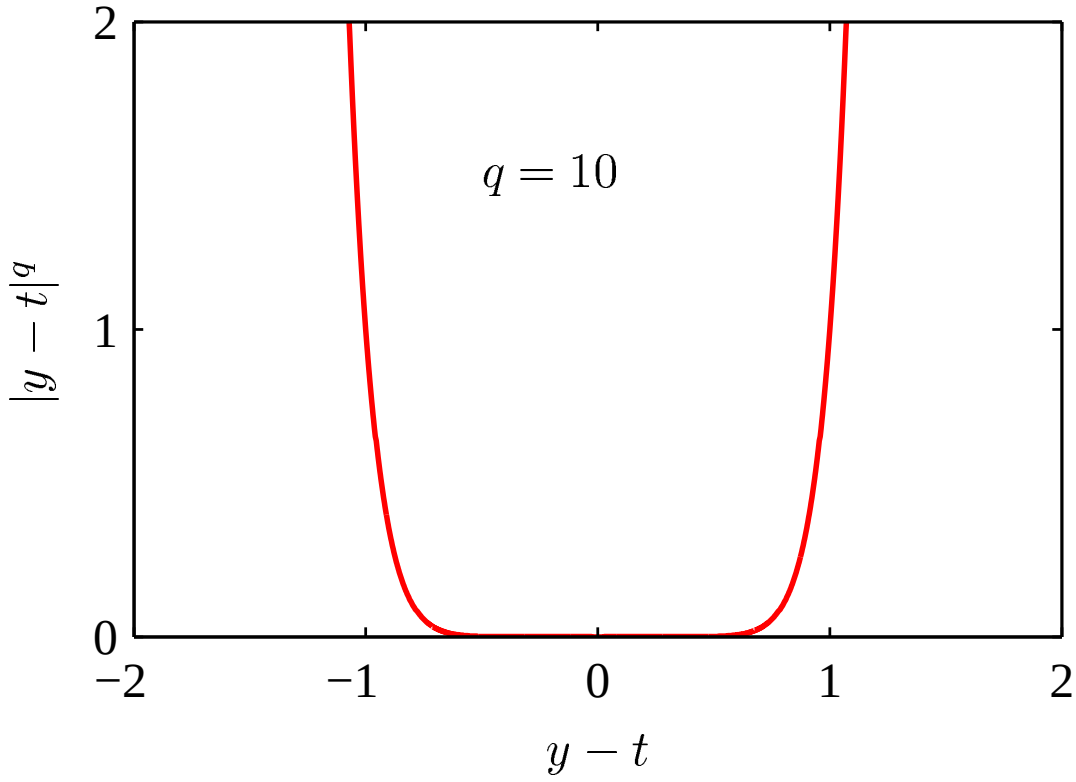

Figure: Chapter 1, Figure 29d

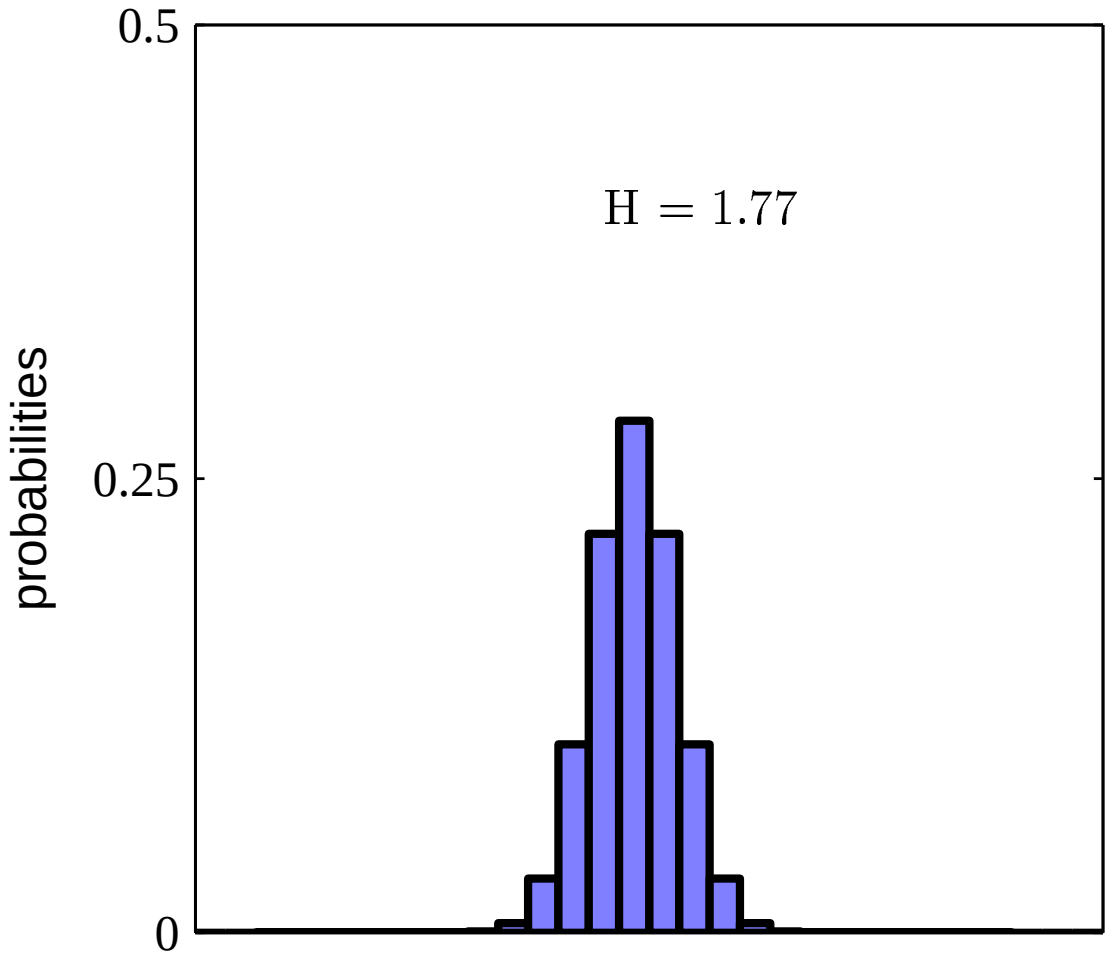

Figure: Chapter 1, Figure 30a

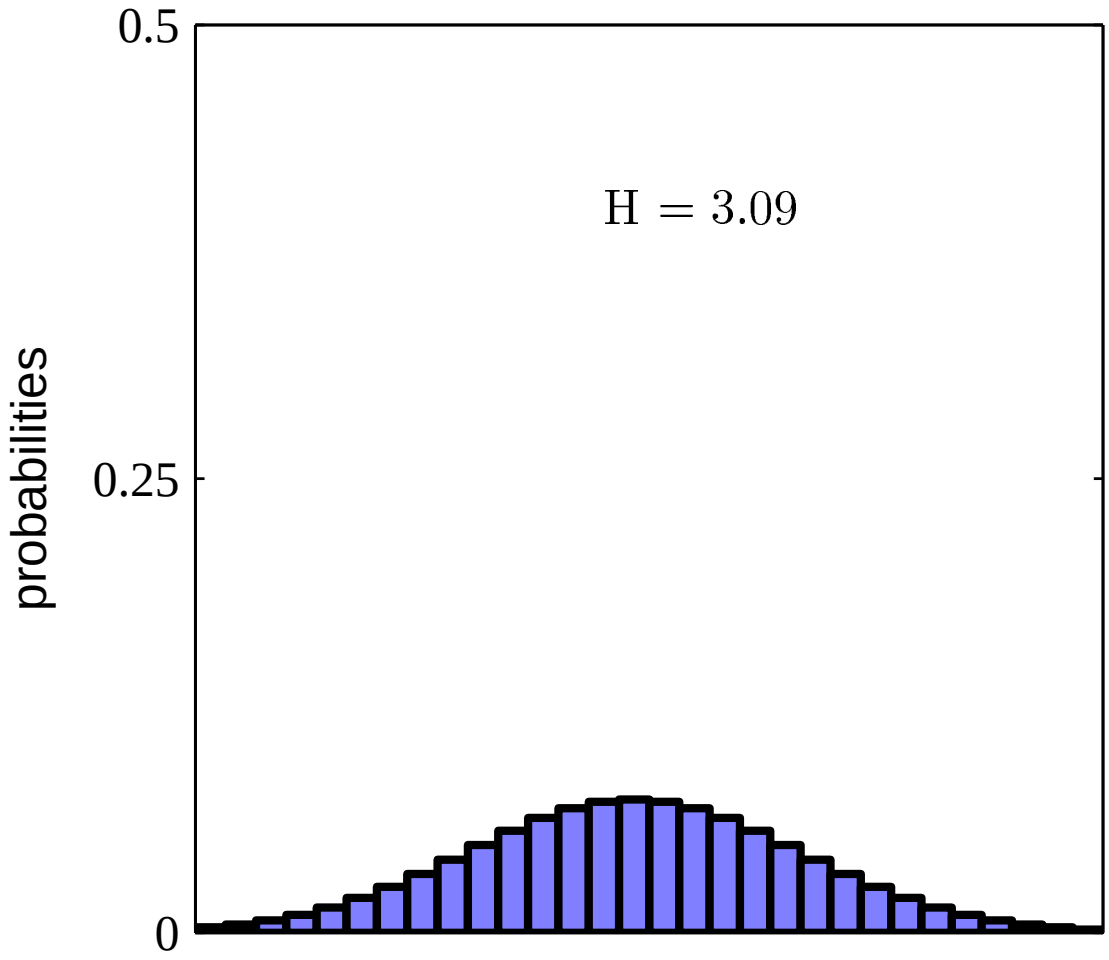

Figure: Chapter 1, Figure 30b

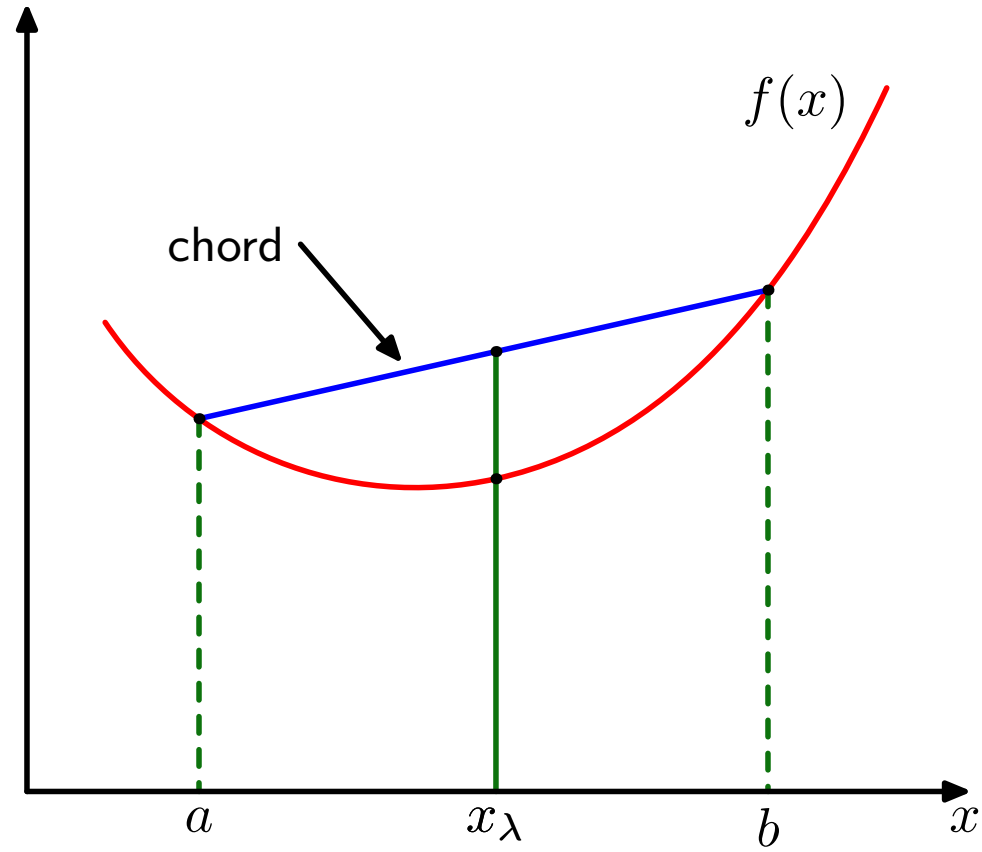

Figure: Chapter 1, Figure 31