LaTeX Workshop

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Abstract

This is how you define an abstract.

1   Introduction

In Section 1.1 we will discuss math environments and user commands. In Section 2 we will discuss figures. In Section 3 we will discuss tables. In Section 4 we will discuss citations. The layout of this section is follows:

1. Math Environments

   - In-line Math
   - Equations
   - Multi-line equations (align environment)

2. User Commands

1.1   Math Environments

1.1.1   In-line Math

In order to write math symbols within a line you need place your math symbols within dollar signs $ $. For example, the penalization coefficient for LASSO is $\lambda = 0.5$.

1.1.2   Display Math

Quickly displaying one line of math

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

Piecewise functions

$$|x| = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$

Equation environment allows you to label and reference math lines. For example Equation (1) represents the product rule.

$$\nabla(fg) = f\nabla g + g\nabla f \tag{1}$$

1.1.3 Multi-line Equations

In this section we will write the formulation for the maximum clique problem. Given a graph $G = (V, E)$, a clique $C \subseteq V$ such that $\forall i, j \in C$, $\{i, j\} \in E$. The maximum clique problem seeks the maximum weight or cardinality clique in G. For each $i \in V$ we have the following binary variable.

$$x_i = \begin{cases} 1 & \text{if } i \text{ is in the max clique} \\ 0 & \text{otherwise} \end{cases}$$

In order to display multiple lines of equations we can use the align environment

$$\max \quad \sum_{i \in V} w_i x_i \tag{2}$$
$$\text{s.t} \quad x_i + x_j \leq 1 \qquad\qquad\qquad \{i, j\} \notin E \tag{3}$$
$$x_i \in \{0, 1\} \qquad\qquad\qquad i \in V \tag{4}$$

Constraint (3) states that for each node pair not connected by a vertex, only one can belong to the maximum clique. If you don't want to see the numbers on the equations just add * after align.

$$\max \quad \sum_{i \in V} w_i x_i$$
$$\text{s.t} \quad x_i + x_j \leq 1 \qquad\qquad\qquad \{i, j\} \notin E$$
$$x_i \in \{0, 1\} \qquad\qquad\qquad i \in V$$

1.2 User Commands

Some formatting conventions are specific to a research area and are not defined in LaTeX. For example to typeset the conditional expectation $\mathbf{E}[X|N = n]$ we type:

```
$\mathbf{E}\left[X|N=n\right]$
```

If you need to type this equation multiple times it can become cumbersome and make your document a bit difficult to read. With LaTeX, you can define your own commands in the preamble of your .tex file in order simplify repetitive and complex formatting. The format for defining your own command is:

```
\newcommand{\commandname}[number of args]{out}
```

In the preamble you can place

```
\newcommand{\condExp}[2]{\mathbf{E}\left[#1|#2\right]}
```

To call our newly defined command, we will type

```
\[
$\condExp{X}{N=n}$
\]
```

$$\mathbf{E}[X|N = n]$$

2 Plotting Figures

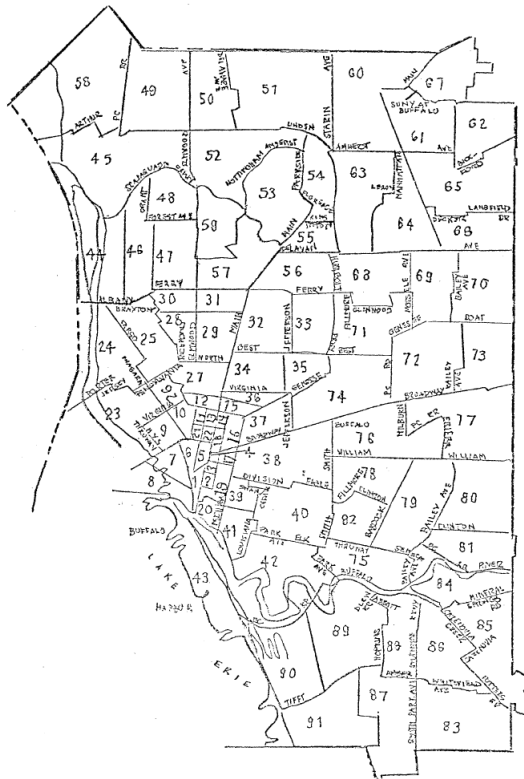Figure 1 show a map of the different districts in Buffalo.

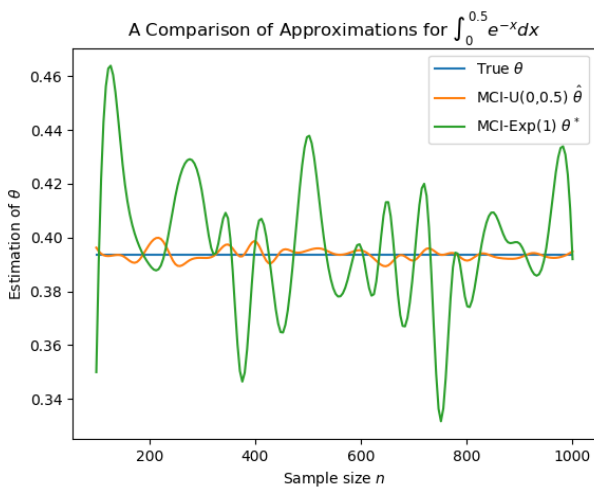Figure 1: Map of Buffalo

2.1 Multiple Plots
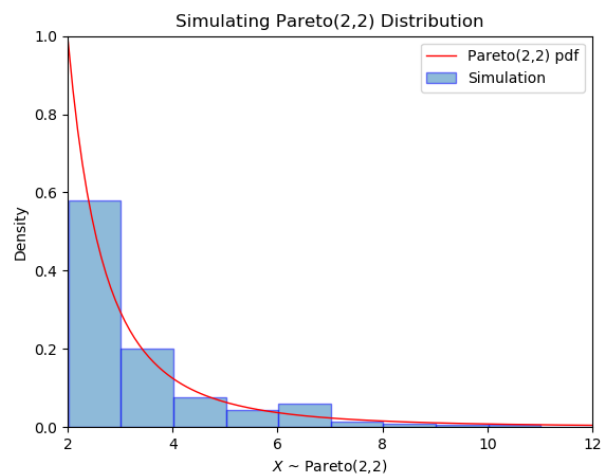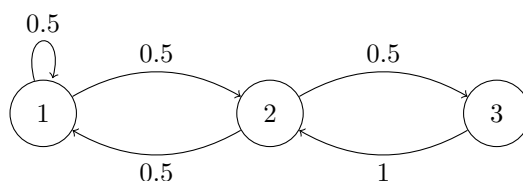

Figure 2: SOM Plot

Figure 3: PCA Plot

2.2 Tikz Picture

Suppose we want to draw the following transition matrix as a Markov Chain

$$\mathbb{P} = \begin{bmatrix} 0.5 & 0.5 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \end{bmatrix}$$

3 Tables

For constructing tables in LaTeX, I highly recommend creating tables in Excel and using this webstie: `https://www.tablesgenerator.com/latex_tables` to generate the code for those tables. We will create the table from `table.xlsx`.

	A	B	C
High	25	10	5
Mid	30	15	8
Low	35	20	10

Table 1: Table 1

4 Citations

We will learn how to cite in Latex by citing the textbook, *Elements of Statistical Learning.*

1. Create a .bib file to place your BibTeX citations.

2. Right before end document, place the following code

   ```
   \bibliographystyle{plain}
   \bibliography{bibliography}
   ```

   For a list of different bibliography styles refer to `https://www.overleaf.com/learn/latex/Bibtex_bibliography_styles`

3. Get your citation, look up Elements of Statistical Learning on Google Scholar

4. Click on the quotation marks below the article

[BOOK] The elements of statistical learning

J Friedman, T Hastie, R Tibshirani - 2001 - statweb.stanford.edu

… Preface to the Second Edition In God we trust, all others bring data. –William Edwards Deming (1900-1993)1. We have been gratified by the popularity of the first edition of The **Elements** of **Statistical Learning** … We have changed the color palette in this edition to a large extent, replacing …

☆ 🔊 Cited by 4247 Related articles ≫

```
@book{friedman2001elements,
  title={The elements of statistical learning},
  author={Friedman, Jerome and Hastie, Trevor and Tibshirani, Robert},
  volume={1},
  number={10},
  year={2001},
  publisher={Springer series in statistics New York}
}
```

5. Click on BibTeX on the bottom of the window that pops up. You should get the BibTeX citation below. Copy that citation and place into your bibliography.bib file.

6. Once those steps are completed, you can cite our textbook [1]. A reference section with all of the citations used in the document will be generated at the end of the document.

References

[1] Jerome Friedman, Trevor Hastie, and Robert Tibshirani. *The elements of statistical learning*, volume 1. Springer series in statistics New York, 2001.