Writing Mathematical Equations in RMarkdown

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Lab Note for STA321

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1 Intorduction

This note list commands for creating mathematics formulas in RMarkdown.

2 Greek Letters

| Symbol | Script |
|----------|---------|
| α | \alpha |
| A | A |
| β | \beta |
| B | В |
| γ | \gammma |

| Symbol | Script |
|-----------|---------|
| Γ | \Gamma |
| π | \pi |
| Π | \Pi |
| ϕ | \phi |
| Φ | \Phi |
| φ | \varphi |
| θ | \theta |

3 Operators

| Symbol | Script |
|----------------------|---------------|
| cos | \cos |
| \sin | \sin |
| \lim | \label{lim} |
| \exp | \exp |
| \rightarrow | \to |
| ∞ | ∞ |
| ≡ | \equiv |
| mod | \bmod |
| × | \times |
| | |

4 Power and Indicies

| Symbol | Script |
|-----------|---------|
| k_{n+1} | k_{n+1} |
| n^2 | n^2 |
| k_n^2 | k_n^2 |

5 Fractions and Binomials

| Symbol | Script |
|--|-----------------------|
| $\frac{n!}{k!(n-k)!}$ | \frac{n!}{k!(n-k)!} |
| $ \frac{k!(n-k)!}{k!(n-k)!} $ $ \frac{k!}{k} $ $ \frac{x}{x-y} $ 3 / | $\min\{n\}\{k\}$ |
| $\frac{\frac{x}{1}}{x-y}$ | $\frac{x}{1}}{x - y}$ |
| $\frac{3}{7}$ | ^3/_7 |

6 Radical Roots

| Symbol | Script |
|---------------|---------------|
| \sqrt{k} | \sqrt{k} |
| $\sqrt[n]{k}$ | $\sqrt[n]{k}$ |

7 Sums, Integrals, and Related Symbols

| Symbol | Script |
|---|---|
| $ \frac{\sum_{i=1}^{10} t_i}{\int_0^\infty e^{-x}, dx} $ $ \prod_{i=1}^{\infty} \prod_{i=1}^{\infty} \int_{0}^{\infty} e^{-x} dx $ $ \prod_{i=1}^{\infty} \prod_{i=1}^{\infty} \int_{0}^{\infty} e^{-x} dx $ $ \bigcup_{i=1}^{\infty} \bigcup_{i=1}^{\infty} \int_{0}^{\infty} e^{-x} dx $ $ \bigcup_{i=1}^{\infty} \bigcup_{i=1}^{\infty} \int_{0}^{\infty} e^{-x} dx $ | \sum_{i=1}^{10} t_i |
| $\int_0^\infty e^{-x}, dx$ | \int_0^\infty \mathrm{e}^{-x},\mathrm{d}x |
| $\sum_{i=1}^{n}$ | \sum |
| $\overline{\Pi}$ | \prod |
| $ar{oxed}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}$ | \coprod |
| $\overline{\oplus}$ | \bigoplus |
| \otimes | \bigotimes |
| \odot | \bigodot |
| Ū | \bigcup |
| Ň | \bigcap |
| <u>+</u> j | \biguplus |
| Ĭ | \bigsqcup |
| $\overline{\bigvee}$ | \bigvee |
| $\dot{\wedge}$ | \bigwedge |
| ſ | \int |
| • | \oint |
| ſſ | \iint |
| ĴĴſ | \iiint |
| ĵ ſ | \idotsint |
| $\sum_{0 < i < m, \ 0 < j < n}^{\infty} P(i, j)$ | lem:lem:lem:lem:lem:lem:lem:lem:lem:lem: |
| $\int\limits_a^o$ | \int\limits_a^b |

8 More Special Symbols

| Symbol | Script |
|--------------------------|--|
| $\overline{a'}$ | a^{\prime} |
| $a^{\prime\prime}$ | a^{\prime\prime} |
| \hat{a} | \hat{a} |
| \bar{a} | \bar{a} |
| \grave{a} | \grave{a} |
| $cute{a}$ | \acute{a} |
| \dot{a} | \dot{a} |
| \ddot{a} | \ddot{a} |
| ,la | \not{a} |
| å | $\mathbf{mathring}\{a\}$ |
| \overrightarrow{AB} | $\operatorname{Noverrightarrow}\{AB\}$ |
| \overleftarrow{AB} | \overleftarrow{AB} |
| $a^{\prime\prime\prime}$ | a^{\prime\prime\prime} |
| \overline{aaa} | \overline{aaa} |
| \check{a} | \check{a} |
| \vec{a} | \vec{a} |
| \underline{a} | \underline{a} |
| \boldsymbol{x} | \color{red}x |
| \pm | \pm |
| 干 | \mp |
| $\int y \mathrm{d}x$ | $\int y \operatorname{mathrm}{d}x$ |

| Symbol | Script |
|--------------|------------------------------------|
| , | , |
| : | : |
| ; | ; |
| ! | ! |
| $\int y, dx$ | $\int y, \mathbf{y} = \mathbf{d}x$ |
| | \dots |
| | \ldots |
| • • • | \cdots |
| ÷ . | \vdots |
| ··. | \ddots |

9 Brackets

| Symbol | Script |
|---------------------|-----------------------|
| $\overline{(a)}$ | (a) |
| [a] | [a] |
| $\{a\}$ | \{a\} |
| $\langle f \rangle$ | \langle f \rangle |
| $\lfloor f \rfloor$ | \lfloor f \rfloor |
| $\lceil f \rceil$ | \lceil f \rceil |
| $\lceil f \rceil$ | \ulcorner f \urcorner |

10 Matrices and System of Equations

10.1 Matrix

```
$$
X_{m,n} =
\begin{pmatrix}
    x_{1,1} & x_{1,2} & \cdots & x_{1,n} \\
    x_{2,1} & x_{2,2} & \cdots & x_{2,n} \\
    \vdots & \vdots & \ddots & \vdots \\
    x_{m,1} & x_{m,2} & \cdots & x_{m,n}
\end{pmatrix}
$$
produces
```

$$X_{m,n} = \begin{pmatrix} x_{1,1} & x_{1,2} & \cdots & x_{1,n} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1} & x_{m,2} & \cdots & x_{m,n} \end{pmatrix}$$

```
$$
M =
\begin{bmatrix}
\frac{5}{6} & \frac{1}{6} & 0 \\[0.3em]
\frac{5}{6} & 0 & \frac{1}{6} \\[0.3em]
```

0 & \frac{5}{6} & \frac{1}{6} \end{bmatrix} \$\$
produces

$$M = \begin{bmatrix} \frac{5}{6} & \frac{1}{6} & 0\\ \frac{5}{6} & 0 & \frac{1}{6}\\ 0 & \frac{5}{6} & \frac{1}{6} \end{bmatrix}$$

10.2 Aligned Equations

```
$$
\begin{aligned}
Bias(\hat{\theta}) &= E(\hat{\theta}) - \theta \\
Bias(\hat{\theta}) &= E(2 \bar{X} -1) - \theta \\
Bias(\hat{\theta}) &= \frac{2}{n}\sum_{i=1}^n E(X_i) -1 - \theta \\
Bias(\hat{\theta}) &= 2E(X) - 1 - \theta \\
Bias(\hat{\theta}) &= 2 \cdot \frac{\theta+1}{2} - 1 - \theta \\
Bias(\hat{\theta}) &= 0 \\
end{aligned}
$$
```

Produces the following system of equations

$$Bias(\hat{\theta}) = E(\hat{\theta}) - \theta$$

$$Bias(\hat{\theta}) = E(2\bar{X} - 1) - \theta$$

$$Bias(\hat{\theta}) = \frac{2}{n} \sum_{i=1}^{n} E(X_i) - 1 - \theta$$

$$Bias(\hat{\theta}) = 2E(X) - 1 - \theta$$

$$Bias(\hat{\theta}) = 2 \cdot \frac{\theta + 1}{2} - 1 - \theta$$

$$Bias(\hat{\theta}) = 0$$

10.3 Piece-wise Function

 $f(x) = \left(1\right)_{b-a} \ 0 \$ produces the following piece-wise function

$$f(x) = \begin{cases} \frac{1}{b-a} \\ 0 \end{cases}$$

11 Pseudo-code of Algorithms

while not convergence:

compute
$$\nabla(J)$$

 $\theta_0 := \theta_0 - \alpha \nabla(J)_0$
 $\theta_1 := \theta_1 - \alpha \nabla(J)_1$
end while