Writing Mathematical Equations in RMarkdown

Cheng Peng

Lab Note for MAT325 Numerical Analysis

Contents

1 Intorduction

This note list commands for creating mathematics formulas in RMarkdown.

2 Greek Letters

Symbol	Script
α	`\alpha`
A	`A`
β	`\beta`
B	`B`
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	`\lim`
exp	`\exp`
$\to$	`\to`
∞	`\infty`
$\equiv$	`\equiv`
mod	`\bmod`
$\times$	`\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)!}`
$\binom{n}{k}$	`\binom{n}{k}`
$\frac{\frac{x}{1}}{x-y}$	`\frac{\frac{x}{1}}{x - y}`
$^3/_7$	`^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
$\sum_{i=1}^{10} t_i$	`\sum_{i=1}^{10} t_i`
$\int_0^{\infty} \mathrm{e}^{-x}, \mathrm{d}x$	`\int_0^\infty \mathrm{e}^{-x},\mathrm{d}x`
$\sum$	`\sum`
$\prod$	`\prod`
$\coprod$	`\coprod`
$\bigoplus$	`\bigoplus`
$\bigotimes$	`\bigotimes`
$\bigodot$	`\bigodot`
$\bigcup$	`\bigcup`
$\bigcap$	`\bigcap`
$\biguplus$	`\biguplus`
$\bigsqcup$	`\bigsqcup`
$\bigvee$	`\bigvee`
$\bigwedge$	`\bigwedge`
$\int$	`\int`
$\oint$	`\oint`
$\iint$	`\iint`
$\iiint$	`\iiint`
$\int \cdots \int$	`\idotsint`
$\sum_{0<i<m,\ 0<j<n} P(i,j)$	`\sum_{\substack{0<i<m, \ 0<j<n}} P(i, j)`
$\int_a^b$	`\int\limits_a^b`

8 More Special Symbols

Symbol	Script
a'	`a^{\prime}`
a''	`a^{\prime\prime}`
$\hat{a}$	`\hat{a}`
$\bar{a}$	`\bar{a}`
$\grave{a}$	`\grave{a}`
$\acute{a}$	`\acute{a}`
$\dot{a}$	`\dot{a}`
$\ddot{a}$	`\ddot{a}`
$\not{a}$	`\not{a}`
$\mathring{a}$	`\mathring{a}`
$\overrightarrow{AB}$	`\overrightarrow{AB}`
$\overleftarrow{AB}$	`\overleftarrow{AB}`
a'''	`a^{\prime\prime\prime}`
$\overline{aaa}$	`\overline{aaa}`
$\check{a}$	`\check{a}`
$\vec{a}$	`\vec{a}`
$\underline{a}$	`\underline{a}`
$\color{red}x$	`\color{red}x`
$\pm$	`\pm`
$\mp$	`\mp`
$\int y \mathrm{d}x$	`\int y \mathrm{d}x`

Symbol	Script
,	,
:	:
;	;
!	!
$\int y, \mathrm{d}x$	`\int y, \mathrm{d}x`
$\dots$	`\dots`
$\ldots$	`\ldots`
$\cdots$	`\cdots`
$\vdots$	`\vdots`
$\ddots$	`\ddots`

9 Brackets

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

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

10.3 Piece-wise Function

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

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