Writing Mathematical Equations in RMarkdown

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Lab Note for MAT325 Numerical Analysis

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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}
,h	\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