Slightly Less Basic LaTeX

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moving on…

- figures
- equations and mathematical formatting
- tables
- modifying standard environments
- using ACM/IEEE templates
- etc. etc. etc…

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- figures
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Tables

```
\begin{figure}
        \centering
        \includegraphics[width=2in]{images/AnImage}
        \caption{Images can be .jpg, .png, .pdf, .eps
                        (.eps may require the epstopdf package)}
         \label{figure-handle}
\end{figure}
```

Table Variations

- \begin{figure}[htb] % here, top, or bottom
- \begin{figure*} % span the page even in two-column mode
- \includegraphics[width=0.8\columnwidth]{…}
  - \textwidth is the (constant) width of the total text block
  - \columnwidth is the (constant) width of a single column of text
    - (which is the same as \textwidth for a single column document)
  - \linewidth is a variable that represents the current size of the line of text, whether inside a column or a minipage or a list

Equations

- equations are formatted in “math mode”
- \(… math mode …)\
- $ … math mode … $
- \begin{math} … math mode … \end{math}
- \[… “display math” mode…]\

Equations

- subscript A_{x}
- superscript B^{x}
- fractions / or \frac{x}{y}
- \sqrt{x}, \sqrt[3]{x}

A_{x} results in A_x
B^{x} results in B^x
$\frac{x}{y}$ results in $\frac{x}{y}$
$\sqrt{x}$ results in $\sqrt{x}$
$\sqrt[3]{x}$ results in $\sqrt[3]{x}$

quick aside: verbatim

- Sometimes you just want a bunch of text exactly as you type it, without worrying about LaTeX commands
- \begin{verbatim}
  … don't format me …
  \end{verbatim}
- \verb+ … don't format me … +
  % you can use any pair of matching chars to
  % delimit the verbatim… I used +

simple math

```
$x^{2y}$
$x^{y^{2}}$
$x_{2}$
$x^{y_{1}}$
$x_{1}^{y}$
$\sqrt{x+y}$
$\sqrt[3]{10}$
\[x = \frac{y + \sqrt{z}/2}{y^{2} + 1} \]
\[ \sum_{i=1}^{n} x_{i} = \int_{0}^{1} f \]
\( \sum_{i=1}^{n} x_{i} = \int_{0}^{1} f \)
```

Greek!

TABLE 4: Greek Letters

α	\alpha	θ	\theta	o	o	τ	\tau
β	\beta	ϑ	\vartheta	π	\pi	υ	\upsilon
γ	\gamma	ι	\iota	ϖ	\varpi	ϕ	\phi
δ	\delta	κ	\kappa	ρ	\rho	φ	\varphi
ϵ	\epsilon	λ	\lambda	ϱ	\varrho	χ	\chi
ε	\varepsilon	μ	\mu	σ	\sigma	ψ	\psi
ζ	\zeta	ν	\nu	ς	\varsigma	ω	\omega
η	\eta	ξ	\xi				
Γ	\Gamma	Λ	\Lambda	Σ	\Sigma	Ψ	\Psi
Δ	\Delta	Ξ	\Xi	Υ	\Upsilon	Ω	\Omega
Θ	\Theta	Π	\Pi	Φ	\Phi		

binary operations

TABLE 7: Binary Operation Symbols

$\pm$	\pm	$\cap$	\cap	$\diamond$	\diamond	$\oplus$	\oplus
$\mp$	\mp	$\cup$	\cup	$\bigtriangleup$	\bigtriangleup	$\ominus$	\ominus
$\times$	\times	$\uplus$	\uplus	$\bigtriangledown$	\bigtriangledown	$\otimes$	\otimes
$\div$	\div	$\sqcap$	\sqcap	$\triangleleft$	\triangleleft	$\oslash$	\oslash
$*$	\ast	$\sqcup$	\sqcup	$\triangleright$	\triangleright	$\odot$	\odot
$\star$	\star	$\vee$	\vee	$\lhd^*$	\lhd*	$\bigcirc$	\bigcirc
$\circ$	\circ	$\wedge$	\wedge	$\rhd^*$	\rhd*	$\dagger$	\dagger
$\bullet$	\bullet	$\setminus$	\setminus	$\unlhd^*$	\unlhd*	$\ddagger$	\ddagger
$\cdot$	\cdot	$\wr$	\wr	$\unrhd^*$	\unrhd*	$\amalg$	\amalg
$+$	+	$-$	-				

relations

TABLE 8: Relation Symbols

$\leq$	\leq	$\geq$	\geq	$\equiv$	\equiv	$\models$	\models
$\prec$	\prec	$\succ$	\succ	$\sim$	\sim	$\perp$	\perp
$\preceq$	\preceq	$\succeq$	\succeq	$\simeq$	\simeq	$\mid$	\mid
$\ll$	\ll	$\gg$	\gg	$\asymp$	\asymp	$\parallel$	\parallel
$\subset$	\subset	$\supset$	\supset	$\approx$	\approx	$\bowtie$	\bowtie
$\subseteq$	\subseteq	$\supseteq$	\supseteq	$\cong$	\cong	$\Join^*$	\Join*
$\sqsubset^*$	\sqsubset*	$\sqsupset^*$	\sqsupset*	$\neq$	\neq	$\smile$	\smile
$\sqsubseteq$	\sqsubseteq	$\sqsupseteq$	\sqsupseteq	$\doteq$	\doteq	$\frown$	\frown
$\in$	\in	$\ni$	\ni	$\propto$	\propto	$=$	=
$\vdash$	\vdash	$\dashv$	\dashv	$<$	<	$>$	>
$:$	:						

arrows

TABLE 10: Arrow Symbols

$\leftarrow$	\leftarrow	$\longleftarrow$	\longleftarrow	$\uparrow$	\uparrow
$\Leftarrow$	\Leftarrow	$\Longleftarrow$	\Longleftarrow	$\Uparrow$	\Uparrow
$\rightarrow$	\rightarrow	$\longrightarrow$	\longrightarrow	$\downarrow$	\downarrow
$>$	\Rightarrow	$=>$	\Longrightarrow	$\Downarrow$	\Downarrow
$\leftrightarrow$	\leftrightarrow	$\longleftrightarrow$	\longleftrightarrow	$\updownarrow$	\updownarrow
$\Leftrightarrow$	\Leftrightarrow	$\Longleftrightarrow$	\Longleftrightarrow	$\Updownarrow$	\Updownarrow
$\mapsto$	\mapsto	$\longmapsto$	\longmapsto	$\nearrow$	\nearrow
$\hookleftarrow$	\hookleftarrow	$\hookrightarrow$	\hookrightarrow	$\searrow$	\searrow
$\leftharpoonup$	\leftharpoonup	$\rightharpoonup$	\rightharpoonup	$\swarrow$	\swarrow
$\leftharpoondown$	\leftharpoondown	$\rightharpoondown$	\rightharpoondown	$\nwarrow$	\nwarrow
$\rightleftharpoons$	\rightleftharpoons	$\leadsto$*	\leadsto*		

misc

TABLE 11: Miscellaneous Symbols

$\ldots$	\ldots	$\cdots$	\cdots	$\vdots$	\vdots	$\ddots$	\ddots
$\aleph$	\aleph	$\prime$	\prime	$\forall$	\forall	∞	\infty
$\hbar$	\hbar	$\emptyset$	\emptyset	$\exists$	\exists	$\Box$	\Box*
$\imath$	\imath	∇	\nabla	$\neg$	\neg	$\Diamond$	\Diamond*
$\jmath$	\jmath	$\surd$	\surd	$\flat$	\flat	$\triangle$	\triangle
ℓ	\ell	$\top$	\top	$\natural$	\natural	$\clubsuit$	\clubsuit
$\wp$	\wp	$\bot$	\bot	$\sharp$	\sharp	$\diamondsuit$	\diamondsuit
$\Re$	\Re	$\|$	\\|	\	\backslash	$\heartsuit$	\heartsuit
$\Im$	\Im	$\angle$	\angle	∂	\partial	$\spadesuit$	\spadesuit
$\mho$	\mho*	.	.	$\|$	|		

even more…

TABLE 12: Variable-sized Symbols

$\sum$	\sum	$\bigcap$	\bigcap	$\bigodot$	\bigodot
$\prod$	\prod	$\bigcup$	\bigcup	$\bigotimes$	\bigotimes
$\coprod$	\coprod	$\bigsqcup$	\bigsqcup	$\bigoplus$	\bigoplus
$\int$	\int	$\bigvee$	\bigvee	$\biguplus$	\biguplus
$\oint$	\oint	$\bigwedge$	\bigwedge		

TABLE 13: Log-like Symbols

\arccos	\cos	\csc	\exp	\ker	\limsup	\min	\sinh
\arcsin	\cosh	\deg	\gcd	\lg	\ln	\Pr	\sup
\arctan	\cot	\det	\hom	\lim	\log	\sec	\tan
\arg	\coth	\dim	\inf	\liminf	\max	\sin	\tanh

ridiculous example

```
\begin{equation}
\Re{z} =\frac{n\pi \dfrac{\theta +\psi}{2}}
{\left(\dfrac{\theta +\psi}{2}\right)^2 + \left( \dfrac{1}
{2} \log \left\lvert\dfrac{B}{A}\right\rvert\right)^2}
\end{equation}
```

ridiculous example

```
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{\left(\dfrac{\theta +\psi}{2}\right)^2 + \left( \dfrac{1}
{2} \log \left\lvert\dfrac{B}{A}\right\rvert\right)^2}
\end{equation}
```

$$\Re z = \frac{n\pi \dfrac{\theta + \psi}{2}}{\left(\dfrac{\theta + \psi}{2}\right)^2 + \left(\dfrac{1}{2} \log \left|\dfrac{B}{A}\right|\right)^2}$$

tables

- actually “tabular” - a “table” is just like a “figure” but numbered using a different counter…
- use the “tabular” environment to make tables of data

```
\begin{tabular}{column-alignment}
data & data & data \\
\end{tabular}
```

tabular

```
\begin{tabular}{ c c c }
cell1 & cell2 & cell3 \\
cell4 & cell5 & cell6 \\
cell7 & cell8 & cell9
\end{tabular}
```

tabular

```
\begin{tabular}{ c c c }
cell1 & cell2 & cell3 \\
cell4 & cell5 & cell6 \\
cell7 & cell8 & cell9
\end{tabular}
```

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

tabular

```
\begin{tabular}{ | c | c | c ||}
\hline \hline
cell1 & cell2 & cell3 \\ \hline
cell4 & cell5 & cell6 \\
cell7 & cell8 & cell9
\hline \hline
\end{tabular}
```

tabular

```
\begin{tabular}{ | c | c | c ||}
\hline \hline
cell1 & cell2 & cell3 \\ \hline
cell4 & cell5 & cell6 \\
cell7 & cell8 & cell9
\hline \hline
\end{tabular}
```

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

tabular

```
\begin{tabular}{|l|l|r|}
\hline \hline
{\em type} & \multicolumn{2}{c|}{\em style} \\ \hline
smart & red & short \\
rather silly & puce & tall \\
\hline \hline
\end{tabular}
```

tabular

```
\begin{tabular}{|l|l|r|}
\hline \hline
{\em type} & \multicolumn{2}{c|}{\em style} \\ \hline
smart & red & short \\
rather silly & puce & tall \\
\hline \hline
\end{tabular}
```

type	*style*	
smart	red	short
rather silly	puce	tall

tabular

```
\begin{tabular}{rllrrrrrrr}
    & & Crytek & Dragon & Dragon Box & Vegetation & Hairball & Dragon & San Miguel\\
    & & Sponza &        &            &            &          & Sponza & \\
    \hline&\\[-0.1in]

    \multirow{7}{*}{\rotatebox{90}{\textbf{STRaTA}}}
    & Render Time (ms / Frame)        & \textbf{39.0}  & \textit{23.12}  & \textit{91.27}  & \textbf{48.23}  & \textbf{36.2}   & \textit{70.98}  & \textit{125.51} \\
    & DRAM Energy (J)                 & \textbf{2.26}  & \textit{2.34}   & \textit{10.17}  & \textit{5.38}   & \textbf{4.61}   & \textit{5.32}   & \textit{15.08}  \\
    & Row Buffer Hit Rate, Reads (\%) & \textbf{85.1}  & \textit{81.1}   & \textbf{83.1}   & \textit{77.8}   & \textit{75.0}   &\textit{79.0}    & \textit{71.6}   \\
    & DRAM Power (W)                  & 58.06  & 101.13 & 111.47 & 111.52 & 127.44 & 74.93  & 120.19 \\
    & Avg. Bandwidth (GB/s)           & 101.95 & 219.33 & 266.65 & 229.59 & 254.53 & 137.48 & 219.34 \\
    & Cache Lines Transferred (M)     & 62.14  & 79.2   & 380.1  & 173    & 144    & 152.5  & 430.1  \\
    \hline&\\[-0.1in]

    \multirow{11}{*}{\rotatebox{90}{\textbf{Dual Streaming}}}
    & Render Time (ms / Frame)        & \textit{45.48}  & \textbf{18.64}  & \textbf{66.1}   & \textit{69.67}  & \textit{64.86}  & \textbf{41.06}  & \textbf{80.6}   \\
    & DRAM Energy (J)                 & \textit{4.54}   & \textbf{1.17}   & \textbf{4.60}   & \textbf{4.45}   & \textbf{4.61}   & \textbf{4.52}   & \textbf{8.12}   \\
    & Row Buffer Hit Rate, Reads (\%) & \textit{78.2}   & \textbf{89.3}   & \textit{74.7}   & \textbf{85.8}   & \textbf{83.6}   & \textbf{84.1}   & \textbf{84.2}   \\
    & DRAM Power (W)                  & 99.79  & 62.70  & 69.62  & 63.90  & 71.09  & 110.10 & 100.74 \\
    & Avg. Bandwidth (GB/s)           & 232.21 & 136.01 & 114.13 & 140.13 & 139.45 & 270.45 & 251.89 \\
    & Cache Lines Transferred (M)     & 165    & 39.6   & 117.9  & 152.5  & 141.3  & 173.5  & 317.2  \\
    \cline{2-9}&\\[-0.1in]
    & Row Buffer Hit Rate, Writes (\%) & 86.3  & 85.8  & 77.0  & 89.3  & 80.2  & 81.7  & 85.4  \\
    & Ray Stream Cache Lines (M)       & 80.69 & 11.93 & 45.67 & 94.23 & 76.44 & 43.88 & 146.52 \\
    & Scene Stream Cache Lines (M)     & 2.25  & 7.56  & 8.0   & 8.19  & 19.18 & 54.83 & 71.91  \\
    & Ray Duplication                  & 9.55  & 5.55  & 4.14  & 16.15 & 17.02 & 5.18  & 16.19
\end{tabular}
```

tabular

		Crytek Sponza	Dragon	Dragon Box	Vegetation	Hairball	Dragon Sponza	San Miguel
STRaTA	Render Time (ms / Frame)	**39.0**	*23.12*	*91.27*	**48.23**	**36.2**	*70.98*	*125.51*
	DRAM Energy (J)	**2.26**	*2.34*	*10.17*	*5.38*	**4.61**	*5.32*	*15.08*
	Row Buffer Hit Rate, Reads (%)	**85.1**	*81.1*	**83.1**	*77.8*	*75.0*	*79.0*	*71.6*
	DRAM Power (W)	58.06	101.13	111.47	111.52	127.44	74.93	120.19
	Avg. Bandwidth (GB/s)	101.95	219.33	266.65	229.59	254.53	137.48	219.34
	Cache Lines Transferred (M)	62.14	79.2	380.1	173	144	152.5	430.1
Dual Streaming	Render Time (ms / Frame)	*45.48*	**18.64**	**66.1**	*69.67*	*64.86*	**41.06**	**80.6**
	DRAM Energy (J)	*4.54*	**1.17**	**4.60**	**4.45**	**4.61**	**4.52**	**8.12**
	Row Buffer Hit Rate, Reads (%)	*78.2*	**89.3**	*74.7*	**85.8**	**83.6**	**84.1**	**84.2**
	DRAM Power (W)	99.79	62.70	69.62	63.90	71.09	110.10	100.74
	Avg. Bandwidth (GB/s)	232.21	136.01	114.13	140.13	139.45	270.45	251.89
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	Scene Stream Cache Lines (M)	2.25	7.56	8.0	8.19	19.18	54.83	71.91
	Ray Duplication	9.55	5.55	4.14	16.15	17.02	5.18	16.19

IEEE and ACM templates

- I have examples on Overleaf that you can check out
- IEEE: https://www.overleaf.com/3040084ymrksb#/8391674/
- ACM: https://www.overleaf.com/4509628vncycd#/13543753/