



ECEN 4013
Design of Engineering Systems

Agenda

Test Plans
Standards and Regulations
Latex



Undergrad Research

Areas of Interest

- Neuromorphic computing
- Emerging memory design
- Data privacy for edge devices
- Human machine interface
- Application Specific Memory Design

Contact me

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Dr. Hritom Das



Academic Background

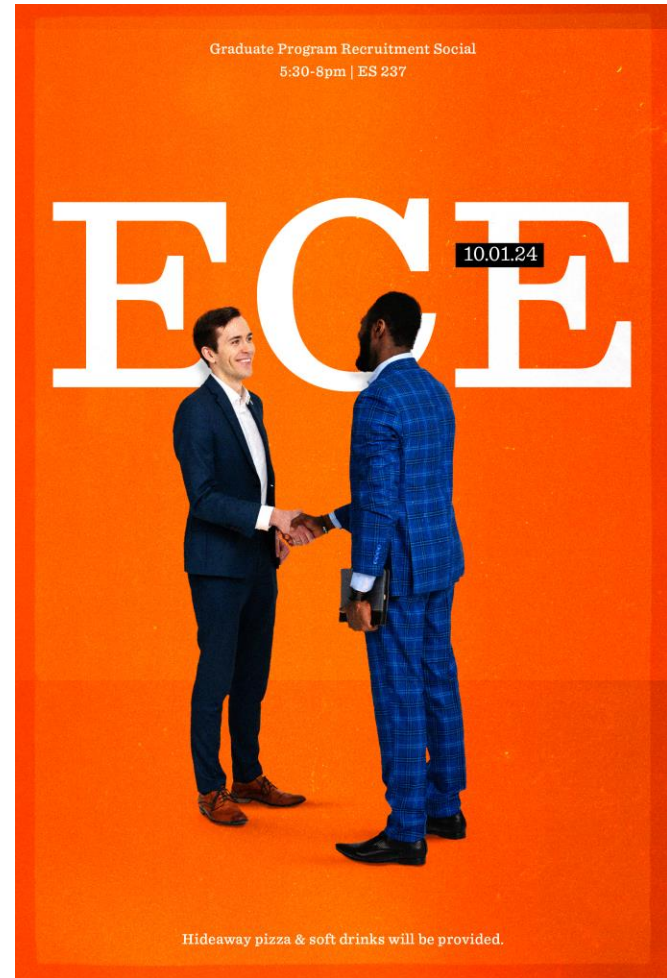
Ph.D., Electrical Engineering
North Dakota State University, 2020

M.Sc., Electronic Engineering
Kyungpook National University, South Korea, 2015

B.Sc., Electrical and Electronic Engineering
American International University, Bangladesh, 2013

Graduate Program Social

- Date: October 1
- Time: 5:30-8 pm
- Location: ES 237



Project 1 questions

Test Plan Generation

1. Analyze what you are testing
2. Design test strategies you are going to use
3. Define the pass/fail criteria
4. Plan the test environment
5. Execute the test plan and track progress in your project management system

Strategies

1. Unit tests – testing the smaller pieces of the design
2. Integration testing – testing the design as it is being assembled as a whole
3. Blackbox – treat the system as a black box, assuming no knowledge of the inner workings
4. Whitebox – test with the knowledge of how the system works, intentionally focusing on these inner workings
5. Verification testing - begins at the culmination of integration testing, the device is completely assembled, and errors have been corrected. Answers the question, is the device functioning correctly?
6. Validation testing – begins at the culmination of integration testing, the device is completely assembled, and errors have been corrected. Answers the question, are we delivering the correct functionality and are we adhering to the project specifications?
7. Performance/Reliability/Stress testing – push it to the limits. Does it remain reliable?
8. Usability testing – how easy is it to use?
9. Localization testing – does it continue to work in all locations?
10. Security Testing – how secure is it?
11. Coverage Matrix – a matrix of scenarios and features the product should support and test cases that test these features

Coverage Matrix

Coverage	Test Cases									
	SA-T10 - Create cont...	SA-T11 - Edit contacts	SA-T14 - Create Opp...	SA-T18 - Create leads	SA-T19 - Edit leads	SA-T20 - Delete leads	SA-T21 - Manage sale...	SA-T22 - Track the sa...	SA-T23 - Login	SA-T68 - Edit opport...
CTR-1 - Story for Traceability Testi...	Fail									
SA-260 - As a user I need to be ab...				Pass						
SA-21 - As a salesperson I want to ...										Not Executed
SA-266 - Demo User Story								In Progress		
SA-23 - As a salesperson I want to...			In Progress							
SA-22 - As a salesperson I want to...										Not Executed
AM-5 - Story	Fail									
SA-126 - As a user, I want to login ...								In Progress		
AM-7 - aaaa	Fail									
SA-222 - Um defeito									Fail	
SA-27 - As a salesperson I want to...						In Progress				
SA-48 - As a salesperson I want to...	Fail							In Progress		
SA-26 - As a salesperson I want to...							In Progress			
Summary Report Sprint 1 - v2.3.1	Fail									
No Coverage	Fail				In Progress	In Progress				Pass

Displaying (15 of 15)

Last test execution: Not Executed Pass In Progress Fail

Coverage Matrix

A Coverage matrix can help you:

- Define exactly what features you need in your design
- How to efficiently cover these features
- Identify edge cases – scenarios that occur when an operating parameter of your system is at an extreme level (converting 0v or 5v)
- Identify corner cases – scenarios that occur when operating outside of normal parameters of the system or multiple operating parameters are simultaneously at extreme levels (converting 6v)
- In cases where complete coverage is impossible – identify what coverage is acceptable

Testing Fundamentals

Attributes of a good test:

- A good test has a high probability of finding an error.
 - How might the device fail?
- A good test is not redundant.
 - Minimize test crossover
- A good test should be “best of breed.”
 - In refining test cases, the best tests are those that have the best possibility of uncovering a large grouping of errors
- A good test should be neither too simple nor too complex.
 - Monolithic tests versus ultra-specific tests

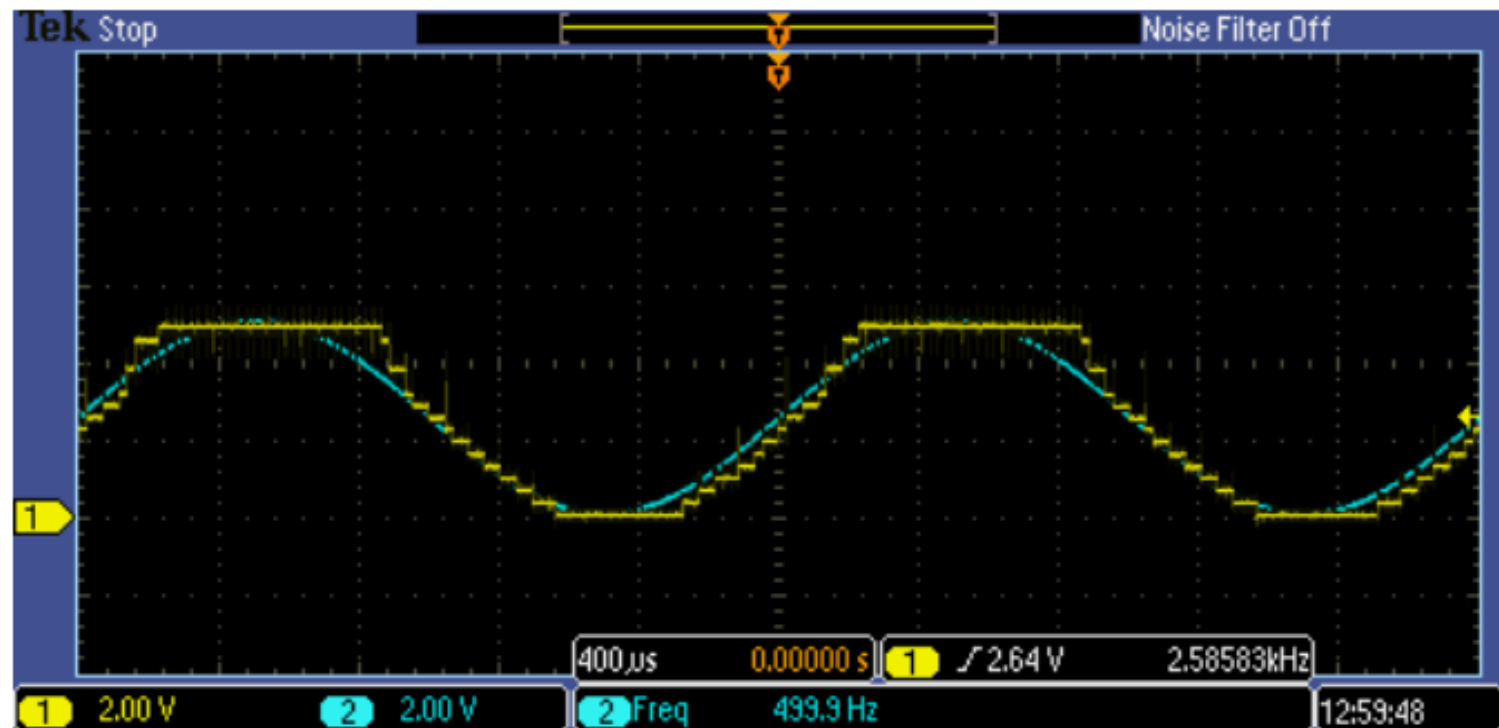
Integration Testing

- *Integration testing* is a systematic technique for verifying design and constructing the final device while conducting tests to uncover errors associated with interconnection.
- The objective is to take unit-tested components and build a program structure that matches the design.
- In the *big bang* approach, all components are combined at once and the entire program is tested as a whole. Chaos usually results!
- In *incremental integration* a program is constructed and tested in small increments, making errors easier to isolate and correct. Far more cost-effective!

Project 1 testing example

Function generator

ADC output



Standards, Specifications, and Regulations

What are the differences in these terms?

- **Standard** – established by an authority as a rule for measure
- **Specification** – Precise presentation, plan or proposal
- **Regulation** – rules and administrative codes by a government agency at all levels
- **Code** – system of principles or rules

Standards, Specifications, and Regulations

What is the purpose of standards and regulations?

- Risk mitigation and reducing the probability of unwanted outcomes

What is Risk?

- Risk = probability*severity

Probability	Harm severity			
	Negligible	Marginal	Critical	Catastrophic
Certain	High	High	Very high	Very high
Likely	Medium	High	High	Very high
Possible	Low	Medium	High	Very high
Unlikely	Low	Medium	Medium	High
Rare	Low	Low	Medium	Medium
Eliminated	Eliminated			

Standards, Specifications, and Regulations

Risk management can then be achieved by

1. Reducing probability of occurrence
2. Reducing the severity of occurrence

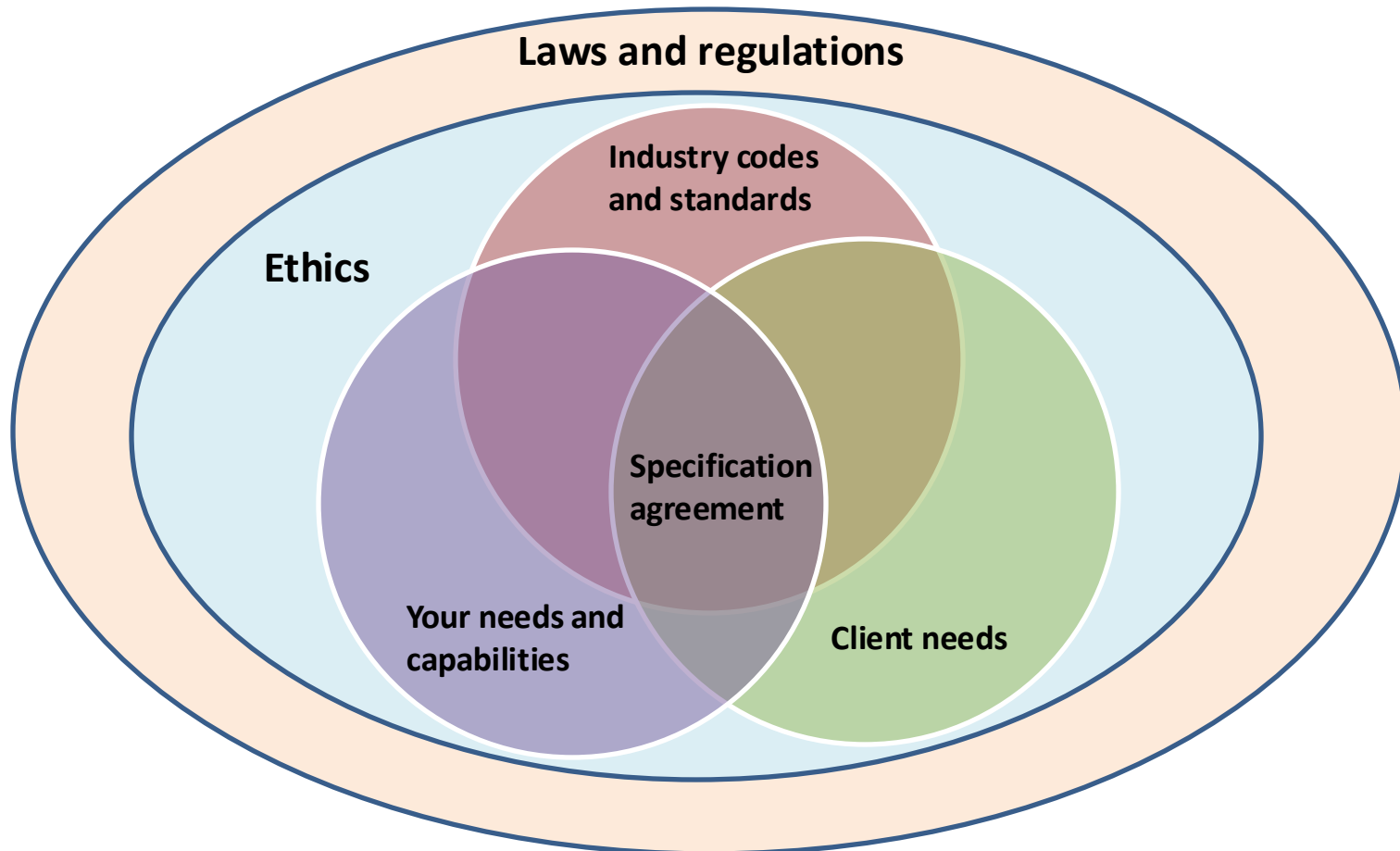
For example, car crashes:

- Government regulation requiring the use of seat belts reduces the severity of occurrence
- Government regulation enforcing stop signs at intersections primarily reduces probability of occurrence (but also reduces severity)



Standards, Specifications, and Regulations

How do we use standards and regulations to influence our specifications and constraints?



Standards, Specifications, and Regulations

Risk management has spawned many organizations for government regulations and industry standards. Many have been created in the aftermath of disaster.

US Centric list of some sources of industry standards:

- IEEE
- ACM
- IEC
- ISO
- NEC
- VDE
- UL
- ETL
- NEMA
- ASME
- API
- ASCE
- NFPA
- AIChE
- ASHRAE
- ANSI
- HAR
- MSHA
- DNV
- ABS
- ASTM
- AWS
- BSI
- CE
- CSA
- RoHs
- SAE

Standards, Specifications, and Regulations

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US Centric list of regulatory agencies:

- EPA
- FAA
- CARB
- BSEE
- DOT
- OSHA
- FERC
- FDA
- FCC
- FTC
- NHTSA
- CPSC
- NRC

Standards, Specifications, and Regulations

What should I use?

- Legal/regulatory requirements
- Expert help and guidance
- RESEARCH
 - What is your project aim?
 - Does it touch on the scope of any of the regulatory or industry standard organizations
 - What have similar projects used?
- Your organization's specifications/guidelines
- Client Specifications

Standards, Specifications, and Regulations

What should I use?

- Risk management matrices and tables are great for choosing standards and regulations

Risk	Type	Frequency	Outcome(s)	Mitigation
Weld Failure	Safety, Legal	Life of Building	<ul style="list-style-type: none">• Fatality• Injuries• Legal Issues	<ul style="list-style-type: none">• Apply ASTM Standards• Conduct weld inspections by qualified inspector of all critical welds• Material quality inspection of structural steel elements
Electrical Fire	Safety, Cost, Legal	Life of building	<ul style="list-style-type: none">• Fatality, Injury• Property Loss• Legal Issues	<ul style="list-style-type: none">• Apply NFPA Codes & NEPA Standards XXX• Conduct quality inspections of electrical work & materials• Conduct fire code inspections
Wireless Network Unreliable	Client Performance Specifications	weekly	<ul style="list-style-type: none">• Cost (warranty repair)• Reputation Damage	<ul style="list-style-type: none">• Apply IEEE Standards• Procurement of quality equipment• Conduct quality inspections of equipment and installations

Standards, Specifications, and Regulations

What should I use?

- Risk management matrices and tables are great for choosing standards and regulations

		A	B	C	D	E
		Negligible	Minor	Moderate	Significant	Severe
E	Very Likely	Low Med	Medium	Med Hi	High	High
D	Likely	Low	Low Med	Medium	Med Hi	High
C	Possible	Low	Low Med	Medium	Med Hi	Med Hi
B	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
A	Very Unlikely	Low	Low	Low Med	Medium	Medium

Proper application of standards along with quality assurance/control reduce risk levels.

IHS Markit

Instructions to create account and locate standards in IHS Markit:

- To create an account in ihs select this URL
 - <https://login.ihserc.com/cgi-bin/ihslogin?username=OKLLOWLIB>
- Select create a new account.
 - For the username you **must** use your firstname.lastname@okstate.edu account, because the vendor requires valid okstate student, staff, or faculty identification.
- Create a unique password. Use your username and password log-in.
- Tell them that you're not a robot.
- you'll get a verification code. Enter it.
- Then you'll get a subscription code which will come in the welcome letter email, enter that.

Starting point

IPC standards for mass producing electronic assemblies,

- IPCJ-STD-001G - Requirements for Soldered Electrical and Electronic Assemblies
- IPC-A-630 – Acceptability Standard for Manufacture, Inspection, and Testing of Electronic Enclosures

Government regulation that all electronics must pass is FCC 15.109 radiation emission limits.

Project 1 Report

1. **Is IPC-A-610 a standard or a regulation?**

Industry standards are created through industry leaders, private companies which are generally non-profit. IPC is one of these companies. Regulations are created by Government agencies like the FCC and FAA. The most common regulation we have to concern ourselves with is FCC 15.109 which has to do with unintentional radiation of EM waves. FCC 105.209 has to do with intentional radiation of EM waves and would be applicable to project 2. Here is a document explaining FCC regulations that affect us:

<https://www.autodesk.com/products/eagle/blog/fcc-requirements-electronics-design-pcb/>

Latex

TEX

Donald Knuth

- Father of Algorithmic analysis
- Popularized big O notation
- Author of *The Art of Computer Programming*
- Tex – typesetting system designed in 1978
 - Considered difficult to learn on its own with no interface
 - Standardized complex mathematical symbology
- Creator of The Potrzebie System of Weights and Measures
 - 1 potrzebie = 2.2633484517438173216473 mm
 - Thickness of issue 26 of Mad Magazine



Leslie Lamport

- Needed to write in Tex for his own use, and figured he could make a general package for others
- Addison-Wesley convinced him to publish and the project took off
- Open-source software that continues to be developed
 - github.com/latex3/latex2e

Latex – Anatomy of a .tex file

`\documentclass{article}`

- Type of document. controls overall appearance
- Other classes include letter, book, report, and slides

`\usepackage[letterpaper,top=2cm,bottom=2cm,left=3cm,right=3cm,marginparwidth=1.75cm]{geometry}`

- Usepackage tags are like including libraries in C or Python
- This package sets up your page type and margins

`\title{Your Paper}` - title line

`\author{You}` - author line

`%\date{\vspace{-0.8cm}}`

- Comments specified with %
- This line removes the date if uncommented
- Vspace tag inserts or removes (-0.8cm) vertical space

`\begin{document}` - tag to signal the start of the document

`\maketitle` - place title at top of the page with the current date

`\begin{abstract}` - create an abstract if you need one

Your abstract.

`\end{abstract}` - end tag for abstract

`\section{foo}` - create section

`\subsection{bar}` - create subsections

`\end{document}` - end tag for the document

Your Paper

You

October 26, 2021

Abstract

Your abstract.

1 foo

1.1 bar

Latex – New paragraphs and pages

`\documentclass{article}`

`\usepackage[letterpaper,top=2cm,bottom=2cm,left=3cm,right=3cm,marginparwidth=1.75cm]{geometry}`

`\usepackage{lipsum}` - include random text generator

`\usepackage{color}` - include text color

`\title{Your Paper}` - title line

`\author{You}` - author line

`%\date{\vspace{-0.8cm}}`

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`\section{foo}` - create section

`\lipsum[1] \emph{\textcolor{red}{\textbf{More text here.}}}`

- 1 paragraph of random text followed by text in italics (`\emph{}`), red (`\textcolor{red}{}`), and bold face (`\textbf{}`)

`\subsection{bar}` - create subsections

`\end{document}` - end tag for the document

Your Paper

You

October 26, 2021

Abstract

Your abstract.

1 foo

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum. *More text here.*

1.1 bar

Latex – New paragraphs and pages

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1 foo

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1.1 bar

`\lipsum[1]`

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More text here.

1.1 bar

`\lipsum[1]`

`\emph{\textcolor{red}{\textbf{More text here.}}}`

Latex – New paragraphs and pages

- `\\` - start a new paragraph
- `\linebreak[number]`
 - break the line at the point of the command.
 - `[number]` is from 0 to 4 and is how insistent you are about the break.
 - `linebreak` stretches the line to meet the right margin
- `\newline`
 - breaks the line right where it is.
 - Must be in paragraph mode
- `\newpage` - ends the current page
- `\pagebreak[number]`
 - end the page at the point of the command.
 - `[number]` is how insistent you are
- `\clearpage`
 - flush material (print images waiting to be printed) and start new page

Latex – Figures

```
\documentclass{article}
\usepackage[letterpaper,top=2cm,bottom=2cm,left=3cm,right=3cm,
marginparwidth=1.75cm]{geometry}
```

```
\usepackage{lipsum}
```

```
\usepackage{graphicx}
```

```
\graphicspath{ {./images/} }
```

– Define a path to your images if you need to

```
\title{Your Paper} - title line
```

```
\author{You} - author line
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%\date{\vspace{-0.8cm}}
```

```
\begin{document} - tag to signal the start of the document
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\section{foo} - create section
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```
\includegraphics[scale=0.1]{rNm.jpg}
```

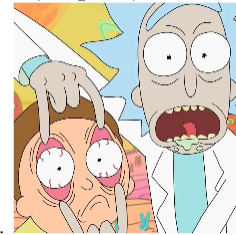
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1 foo

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Latex – Figures

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\graphicspath{ {./images/} }
\usepackage{float}
```

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```

```
\begin{abstract} - create an abstract if you need one
Your abstract.
\end{abstract} - end tag for abstract
```

```
\section{foo} - create section
\lipsum[1]
\begin{figure}
\centering
\includegraphics[width=0.25\textwidth]{images/rNm.jpg}
\caption{Rickdoc and Mortex}
\label{fig:rickMorty}
\end{figure}
\lipsum[1]
\subsection{bar} - create subsections
\end{document} - end tag for the document
```

1 foo

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1.1 bar



Figure 1: Rickdoc and Mortex

Latex – Figures

Placement Specifiers

- h – approximately here
- t – top of page
- b – bottom of page
- p – special page for floats only
- ! - override latex algorithms for determining good position
- H – place at precisely this location (effectively the equivalent of [!h])
- Protip: Sometimes to get an image to land where you want it to, you need to place the code for it far above the place where you want it to land.

1 foo

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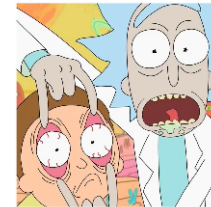


Figure 1: Rickdoc and Mortex

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1.1 bar

```
\begin{figure}[H]
```


Latex – Tables

```
\lipsum[1]
\begin{table}[H]
\caption{Example table} - captions are at top of tables
\begin{center}
\begin{tabular}{||c|c|c|c|c|} - 1 left justified column followed
by 5 centered columns separated by vertical lines
\hline - horizontal line
\textbf{Joint}&\textbf{D-Mocap} & \textbf{EKF} &
\textbf{UKF} & \textbf{TKF} & \textbf{Autoencoder}\\
\hline\hline
1 & 1.5 & 3.2 & 2.4 & 2.0 & 2.2\\ - each column is seperated
with an '&' each row is ended with an '\\'.
2 & 3.6 & 4.1 & 2.6 & 2.9 & 2.4\\
3 & 3.4 & 4.6 & 3.1 & 2.9 & 4.0\\
4 & 3.7 & 4.2 & 3.7 & 3.0 & 4.7\\
5 & 6.7 & 5.6 & 4.0 & 4.2 & 7.5\\
\hline
Ave. & 3.8 & 4.3 & 3.2 & 3.0 & 4.2 \\
\hline
\end{tabular}
\end{center}
\label{tab:initialMHAD} - label
\end{table}
\lipsum[1]
```

1 foo

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Table 1: Example table

Joint	D-Mocap	EKF	UKF	TKF	Autoencoder
1	1.5	3.2	2.4	2.0	2.2
2	3.6	4.1	2.6	2.9	2.4
3	3.4	4.6	3.1	2.9	4.0
4	3.7	4.2	3.7	3.0	4.7
5	6.7	5.6	4.0	4.2	7.5
Ave.	3.8	4.3	3.2	3.0	4.2

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Latex – Formulas

Useful packages - `\usepackage{amsmath,amssymb,amsfonts}`

Standalone eqn - `\begin{equation} ... \end{equation}` or `\[... \]`

Inline eqn - text `\$your eqn\$` more text

Examples:

Inline

where \odot is the Hadamard product and $\textbf{p}^{\{uc\}}_k$ are the probability vector

Matrix (requires amsmath) using `\[... \]`

where \odot is the Hadamard product and $\textbf{p}_k^{(uc)}$, $\textbf{p}_k^{(t)}$, and $\textbf{p}_k^{(n)}$ are the probability vectors

```
\[
H = \begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 \\
\end{bmatrix}
\right]
\label{eq:observation}
\]
```

$$H = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

Sum, absolute value, superscript, subscript

```
\begin{equation} \label{eq:costFilter}
\mathit{Cost}(\textbf{H}) = \sum_j \sum_k \left| \Psi(p_{k,j}^{\textbf{H}}) - r_{k,j} \right|_2
\end{equation}
```

$$Cost(\mathbf{H}) = \sum_j \sum_k \left\| \Psi(p_{k,j}^{\mathbf{H}}) - r_{k,j} \right\|_2 \quad (2)$$

Latex – Formulas

Piecewise

```
\begin{equation}
\rho^{(x)}_k=
\begin{cases}
q^{(x)}_k \quad \text{\mbox{$TL_k^{(x)} < q^{(x)}_k < TH_k^{(x)}$}} \\
TL^{(x)}_k \quad \text{\mbox{$q^{(x)}_k \leq TL_k^{(x)}$}} \\
TH^{(x)}_k \quad \text{\mbox{$q^{(x)}_k \geq TH_k^{(x)}$}},
\end{cases}
\label{eq:newMeas}
\end{cases}
\end{equation}
```

$$\rho_k^{(x)} = \begin{cases} q_k^{(x)} & TL_k^{(x)} < q_k^{(x)} < TH_k^{(x)} \\ TL_k^{(x)} & q_k^{(x)} \leq TL_k^{(x)} \\ TH_k^{(x)} & q_k^{(x)} \geq TH_k^{(x)}, \end{cases} \quad (1)$$

Eqnarray, integrals, limits

```
\begin{eqnarray}
\int_a^b x^2 \, dx
\iiint_V \mu(u,v,w) \, du \, dv \, dw
\oint_V f(s) \, ds
\lim_{x \rightarrow \infty} f(x)
\end{eqnarray}
```

$$\int_a^b x^2 \, dx \quad (3)$$

$$\iiint_V \mu(u, v, w) \, du \, dv \, dw \quad (4)$$

$$\oint_V f(s) \, ds \quad (5)$$

$$\lim_{x \rightarrow \infty} f(x), \quad (6)$$

Eqnarray, derivatives, one eqn number

```
\begin{eqnarray}
\frac{du}{dt} \\
\frac{d^2 u}{dx^2} \\
\frac{\partial u}{\partial t} \\
\frac{\partial^2 u}{\partial x^2}
\end{eqnarray}
```

$$\begin{aligned} & \frac{du}{dt} \\ & \frac{d^2 u}{dx^2} \\ & \frac{\partial u}{\partial t} \\ & \frac{\partial^2 u}{\partial x^2} \end{aligned} \quad (7)$$

Latex – Lists

Enumerate

```
\begin{enumerate}  
  \item One  
  \item Two  
  \item Three  
\end{enumerate}
```

1. One
2. Two
3. Three

Itemize

```
\begin{itemize}  
  \item One  
  \item Two  
  \item Three  
\end{itemize}
```

- One
- Two
- Three

Nested Lists

```
\begin{enumerate}  
\item One  
  \begin{enumerate}  
    \item Two  
      \begin{itemize}  
        \item bullet  
      \end{itemize}  
    \item Three  
    \item Four  
  \end{enumerate}  
\item Five  
\item Six  
\end{enumerate}
```

1. One
 - (a) Two
 - bullet
 - (b) Three
 - (c) Four
2. Five
3. Six

Change bullet

```
\begin{itemize}  
  \item[--] Dash  
  \item[$-$] Dash  
  \item[$\ast$] Asterisk  
\end{itemize}
```

- Dash
- Dash
- * Asterisk

Latex – Algorithms

Package

```
\usepackage{algpseudocode}
\usepackage{algorithm} - to add captions, labels, and
                        numbering in document
```

Ex 1 (basic)

```
\begin{algorithmic}
\State $i$ \gets 10$
\If{$i \geq 5$}
  \State $i$ \gets $i-1$
\Else
  \If{$i \leq 3$}
    \State $i$ \gets $i+2$
  \EndIf
\EndIf
\end{algorithmic}
```

Ex 2 (line numbers)

```
\begin{algorithmic} [1]
```

Ex 3 (with algorithm package)

```
\begin{algorithm}
\caption{An algorithm with caption}\label{alg:cap}
\begin{algorithmic}
\Require $n \geq 0$
\Ensure $y = x^n$
\State $y$ \gets 1$
\State $X$ \gets $x$
\State $N$ \gets $n$
\While{$N \neq 0$}
\If{$N$ is even}
  \State $X$ \gets $X \times X$
  \State $N$ \gets $\frac{N}{2}$ \Comment{This is a comment}
\ElseIf{$N$ is odd}
  \State $y$ \gets $y \times X$
  \State $N$ \gets $N - 1$
\EndIf
\EndWhile
\end{algorithmic}
```

$i \leftarrow 10$

if $i \geq 5$ **then**

$i \leftarrow i - 1$

else

if $i \leq 3$ **then**

$i \leftarrow i + 2$

end if

end if

1: $i \leftarrow 10$

2: **if** $i \geq 5$ **then**

3: $i \leftarrow i - 1$

4: **else**

5: **if** $i \leq 3$ **then**

6: $i \leftarrow i + 2$

7: **end if**

8: **end if**

Algorithm 1 An algorithm with caption

Require: $n \geq 0$

Ensure: $y = x^n$

$y \leftarrow 1$

$X \leftarrow x$

$N \leftarrow n$

while $N \neq 0$ **do**

if N is even **then**

$X \leftarrow X \times X$

$N \leftarrow \frac{N}{2}$

▷ This is a comment

else if N is odd **then**

$y \leftarrow y \times X$

$N \leftarrow N - 1$

end if

end while

Latex – Citations and Labels

Traditional bibliography and figure label

```
\section{foo}
```

This is the MHAD dataset `\cite{mhad}`. Figure `\ref{fig:rickMorty}` is a picture of Rick and Morty.

```
\begin{figure}[H]
\centering
\includegraphics[width=0.25\textwidth]{images/rNm.jpg}
\caption{Rickdoc and Mortex}
\label{fig:rickMorty}
\end{figure}
```

```
\subsection{bar}
\begin{thebibliography}{1}
\bibitem{mhad} Ofli, Ferda and Chaudhry, Rizwan and
Kurillo, Gregorij and Vidal, Ren{\e} and Bajcsy,
Ruzena, ``Berkeley MHAD: A comprehensive
multimodal human action database," \emph{2013
IEEE Workshop on Applications of Computer Vision
(WACV)}, pp. 53--60, 2013.
\end{thebibliography}
\end{document}
```

1 foo

This is the MHAD dataset [1]. Figure 1 is a picture of Rick and Morty.



Figure 1: Rickdoc and Mortex

1.1 bar

References

- [1] Ofli, Ferda and Chaudhry, Rizwan and Kurillo, Gregorij and Vidal, Ren   and Bajcsy, Ruzena, "Berkeley MHAD: A comprehensive multimodal human action database," *2013 IEEE Workshop on Applications of Computer Vision (WACV)*, pp. 53–60, 2013.

Latex – bibtex

Using a .bib file for references

1. Create a separate file with bibtex entries
2. Reference the bib file at the end of your tex file
3. Use bibtex to compile if not using overleaf or MiKTeX
 - `pdflatex myfile.tex`
 - `bibtex myfile.aux`
 - `pdflatex myfile.tex`
 - `pdflatex myfile.tex`

.bib file

```
@inproceedings{mhad,  
  title={Berkeley MHAD: A comprehensive  
    multimodal human action database},  
  author={Ofli, Ferda and Chaudhry, Rizwan and  
    Kurillo, Gregorij and Vidal, Ren{\e} and Bajcsy,  
    Ruzena},  
  booktitle={2013 IEEE Workshop on Applications of  
    Computer Vision (WACV)},  
  pages={53--60},  
  year={2013},  
  organization={IEEE}  
}
```

.tex file

This is the MHAD dataset `\cite{mhad}`.

...

```
\bibliographystyle{plain}
```

```
\bibliography{references} - assuming your bib file is  
  references.bib and is in the same directory as  
  your tex file
```

Latex – Useful tags

Font Face

The *command* and *declaration* versions of these are mostly the same, though the command handles spacing a little better. If you use a declaration without the wrapping curly braces, the rest of the text in the document will be affected.

<i>Command</i>	<i>Declaration</i>	<i>Effect</i>
<code>\textrm{<i>text</i>}</code>	<code>{\rmfamily <i>text</i>}</code>	Roman family
<code>\textsf{<i>text</i>}</code>	<code>{\sffamily <i>text</i>}</code>	Sans serif family
<code>\texttt{<i>text</i>}</code>	<code>{\ttfamily <i>text</i>}</code>	Typewriter family
<code>\textmd{<i>text</i>}</code>	<code>{\mdseries <i>text</i>}</code>	Medium series
<code>\textbf{<i>text</i>}</code>	<code>{\bfseries <i>text</i>}</code>	Bold series
<code>\textup{<i>text</i>}</code>	<code>{\upshape <i>text</i>}</code>	Upright shape
<code>\textit{<i>text</i>}</code>	<code>{\itshape <i>text</i>}</code>	<i>Italic shape</i>
<code>\textsl{<i>text</i>}</code>	<code>{\slshape <i>text</i>}</code>	<i>Slanted shape</i>
<code>\textsc{<i>text</i>}</code>	<code>{\scshape <i>text</i>}</code>	SMALL CAPS SHAPE
<code>\emph{<i>text</i>}</code>	<code>{\em <i>text</i>}</code>	<i>Emphasized</i>
<code>\textnormal{<i>text</i>}</code>	<code>{\normalfont <i>text</i>}</code>	Document font
<code>\underline{<i>text</i>}</code>		<u>Underline</u>

Custom

`\newcommand{\etal}{\emph{et al}. }`

Font Size

These are declarations, and you should use the curly brace format (`{\small ...}`) in order to prevent it from affecting the whole document.

<code>\tiny <i>text</i></code>	<code>\large <i>text</i></code>
<code>\scriptsize <i>text</i></code>	<code>\Large <i>text</i></code>
<code>\footnotesize <i>text</i></code>	<code>\LARGE <i>text</i></code>
<code>\small <i>text</i></code>	<code>\huge <i>text</i></code>
<code>\normalsize <i>text</i></code>	<code>\Huge <i>text</i></code>

Justification

<i>Environment</i>	<i>Declaration</i>
<code>\begin{center}</code>	<code>\centering</code>
<code>\begin{flushleft}</code>	<code>\raggedright</code>
<code>\begin{flushright}</code>	<code>\raggedleft</code>

Text-mode Symbols

<code>\& &</code>	<code>_ -</code>	<code>\ldots ...</code>	<code>\textbullet •</code>
<code>\\$ \$</code>	<code>\^{ } ^</code>	<code>\textbar </code>	<code>\textbackslash \</code>
<code>\% %</code>	<code>\~{ } ~</code>	<code>\# #</code>	<code>\S §</code>

Latex – Options for creating a pdf

1. Overleaf.com
2. MikTeX - <https://miktex.org/>
3. Pdflatex
 - Install:
 - `sudo apt install texlive-latex-base texlive-fonts-recommended texlive-fonts-extra texlive-latex-extra`
 - Run:
 - `pdflatex myfile.tex && bibtex myfile.aux && pdflatex myfile.tex && pdflatex myfile.tex`
4. Pandoc - <https://pandoc.org/>

Pandoc

Conversion tool for pretty much any markup format to another

Lightweight markup formats

- ↔ Markdown (including [CommonMark](#) and [GitHub-flavored Markdown](#))
- ↔ [reStructuredText](#)
- [AsciiDoc](#)
- ↔ Emacs [Org-Mode](#)
- ↔ Emacs [Muse](#)
- ↔ [Textile](#)
- ← [txt2tags](#)

HTML formats

- ↔ (X)HTML 4
- ↔ HTML5

Ebooks

- ↔ [EPUB](#) version 2 or 3
- ↔ [FictionBook2](#)

Documentation formats

- [GNU TexInfo](#)
- ↔ [Haddock](#) markup

Roff formats

- ↔ [roff](#) man
- [roff](#) ms

TeX formats

- ↔ [LaTeX](#)
- [ConTeXt](#)

XML formats

- ↔ [DocBook](#) version 4 or 5
- ↔ [JATS](#)
- [TEI Simple](#)

Outline formats

- ↔ [OPML](#)

Bibliography formats

- ↔ [BibTeX](#)
- ↔ [BibLaTeX](#)
- ↔ [CSL JSON](#)
- ↔ [CSL YAML](#)

Word processor formats

- ↔ Microsoft Word [docx](#)
- ↔ Rich Text Format [RTF](#)
- ↔ OpenOffice/LibreOffice [ODT](#)
- [OpenDocument XML](#)
- Microsoft [PowerPoint](#)

Interactive notebook formats

- ↔ Jupyter notebook ([ipynb](#))

Page layout formats

- [InDesign ICML](#)

Wiki markup formats

- ↔ [MediaWiki](#) markup
- ↔ [DokuWiki](#) markup
- ← [TikiWiki](#) markup
- ← [TWiki](#) markup
- ← [Vimwiki](#) markup
- [XWiki](#) markup
- [ZimWiki](#) markup
- ↔ [Jira](#) wiki markup

Slide show formats

- [LaTeX Beamer](#)
- [Slidy](#)
- [reveal.js](#)
- [Slideous](#)
- [S5](#)
- [DZSlides](#)

Data formats

- ← [CSV](#) tables

Custom formats

- custom writers can be written in [lua](#).

PDF

- via [pdflatex](#), [lualatex](#), [xelatex](#),
[latexmk](#), [tectonic](#), [wkhtmltopdf](#),
[weasyprint](#), [prince](#), [context](#), or [pdfroff](#).

Questions?