

# Encouraging Student Entrepreneurship:

A KEEN Sharing Event

February 28, 2018



Center for Advancing Faculty Excellence



# Team Synergy - Ranking Activity

- ▶ The goal of this activity is to correctly order the 15 inventions from the earliest invented (#1) to the latest invented (#15)
- ▶ Searching for answers on the internet is not allowed for this activity!

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer					
Automobile					
Hot Air Balloon					
Gasoline Engine					
Jet Engine					
Laser					
Light Bulb					
Magnetic Compass					
Modern Paper					
Power Aircraft					
Printing Press					
Screw					
Telephone					

# Team Synergy - Ranking Activity

- ▶ Stage 1: Individual Stage
  - ▶ 2 minutes, no talking, no internet searching!
  - ▶ 1 is oldest, 15 is most recent

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer					
Automobile					
Hot Air Balloon					
Gasoline Engine					
Jet Engine					
Laser					
Light Bulb					
Magnetic Compass					
Modern Paper					
Power Aircraft					
Printing Press					

# Team Synergy - Ranking Activity

- ▶ Stage 2: Team Stage
  - ▶ 5 minutes, still no internet searching!
  - ▶ 1 is oldest, 15 is most recent

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer					
Automobile					
Hot Air Balloon					
Gasoline Engine					
Jet Engine					
Laser					
Light Bulb					
Magnetic Compass					
Modern Paper					
Power Aircraft					
Printing Press					

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer					6
Automobile					11
Hot Air Balloon					7
Gasoline Engine					8
Jet Engine					13
Laser					15
Light Bulb					10
Magnetic Compass					4
Modern Paper					3
Power Aircraft					12
Printing Press					5
Screw					2
Telephone					9
Transistor					14
Wheel					1



# Score your list

- For both individual and team lists, subtract your ranking from the correct ranking (absolute value, positive numbers only)

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer	1	5	4	2	6
Automobile	8	3	12	1	11
Hot Air Balloon	3	4	6	1	7
Gasoline Engine	10	2	5	3	8
Jet Engine	14	1	14	1	13
Laser	12	3	13	2	15
Light Bulb	4	6	8	2	10
Magnetic Compass					4
Modern Paper					3
Power Aircraft					12
Printing Press					5

# Score your list

- Sum the values in the delta columns to get your individual and team scores (lower is better)

Inventions	Individual		Team		Actual
	Rank	$\Delta$	Rank	$\Delta$	
Thermometer	1	5	4	2	6
Automobile	8	3	12	1	11
Hot Air Balloon	3	4	6	1	7
Gasoline Engine	10	2	5	3	8
Jet Engine	14	1	14	1	13
Laser	12	3	13	2	15
Light Bulb	4	6	8	2	10
Magnetic Compass					4
Modern Paper					3
Power Aircraft					12
Printing Press					5

# Overview of KEEN

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# KEEN

- ▶ KEEN: Kern Entrepreneurial Engineering Network
- ▶ Supported by the Kern Family Foundation
- ▶ According to KEEN, the Engineers we need must possess **Entrepreneurial Mindset** coupled with **Engineering Thought and Action** expressed through **Collaboration and Communication** and founded on **Character**.

# Resources

- ▶ **Network** of KEEN institutions (Collaborative Platform)
- ▶ Network of Cohort groups in the same academic fields
- ▶ Workshops like ICE (**Innovating Curriculum** with **Entrepreneurial** mindset)
  - ▶ Financial Support
  - ▶ Workshops and mentoring in activity development for a specific course and instructor
  - ▶ Benchmark and reference documents to help with planning, execution and publication

# Emphasis Areas

- ▶ **Value** Creation and Proposition
- ▶ **Opportunity** Recognition
- ▶ Service **Innovation**

# Entrepreneurial Mindset-based Learning Modules for EE3440 Digital Communication

Dr. Rosa Zheng

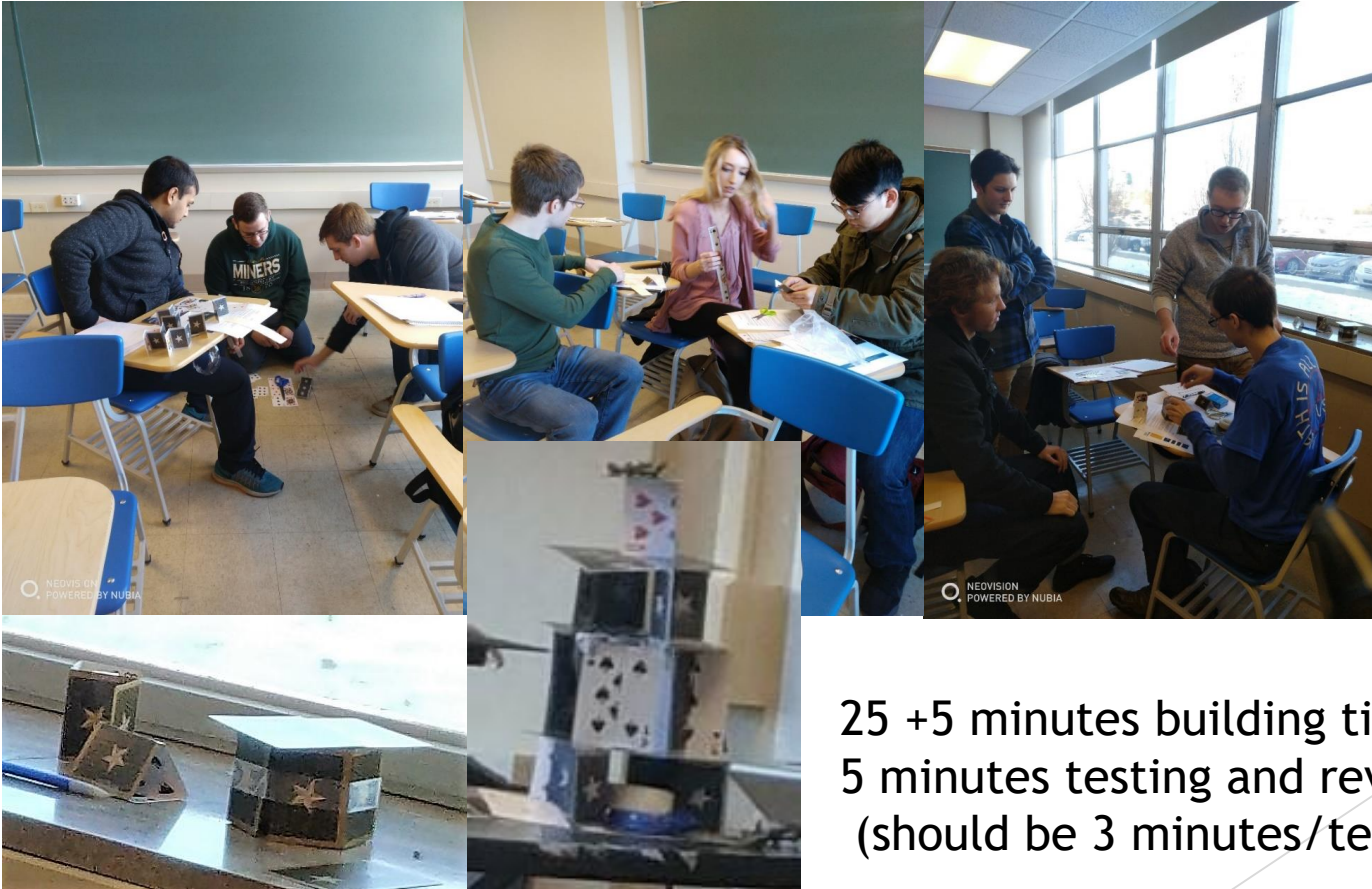
Missouri University of Science and Technology  
Dept. of Electrical and Computer Engineering

# Get me Interested: House of Card

2018 Dallas KEEN ICE workshop by faculty members



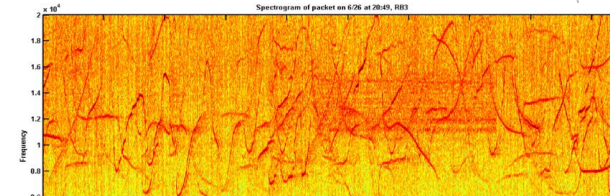
# Get them interested the First Day of Class



25 +5 minutes building time  
5 minutes testing and review  
(should be 3 minutes/team)

# Four EML Modules for Digital Communications II

1. Information and source coding: How many bits are there in a message?  
Example: “Can you can a can as a canner can can a can?”
2. Media and Channels: what kind of communication channels do these systems use: WiFi, Internet servers, autonomous cars, and dolphins?
3. Channel Coding: How can you talk better than Donald Trump?
4. Modulation and demodulation: How are bits transmitted and received by these systems: Mars rover, Mr. and Mrs. Sat, computer hard drive, and mud pulse?



# Implementation of Module 1

- ▶ Topic(s): Concept of Information bits and Source Coding
- ▶ Objectives:
  - ▶ Review basic concepts in probability theory
  - ▶ Understand the concept of self- information (bits), entropy, and source coding (fixed length vs variable length coding) (**curiosity**);
  - ▶ Compute the amount of average information bits in a given message (**connection**);
  - ▶ Program Matlab to encode and decode messages by Huffman coding
- ▶ Deliverables and student assessment
  - ▶ Deliverables: Matlab programs, written reports.
  - ▶ Student assessment:
    - ▶ rubrics for project programs and reports (modified from existing ones)
    - ▶ peer evaluation of effort and participation (modified from a template).
- ▶ Deployment and staging schedule
  - ▶ Duration of the module: planned 2 – 2.5 weeks, actually used 2 weeks
  - ▶ In-class sessions: planned 4-5 class periods, 75 min each, actually used 4 class periods
  - ▶ Out-of-class sessions: 2-3 LEAD sessions 1 hour each; none of them come
  - ▶ Number of stages: planned 4; actually used 3.



# Lessons learned during Module 1

- ▶ During this module, I found out:
  - ▶ Good skills on computing the probabilities of each letter in a message, knowledge of ASCII codes (fixed-length coding)
  - ▶ Students were surprised by how small the entropy is in a message. This really prompts them to learn variable-length source coding.
  - ▶ Matlab built-in functions on `huffmanenco()` and `huffmandec()` made the project easy. Added the complexity on finding the probabilities of each letter. Reinforced the learning by a paper-and-pencil quiz.
  - ▶ Team work is really good.
- ▶ Things to improve:
  - ▶ Students reading handouts in class: very slow
  - ▶ Discussion in groups:  $\frac{1}{2}$  of the students were not active
  - ▶ Did not get into “Estimate the storage costs of information contents (**Creating value**)”

# Implementation of Module 2

- ▶ Topic(s): Communication Channels
- ▶ Objectives:
  - ▶ Channel Modeling as a linear system: AWGN channel
  - ▶ Channel capacity: frequency bandwidth (Hz) vs. data rate (bps) (**curiosity**);
  - ▶ Channel impairments in practical communication systems
- ▶ Deliverables and student assessment
  - ▶ Deliverables: Customer Interviews, in-class presentation.
  - ▶ Student assessment:
    - ▶ rubrics for presentation scoring (use existing ones)
    - ▶ peer evaluation of effort and participation.
- ▶ Deployment and staging schedule
  - ▶ Duration of the module: planned 2 - 2.5 weeks, actually used 2 weeks
  - ▶ In-class sessions: planned 4-5 class periods, 75 min each, actually used 4 class periods
  - ▶ Out-of-class sessions: 2-3 LEAD sessions 1 hour each; none of them come
  - ▶ Number of stages: planned 2; actually used 2.

# Lessons learned during Module 2

- ▶ During this module, I learned:
  - ▶ Students demonstrate good skills on customer interview: 2-3 interviews per team
  - ▶ Students realize that practical systems experience a lot of impairment, and the AWGN channel model is too ideal to be true. All teams get to some details of antenna propagation.
  - ▶ Reinforced the learning by in-class exercise + paper-and-pencil quiz.
    - ▶ Have a deliberate mistake in the problem for in-class exercise to mimic a real world scenario: 10 Mbps (10 kbps)
  - ▶ Team work is really good. The intuitive types play bigger roles.
- ▶ Things to improve:
  - ▶ Better integration between the math calculation and interviews:
    - ▶ Ask questions about data rate, transmit power, receive power, and bandwidth during interviews;
    - ▶ Compute channel capacity and compare with the actual data rate;
  - ▶ Add more contents in the module: link budget and practical antennas.

# More information:

- ▶ ICE Workshops to transform curriculum
  - ▶ May 21-24 Dearborn, MI
  - ▶ June 4-7 Baltimore, MD
  - ▶ August 4-11 Denver, CO
- ▶ Online Resources
  - ▶ (Google KEEN unleashed) [engineeringunleashed.com](http://engineeringunleashed.com)
  - ▶ Register for free online