Electrical & Computer ENGINEERING

18-642:
Course Information
8/30/2018

http://www.ece.cmu.edu/~ece642/

ece642-staff@lists.andrew.cmu.edu

Carnegie Mellon University

Course Goals

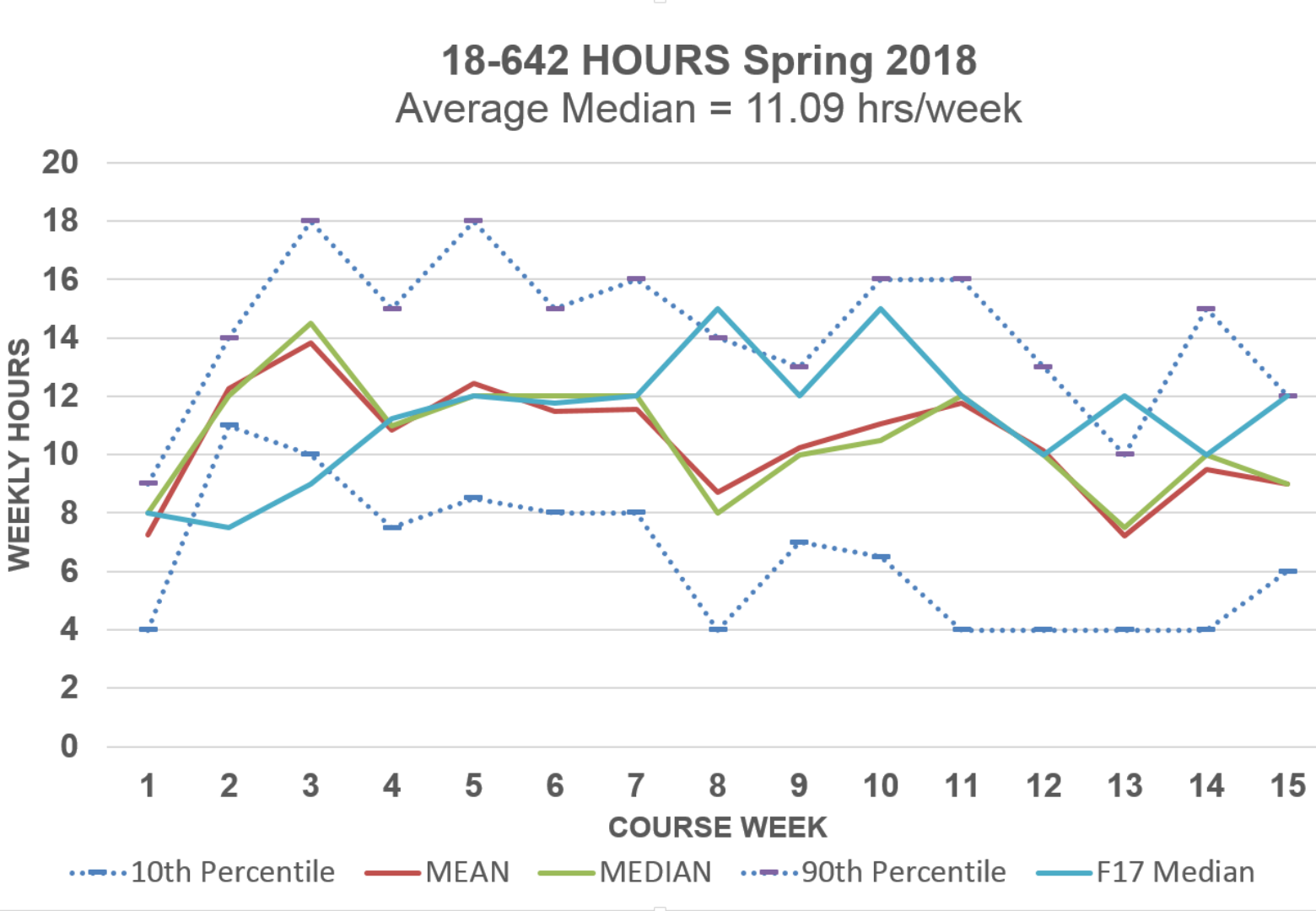
- **Embedded software engineering concepts**
  - Practical code quality
  - Practical, industry-strength software engineering process
  - Embedded System Safety, Embedded-specific Security
  - Generally, the things that grads from other schools don't know
- **Hands-on practice at applying concepts**
  - Software project material
  - Emphasis on improving software, not clean-sheet design
- **Learn how to think about embedded systems**
  - Homework & discussions to encourage critical thinking
- **NON-Goals (things that are not course goals):**
  - There is no embedded hardware platform (you should already have that experience)
  - Not about specific software technology; especially not about Android/IOS/Embedded Linux/…
  - Not about wireless networking, sensor networks, etc.
  - Not about complicated code projects, but is about good code hygiene

Electrical & Computer ENGINEERING

https://commons.wikimedia.org/wiki/File:CMU_Hamerschlag_Hall.jpg

Course Format

- **Thu Lectures (3-4 hours)**
  - Watch 1 or 2 videos BEFORE lecture
  - Generally two live lecture segments
  - Generally 2 in-class exercises
  - *Lecture attendance is mandatory*
    - Skipping will result in failing grade
- **Fri Recitations (1 hour)**
  - Discuss projects
  - Review homeworks
  - Answer questions
  - You should attend all recitations
    - Some aspects will be graded
- **Homeworks**
  - Individual answers to questions
  - Questions generally extend lecture topics
- **Projects**
  - Individual software assignments
    - Programming
    - Other related activities
  - Emphasis on small-scale but realistic experience
  - Emphasizes code quality (first half of course)
  - ***Cumulative work***


18-642 HOURS Spring 2018
Average Median = 11.09 hrs/week
WEEKLY HOURS
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
COURSE WEEK
10th Percentile
MEAN
MEDIAN
90th Percentile
F17 Median

Course Schedule

http://www.ece.cmu.edu/~ece642/

Links to: Handouts, HW, Videos, Projs

Fall 2018 Lecture Date	Lect. #	Live Lecture Slides	Recorded Lecture Slides	Video *Students -- View on Canvas BEFORE lecture this week.*	In-Class Exercise	Homeworks Due Following Wednesday Night	Project Due Following Friday Night
30-Aug-2018	1	Admin Info			C01: Self Intro Complete in class 30-Aug	HW #1 Due 5-Sep	Proj #1 Due 31-Aug
Week 1	2	SW Process				HW #2 Due 5-Sep	
	3		Course Topics Overview View video & do canvas quiz BEFORE class 30-Aug	Embedded Software Code Quality, Safety, Security		HW #3 Due 5-Sep	
31-Aug		Recitation 1					Proj #2 Due 7-Sep
6-Sep	4	Statecharts			C04: Statechart	HW #4 Due Sep 12	
Week 2	5	Requirements			C05: Requirements	HW #5	
	6		Human Coding Style	Code Style Humans		HW #6	
	7		Language Coding Style	Code Style Language		No HW #7	
	Visitor: Nikhil Kumar Rohde & Schwarz						
7-Sep		Recitation 2			Discuss HW #3		Proj #3 Due 14-Sep
13-Sep	8	Peer Reviews		Peer Reviews	C08: Peer Review	No HW #8	
Week 3	9	Unit Testing			C09: Test design	HW #9	
	10		Global Variables	Globals		HW #10	
	11		Spaghetti Code	Spaghetti		HW #11	
	Visitor: General Motors						
14-Sep		Recitation 3			Lightning Round: HW #6 Answers		Proj #4 Due 21-Sep
20-Sep	--	Self-Driving Car Safety				Oh Xkcd	
Week 4	12		Toyota UA Case Study	Toyota UA	C12: Self Driving Car Safety	HW #12	
	13		Stack Overflow	Stack Overflow		No HW	
	Visitor: Edge Case Research						
21-Sep		Recitation 4			Lightning Round: HW #10-3; #11-2a&b		Proj #5 Due 28-Sep
27-Sep	14	HLD & Architecture			C14 Sequence Diagram	HW #14	
Week 5	15	Integration Testing			C15 Another SD	HW #15	
	16		Testing & Quality	Testing & Quality		HW #16	
	17		System Level Test	System Level Test		No HW	
	Reserved for Kan Li						
28-Sep		Recitation 5			Discuss HW #12		Proj #6 Due 5-Oct & 12-Oct
4-Oct	18	SOA Isn't Testing			C18 Quality Metrics		
Week 6	19	Lifecycle & CM			C19 Version Proliferation		
	20		Traceability	Traceability		HW #20 (Exam Prep)	
	21		Date & Time	Date & Time	C21 Counter Rollover	HW #21 (Due week after exam)	
5-Oct					Discuss HWs #14-16		
11-Oct	--	Exam Review (Lectures #2-20) Based on HW #20 questions					
		Exam #1	<------		(Covers Lectures #1-20)		

18-Oct	22	Floating Point Pitfalls			C22 NaN Handling Example	HW #22	
Week 8	23		Process Key Metrics	Key Metrics			
	24		Maintenance	Maintenance			
	--	*Date & Time Stories (HW #21)*					
19-Oct		No Recitation	**Mid-Semester Break**				
25-Oct	25	Dependability		Dependability	C25 Serial & Parallel Examples	HW #25	
Week 9	26	Critical Systems		Critical Systems	C26 Critical Systems	HW #26	
	27		Safety Overview	Software Safety Overview			
	28		Race Conditions	Concurrency & Race Conditions		(Assigned next week)	Proj #8 Due 2-Nov
26-Oct		NO Recitation	2018 ONLY -- **CMU HOLIDAY / no recitation**		Discuss HW #22 (Skip for 2018)		
1-Nov	29	Safety Plan & Standards		Safety Plan	C29 Safety Techniques	HW #28	
Week 10	30	Safety Requirements		Safety Requirements	C30 Safety Regts	HW #30	
	31		Single Points of Failure	Single Points of Failure			
	32		SIL Isolation	SIL Isolation			
	Visitor: Frank Manchaca, SAE International						
2-Nov		Recitation			Discuss HW #25, #26		Proj #9 Due 9-Nov
8-Nov	33	Data Integrity			C33 CRC Selection		
Week 11	34		Redundancy Management	Redundancy Management	C34 Redundancy patterns		
	35		Safety Architecture Patterns	Safety Architecture Patterns		HW TBD	
9-Nov		Recitation			Discuss HW #28, #30		Proj #10 Due 30-Nov
15-Nov	36		Cryptography	Cryptography			
Week 12	37	Security Threats					
	38		Security Plan	Security Plan		HW #38	
	39	Security Vulnerabilities			C39 Project Peer Reviews		
16-Nov		Recitation					
22-Nov		No Lecture	**Thanksgiving Break**				
23-Nov		No recitation	**Thanksgiving Break**				
29-Nov	40	Security Mitigation & Validation				HW #40 (Exam Prep)	
Week 13	41		Security Pitfalls	Security Pitfalls (This includes a review of previous concepts)			
	Security Failure Stories (HW #38)						
30-Nov					Proj #10 Status Check		
Dec		Exam Review (Lectures #21-41) Based on HW #20 questions					
	=>	**Exam #2**	<------				

Everything except test dates subject to change

In-Class Participation

- **Attendance is required**
  - Missing a couple classes affects your grade
  - If you miss more than three (25%), no course credit

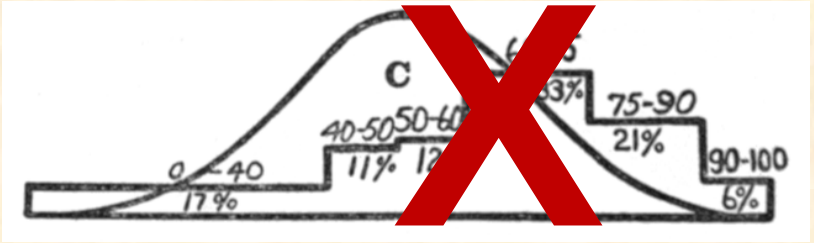
https://www.flickr.com/photos/xverges/3092873536

- **Everyone is going to have to stand up and talk in front of class**
  - Presenting class exercise results
  - Presenting homework answers
  - “Randomly” selected for 1-3 minutes at a time
  - Multiple students at each lecture & recitation

- **These are low-stakes presentations**
  - Preparation is not expected beyond being able to talk about your own homework
  - Emphasis on good faith participation, not perfection
  - Expectation is adequate English & improvement over semester

Grading

- **100 point straight scale**
  - A = 90% and above; B = 80%; C = 73%; below 73% is failing
  - No “curving.” Everyone can get an A. Or not.
  - Grades normalized (e.g., all homeworks have same weight)
- **Video Lectures: 10 points**
  - Watch video & complete quiz BEFORE class; NO free “late”
- **Homework: 10 points**
  - Due Wed night week AFTER class. (Hand in by ~6 AM Thu morning) 3 free “late”
- **In-Class Work: 10 points**
  - Hand-in DURING class. (No freebie misses) Submit only if you are in class (it is, in part, an attendance grade)
- **Programming Projects: 20 points**
  - Due Fri nights. (Hand in by ~6 AM Sat. morning) 1 free “late”
- **Tests: 2 @ 25 points = 50 points**
  - Multiple choice. Historically mean test grade about 80-85%
  - You can bring a single notes sheet of letter size paper in your own handwriting
- **Late penalty: 10 percentage points per day; max 50% penalty**
  - Applies to video, homework, projects. NO late in-class work, tests.



https://commons.wikimedia.org/wiki/File:PSM_V78_D408_College_grade_distribution_and_frequency_statistics_9.png

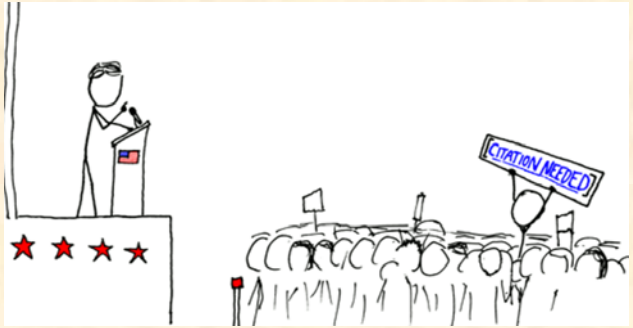
Homework & Projects

- **Homework**
  - Each homework corresponds to a lecture topic
  - A few general questions, which might have sub-parts
  - Recitation includes some homework presentations
    - Homework hand-in format is slides (PPT, PPTX, PDF)
    - Bullet format is OK
    - First homework will establish format and set expectations
- **Projects**
  - Mostly code modification & other hands-on activities
    - Some non-trivial programming, but emphasis is on *code quality*
    - **Projects build upon each other;** slacking off early will hurt you later
  - Will use Robot Operating System (ROS) module as an example, but not ROS-heavy
    - Mostly about code quality and design; projects not specifically about security/safety
  - More about this at recitation on Friday

https://openclipart.org/detail/3020/space-pioneers-135

Academic Integrity Overview

- **Zero-tolerance policy for cheating**
  - **Failure in course for first offense of cheating**
    - Yes, we are serious
  - Per CMU policy, both giver and receiver equally guilty
- **What's *not* cheating?**
  - Asking course staff for help
  - Using an acceptable resource *and citing it* (e.g., give us the URL)
    - See next slide for "acceptable resource"
    - **OK:** materials on the course web page/course Canvas account with no citation
  - Asking your friends for help with background activities
    - Understanding what the lecture was saying
    - Understanding *what* the assignment wants you to do (*not how* to do it; *not the answer*)
    - Help with getting tools, infrastructure, and so on running
      - » But not doing things for you if doing that thing is a project assignment



https://en.wikipedia.org/wiki/Randall_Munroe#/media/File:Webcomic_xkcd_-_Wikipedian_protester.png

Academic Integrity: Acceptable Sources

- **Published material, including WWW, is OK *if ALL of following are met:***
  1. **You make substantive changes or addition**
     - *Changes demonstrate mastery of material*, not just cosmetic/superficial changes
     - Reword and summarize what you find in your own words and give a citation.
     - **Not OK:** simply changing variable names and line ordering on code you got somewhere
     - **Not OK:** block quote copy & pasted from a source unless that is what we asked for
       - » **OK:** pasting a news photo or news article in response to "show us a news article"
  2. **Sources are *NOT* connected to or responsive to this course**
     - **OK:** blog posting that describes a general technique
     - **Not OK:** homework solutions for 18-642 at a "study guide" or help site
  3. **It's not Wikipedia or similar non-authoritative source**
     - Wikipedia is OK for informal orientation, but is not a citeable source unless we say OK
     - **OK:** It's fine to use Wikipedia references as a *starting point*
     - **Not OK:** fraudulent citation, including using Wikipedia summary instead of primary source

Academic Integrity: Concrete Cheating Examples

- **Not OK: Using a previous-year solution as a starting point**
- **Not OK: Using another current-year solution as a starting point**
- **Not OK: Using on-line 18-642 "study aid" resources as a starting point**
- **Not OK: Working with a group on homeworks/projects unless we say to**
  - Homework questions generally graded on "good try"; often there is no single right answer
  - **OK:** study group about concepts *before you start* your homework; before-test study groups
- **Not OK: Accepting step-by-step instructions from another student**
  - Especially bad if this is done verbally to skirt "copying" rules
  - We can tell if you copied, even if it is white-washed or laundered help
- **Not OK: Submitting in-class work when absent, signing in for another student, etc.**
- **Not OK: Test cheating**
  - Using electronics of any kind during a test (no calculators, no smart watches, etc.)
  - Looking at another student's paper during a test
  - Communicating with anyone else during a test other than course staff

Other Polices

- **E-mail to: ece642-staff@lists.andrew.cmu.edu**
  - E-mail direct to instructor or TA might not be read
  - Only e-mail administrative issues, not substantive technical questions/“doubts”/etc.
    - Go to office hours for help understanding course content, homework, project
  - OK to e-mail about infrastructure problems so we can fix them
- **Please be on time to class**
  - Come prepared. Generally you’ll need a laptop or tablet.
- **OK to eat if you need to, but**
  - No noisy/messy/smelly food. NO potato chips, crinkly bags/wrappers.
  - Clean up after yourself -- leave classroom clean, or we’ll lose this
- **Mobile devices must not intrude on classroom**
  - In general, only use electronics directly in support of the class activity
- **No recording, streaming, live-tweeting, etc. of the classroom**
  - Course materials (e.g., handouts) are copyright by instructor; no redistribution
- **See CMU Academic Integrity policy: https://www.cmu.edu/academic-integrity/**

https://commons.wikimedia.org/wiki/File:Alice_par_John_Tenniel_02.png

Special Circumstances & Wellness

- **If you have a special need, let us know the first week of class**
- **If we're doing something that's a problem let us know**
  - Anonymous e-mail is fine if you prefer
  - Paper note under instructor door is also OK
- **If you're experiencing a problem, let us know**
  - You might be surprised about the ways we can help
  - Come to us sooner, not later
    - Not much we can do in last week of class
- **If in doubt, ask us**
  - Especially regarding academic integrity policy
    - Honest mistakes can be corrected if you're acting in good faith

https://pixabay.com/en/cold-ill-fever-thermometer-1972619/

Course Resources

- **Course web page** https://www.ece.cmu.edu/~ece642/
  - Course schedule with on-line copy of lecture slides
    - Video pointers to segmented Youtube videos. Canvas points to all-in-one-file videos.
    - Last semester : https://users.ece.cmu.edu/~koopman/lectures/index.html#642
  - Links to homework assignments & project assignments
  - Official course policies & FAQ (you are responsible for reading these)
  - Canvas used for announcements, hand-in, video quizzes, other administrative matters
- **CMU computing infrastructure**
  - Lab computers & servers for course projects (covered in recitation)
- **WWW**
  - Finding homework answers on Web is OK so long as done properly
- **Course staff**
  - Instructor: office hours after class and by appointment
  - TA office hours will be posted on Canvas

WAIT LIST UPDATE

- **As of the weekend:**
  - Course Capacity: 64
  - Historically most, perhaps all will get in
    - Prioritization based on department, program, class year, etc.
  - Issues with recitation section balancing and timing
    - We'll update this as we have more info (see e-mail & Canvas)

- **Make sure you have signed in to attendance**
  - Add your name if it's not there; be sure to include Andrew ID!
  - **Preference given to students who actually show up to class**

Questions?

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