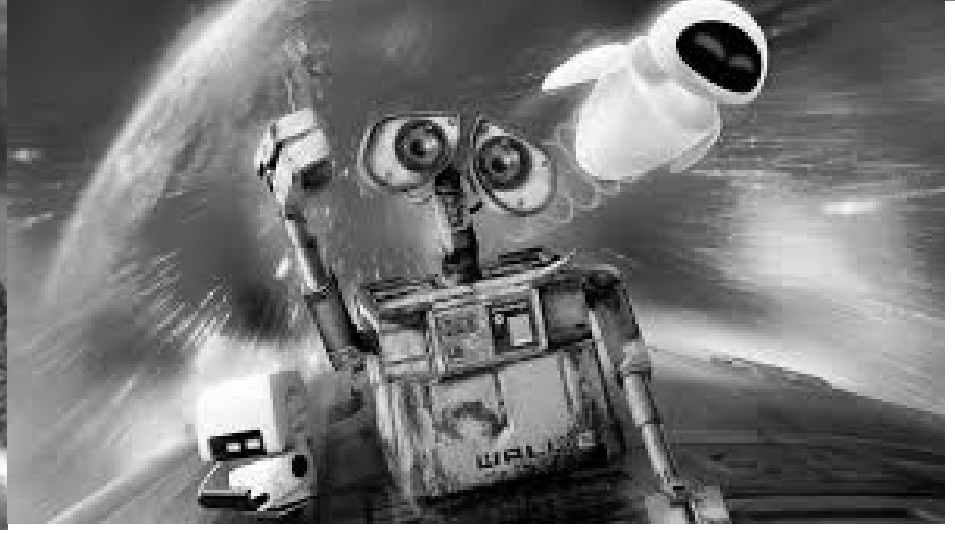
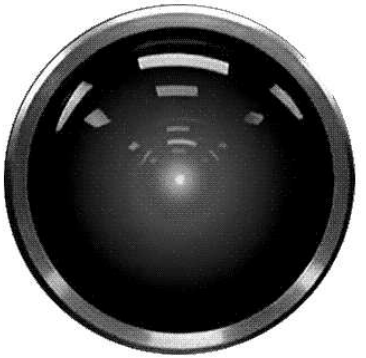
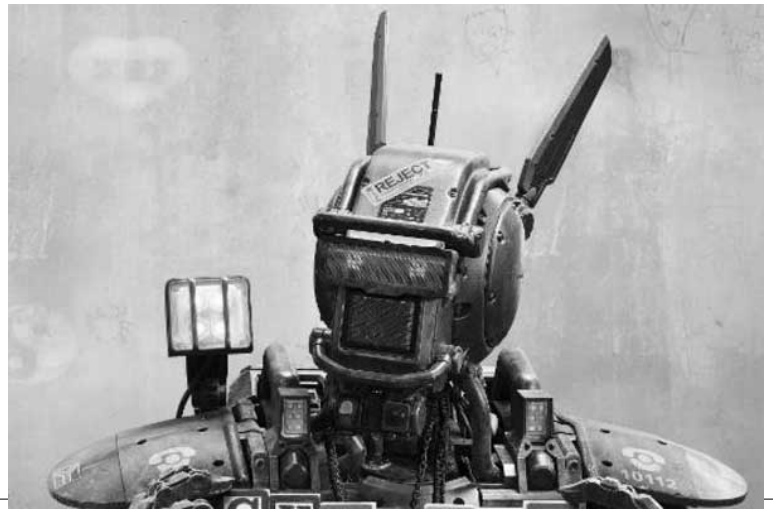




Welcome to CMPT 433
Embedded Systems

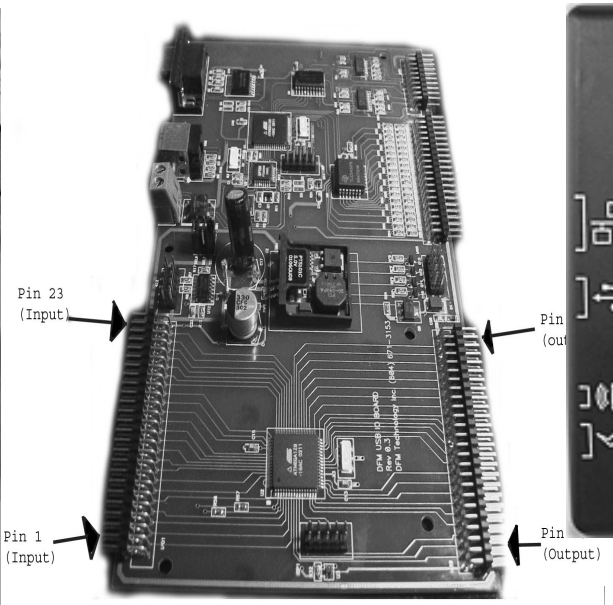
Topics

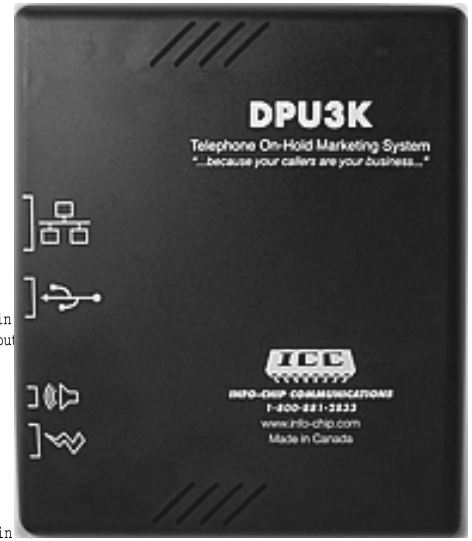
1) Introductions
2) What's an embedded system?
3) Course overview
4) BeagleBone & Zen Cape preview

Who’s Dr. Brian?

Dr. Brian (Fraser) (he/him)

- I love questions and feedback!





About Me

- Love Teaching: I can help share my excitement for programming, and for making the world a better place.
- Degrees: BSc & PhD from SFU (AI)
- Favourite Video Game:
  StarCraft 2, WoW, Elite Dangerous, Mario Kart
- Family: Married with 2 girls (8y & 10y)
- I recognize that I am privileged to be in my position with many advantages afforded to me throughout my life.
  - I work to build a positive inclusive experience for everyone.

Course Expectation

- Only one thing
  - Use a positive tone for all communication (asking questions, on Piazza forums, with TAs)
  - Anon trolling hurts and won't be tolerated
  - Students have wide range of backgrounds; respect it
- If sending a message
  - Give a little context (class, your name, topic, ...)
  - Email: If you are sending more than 2 per week on average, over multiple weeks, it may be too many.

Guide to Slides

- Slide Colour Guide (often...):
  - Green: headings.
  - Yellow: Highlighted text.
    - This course has no exams but some quizzes.
  - Blue: Term being defined.
    - Hour: 60 minutes.
  - Sweep-in Text: Blanked out text.
- Joke:
  - There are 10 types of people in the world...

What is an embedded system?

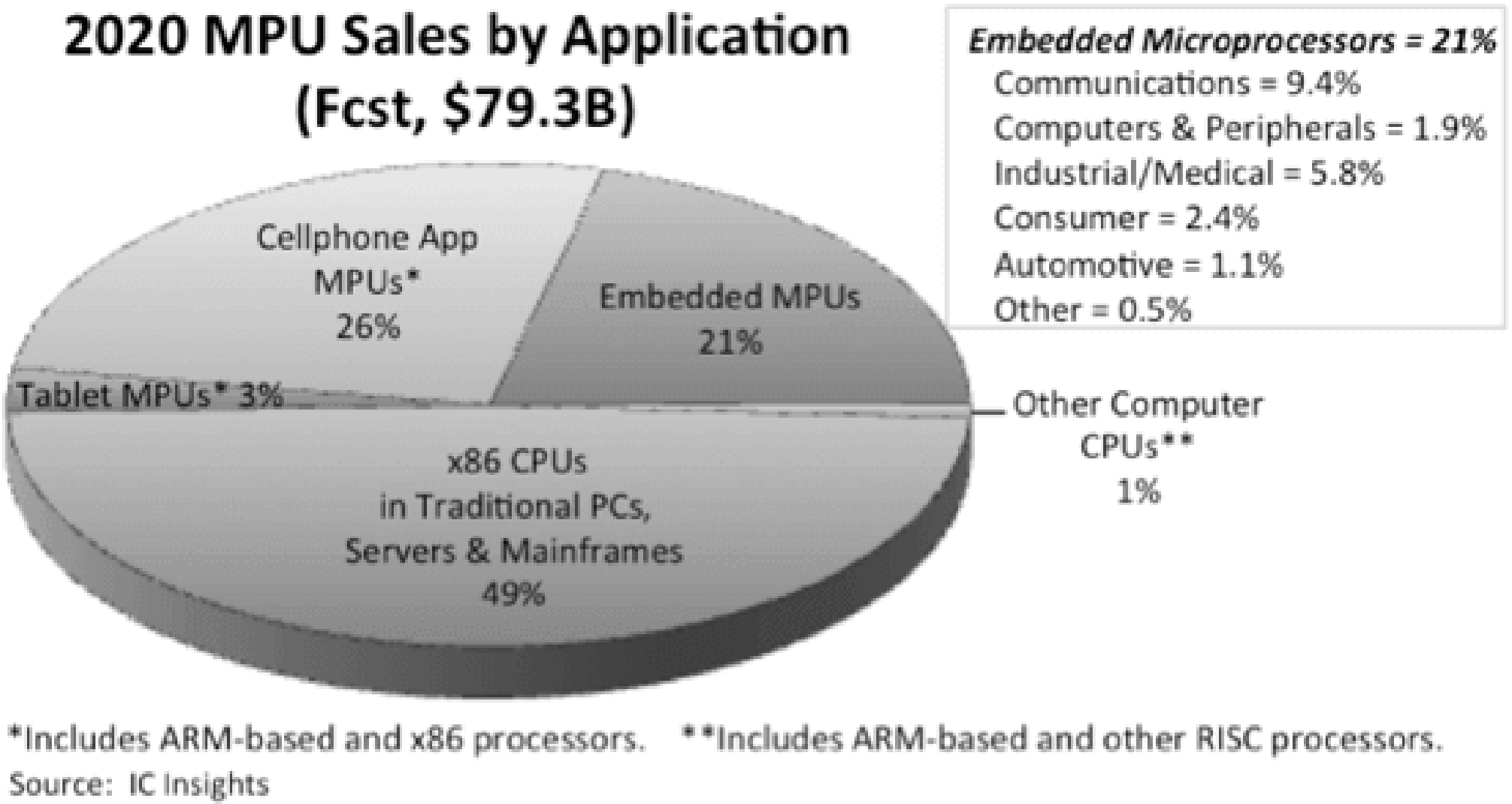
What is an Embedded System?

- Embedded System:
  - A Computer system designed to do...

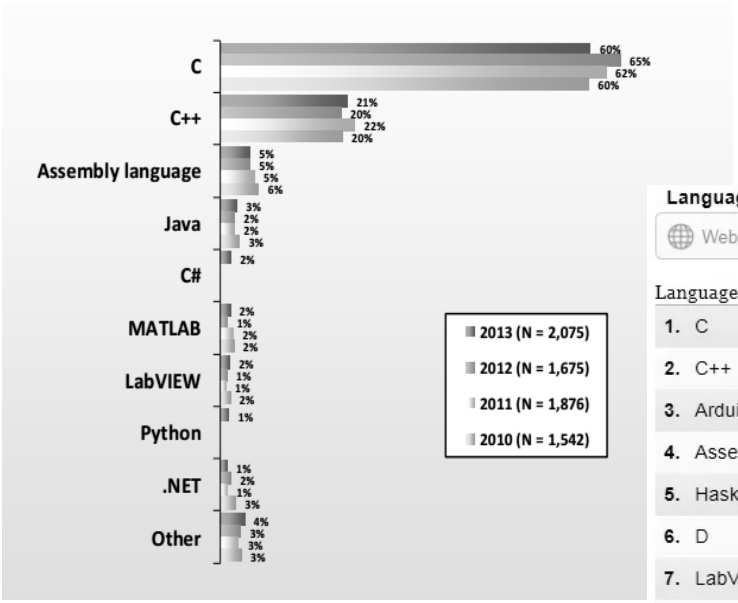
    (wikipedia).

  - Usually does not have a keyboard, screen, mouse.
- Spectrum of Examples:
  - Controller in an AA-battery recharger.
  - Controller in a laser printer.
  - Air-quality controller on international space station.
  - Control software in an autonomous vehicle.

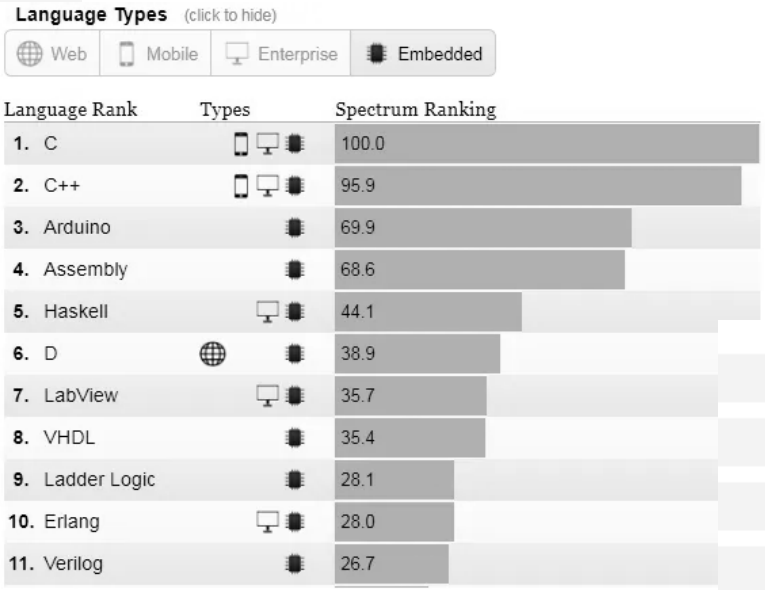
Inspirational Statistics - $ CPU Sales



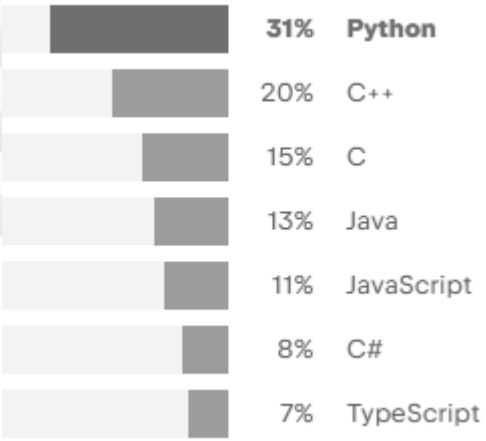
Inspirational – Language Choice for Embedded



From ~2013



IEEE ~2016

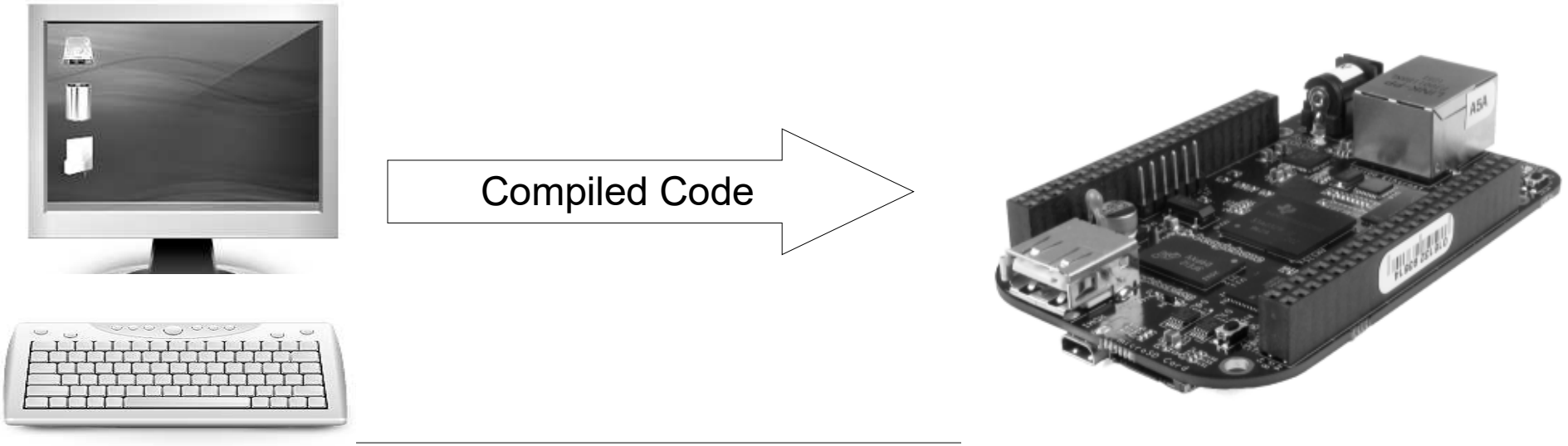


Jet BRAINS (2023)

http://images.content.ubmtechelectronics.com/Web/UBMTechElectronics/%7Ba7a91f0e-87c0-4a6d-b861-d4147707f831%7D_2013EmbeddedMarketStudyb.pdf
https://deepbluembedded.com/programming-languages-for-embedded-systems/
https://www.jetbrains.com/lp/devecosystem-2023/embedded/

Embedded System Development

- Cross-compiling:
  - Development done on the PC using powerful tools: editor, compiler, debugger, etc.
  - Compiled code...



Discussion

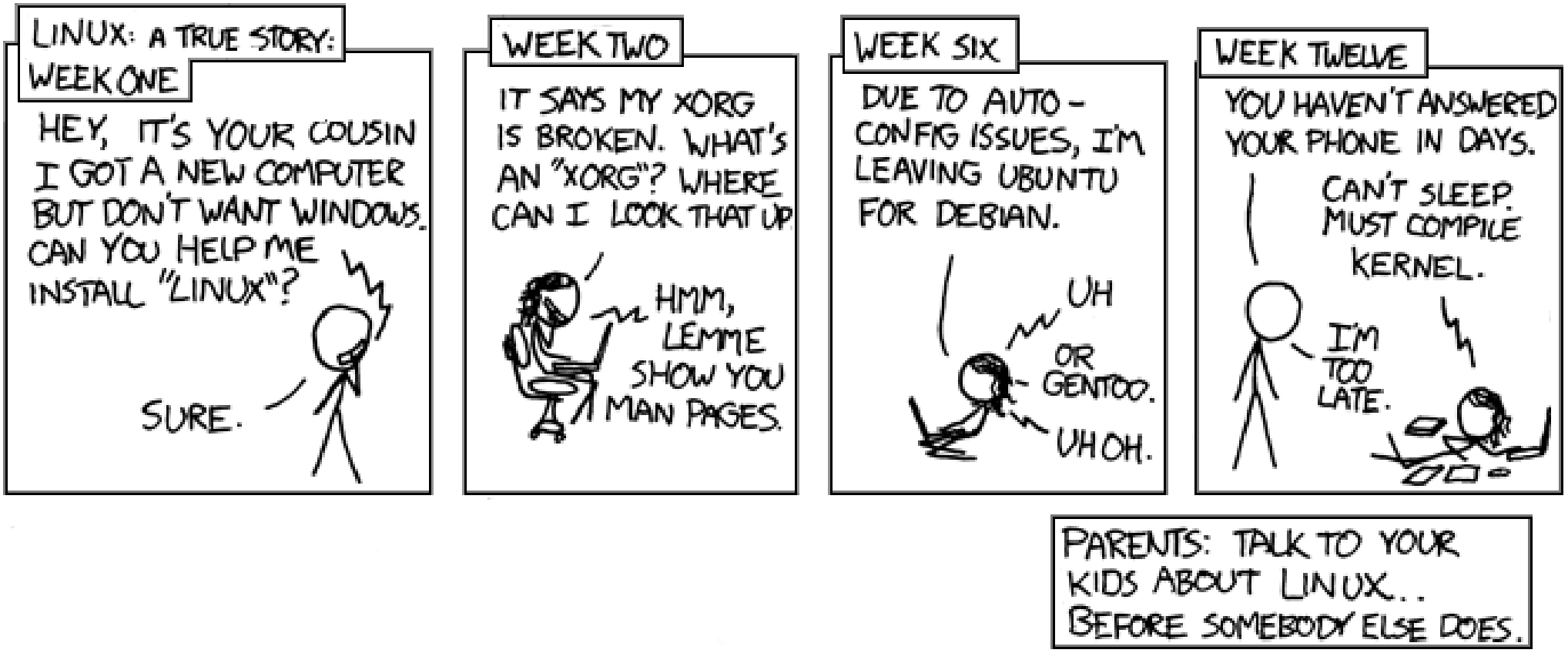
In groups of 3 to 4 people:
- Exchange contact info (email / Discord / ...)
- Answer the following:

1. What are 5 different embedded systems in your rooms right now? Which is most interesting?

2. What one computer failure could be most life critical? Is it an embedded system?

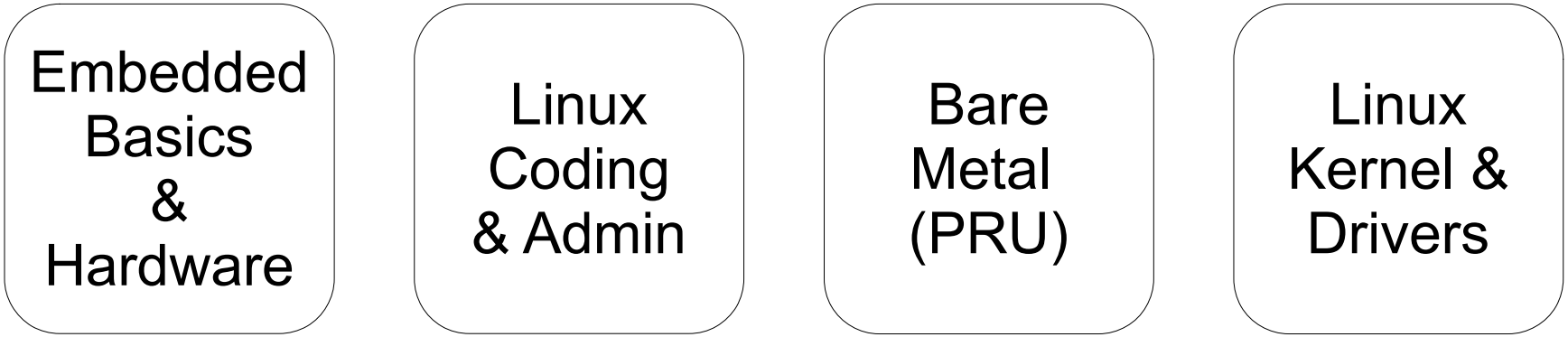
3. What is the best or worst thing an embedded system could be used for?

Course Overview



Course Overview

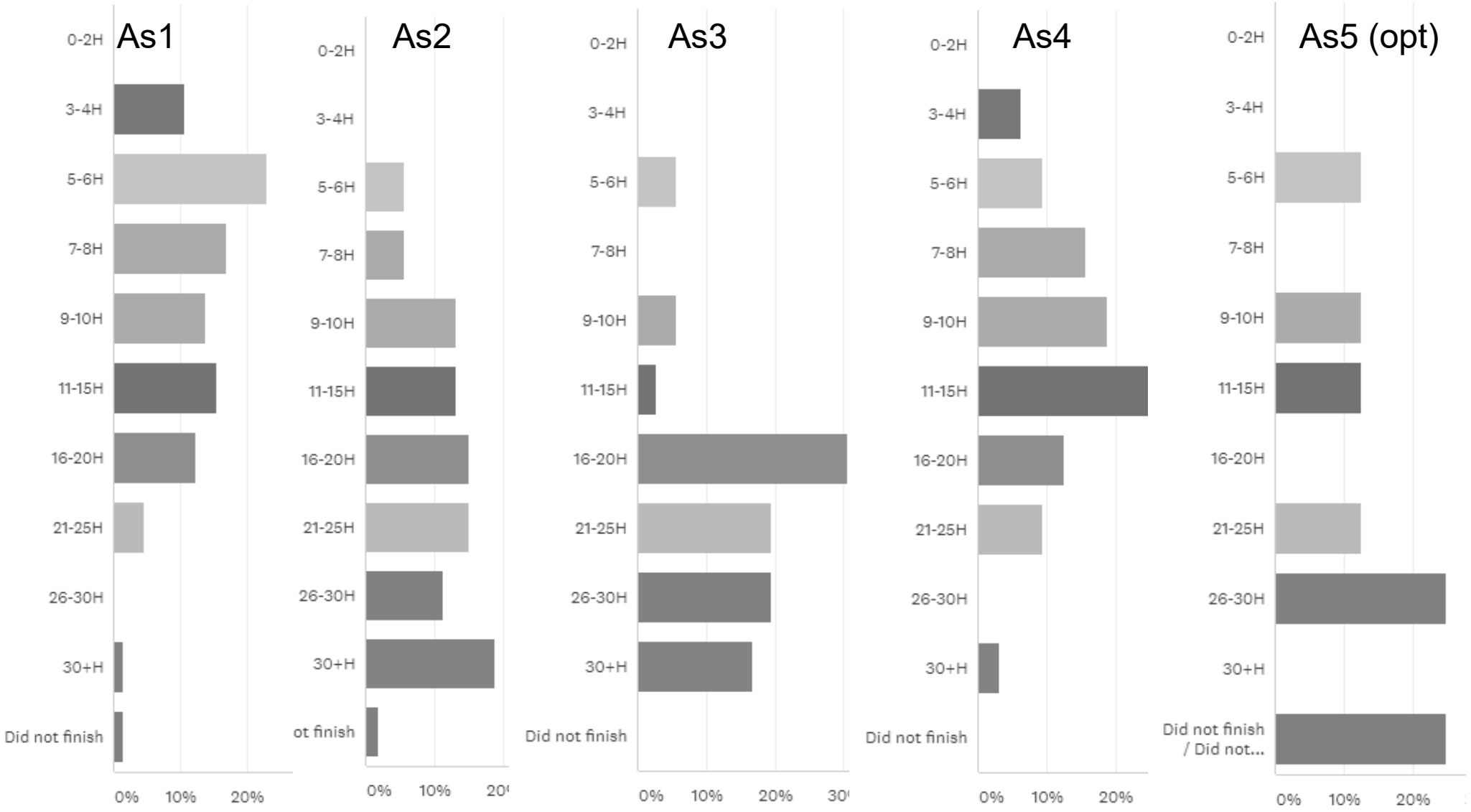
- Goal
  - Qualified for junior embedded software developer.
  - Course mostly...
    - *May* spend hours solving build issues, and downloading code to device.
- Course Components



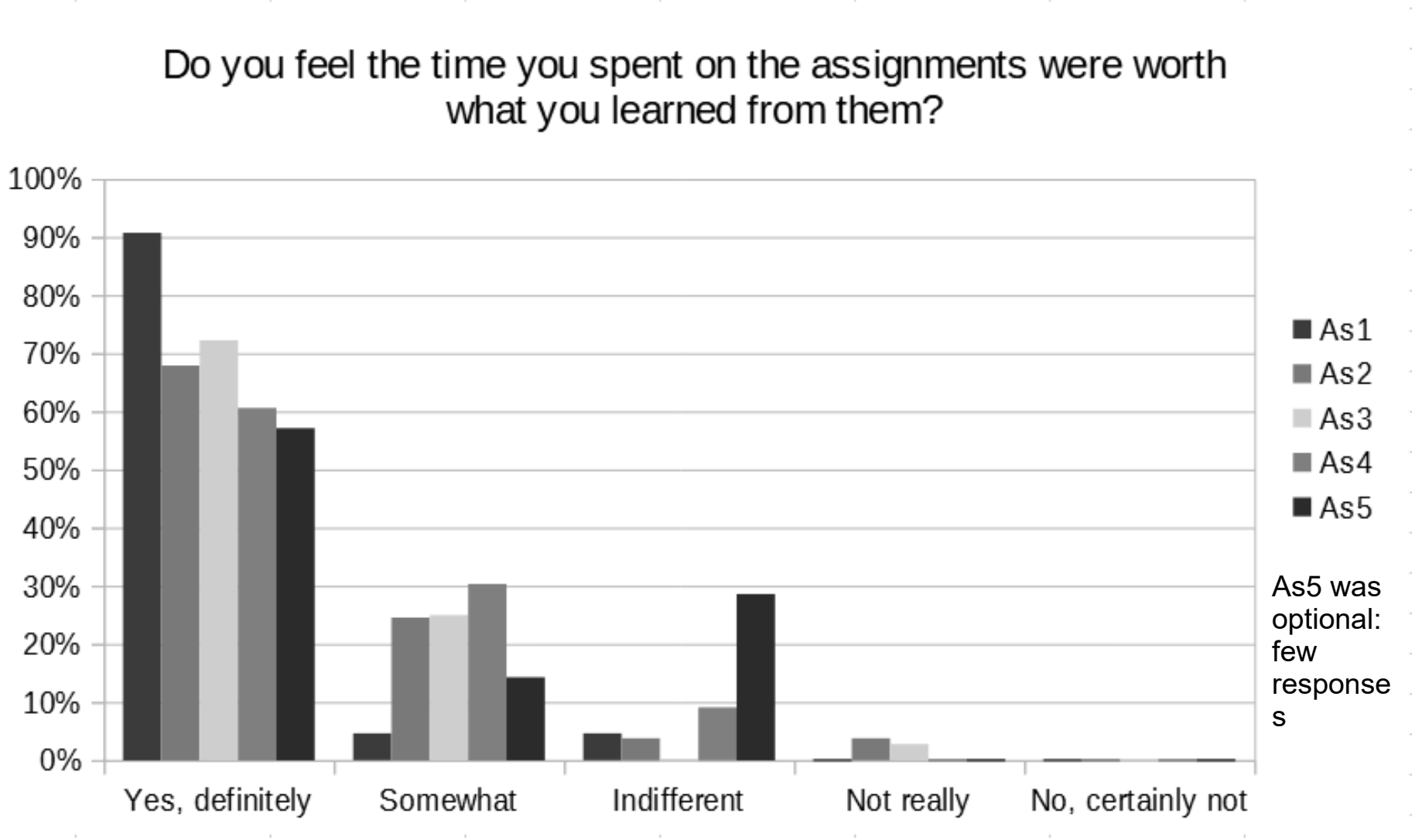
What to expect

- Previous students have found this course:
  - very rewarding to do so much hands-on, and
  - very time consuming to do so much hands-on!
- So be ready for:
  - A **lot** of C/Linux programming
  - Steep initial learning curve working with real HW
  - Group work
  - Spending good time on this course each week.
- Stay on top of assignments and how-to guides.
- Submitted code may anonymously be discussed in class

Hours spent working on assignment (2021 Spring)

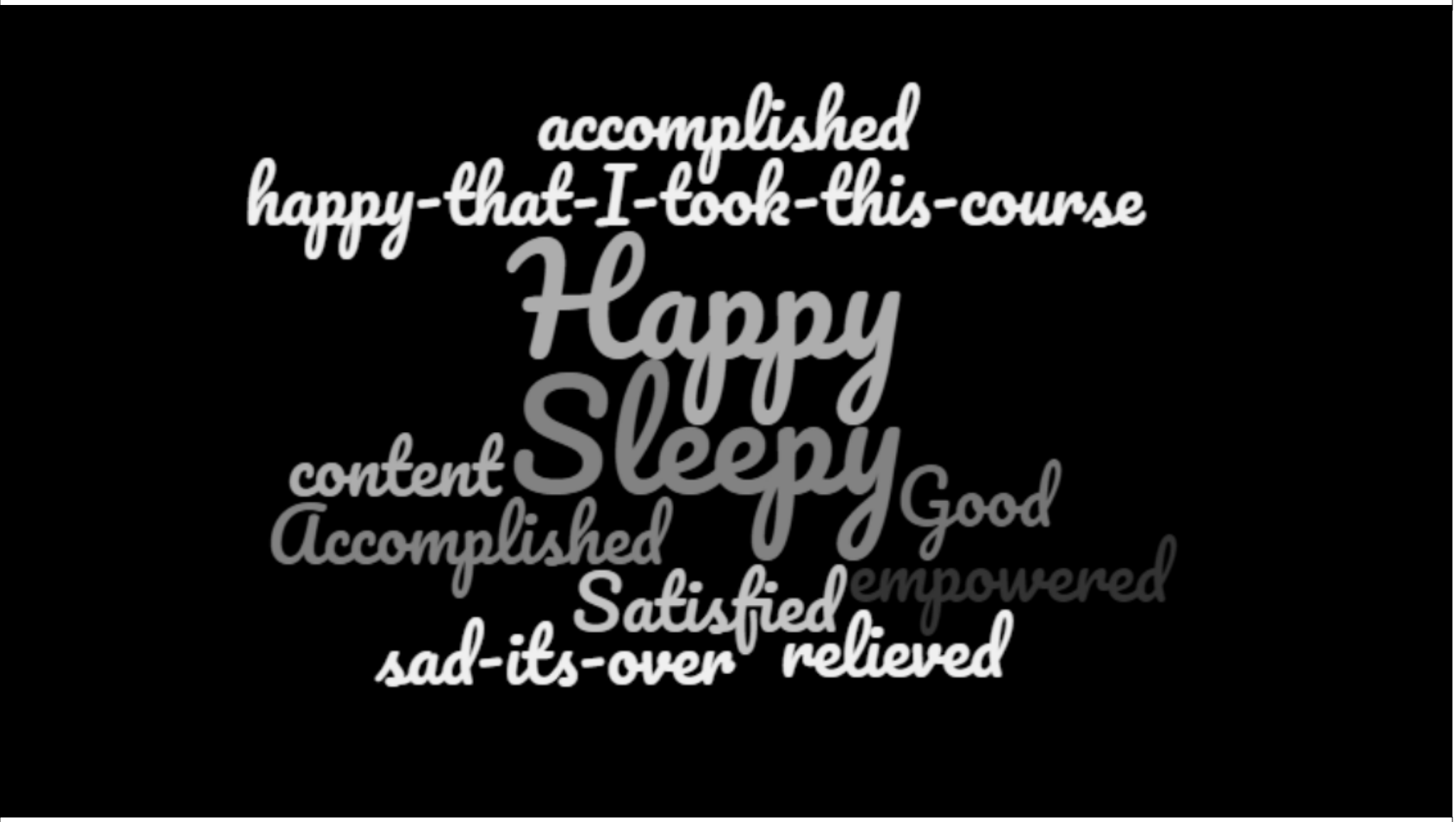


Learning worth the time (2021-Spring)



As5 was optional: few responses

How students felt at end of term-2021 Spr

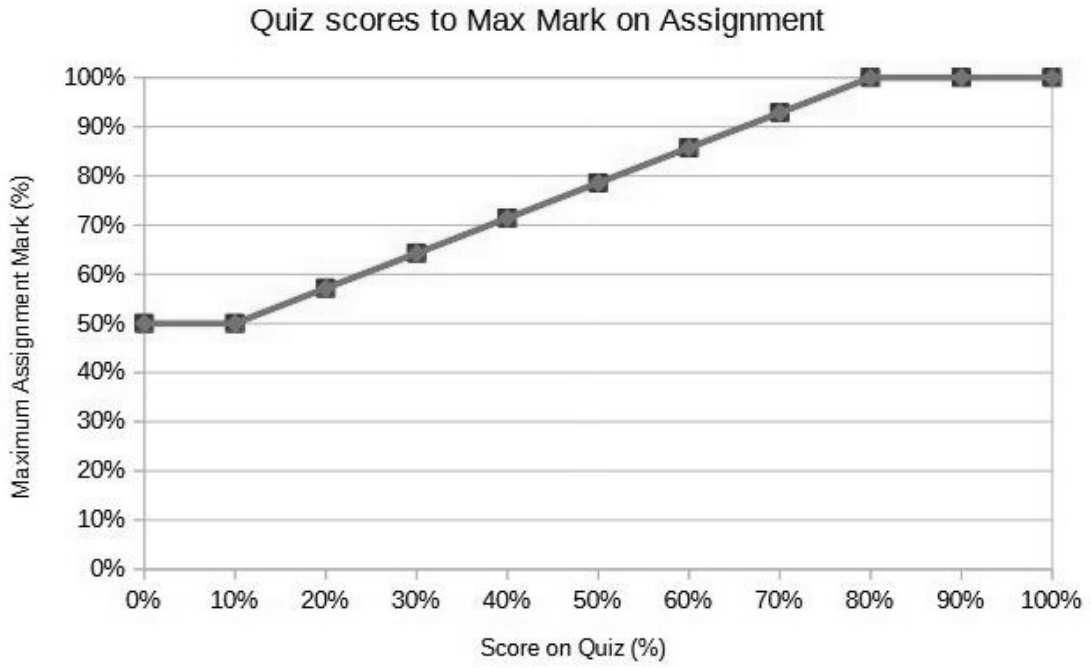


Admin Review

- Assessment
  - Assignments 40%: Individual/pairs to learn skills
    Anon code reviews in class may feature your code!
  - Quizzes 35%: Set an upper bound for assignments (...)
  - Project 25%: group (3-4) to accomplish more
  - Grade breakpoints (“% for B+?”) may be non-standard
- Academic Honesty
  - I am *passionate* about proving
    who did their own work.
  - Corollaries:
    - I'll give you credit for the work you do.
    - I'll catch those who don't do their own work.

Quiz Score Limits Assignment Mark

- Goals
  - Encourage everyone to learn from the assignments.
  - Allow working in pairs, reasonable use of AI
- Mechanism
  - Heavily weight assignments
  - Each assignment has a quiz
  - Quiz score sets an upper bound for the assignment
- Ex: 60% on quiz sets max grade to ~85%

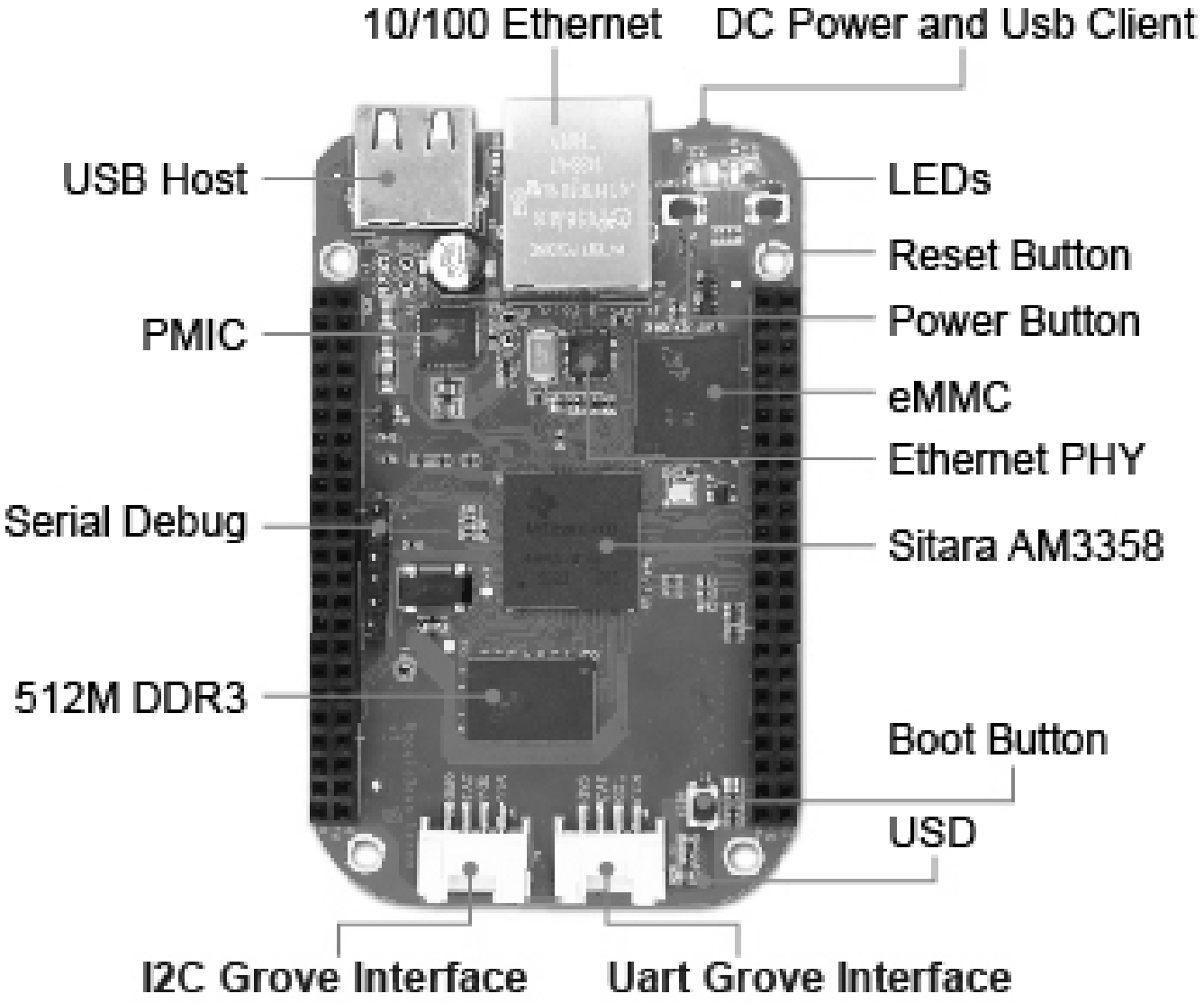


Policies

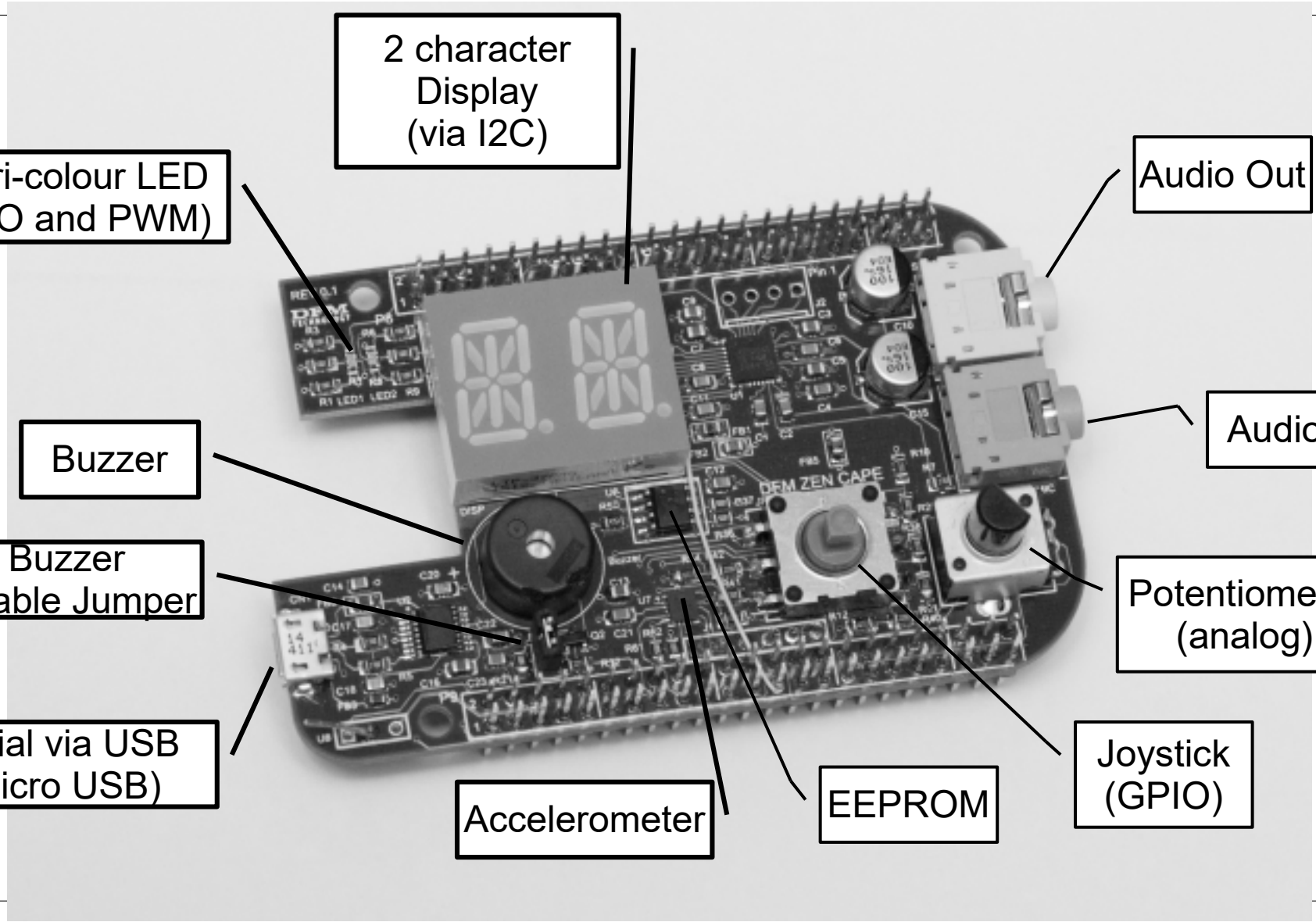
- **Assignment Late Policy**
  Assignments may be turned in up to 4 days late with 0% penalty. Later than this is 100% penalty (60 minute grace period). Contact the instructor if there are extenuating circumstances.
- **Extensions and Deferrals**
  Request a concession via the Faculty of Applied Science's Concessions form. Doctor's notes are *not* required if sick. Extensions only considered for circumstances beyond the student's control; plan to submit assignments on time.
- **Academic Honesty**
  - The MOSS tool will be used to check the originality of all electronic submissions.
  - SFU's Academic Honesty policy is crucial to earning credit in this course. Violations of the policy will be taken seriously and reported to the department and university.
  - Explanation of penalties applied for academic dishonesty.
- **AI Policy**
  - Students may use AI tools (such as GitHub's Copilot, or ChatGPT) to *support* their programming.
  - You must do the high-level design yourself and be able to write all submitted code on your own (even if you used help from the AI).
  - You should use the AI to code no more than a few lines at a time: do not have it write all lines of code.
  - You must add a comment to any functions that you used the AI's help to write more than 5 line of code.
  - Code written exclusively by, or with the help of an AI system is still governed by the academic honesty policies of the course and university. If a significant number of lines of code, or detailed/critical code is found not to be the student's work, then that work will get a zero. If the copied code was not cited correctly (from either a human or AI source) then it will be considered a case of academic dishonesty and the entire assignment may get a grade of 0 and a report on file with the university.

Hardware Package

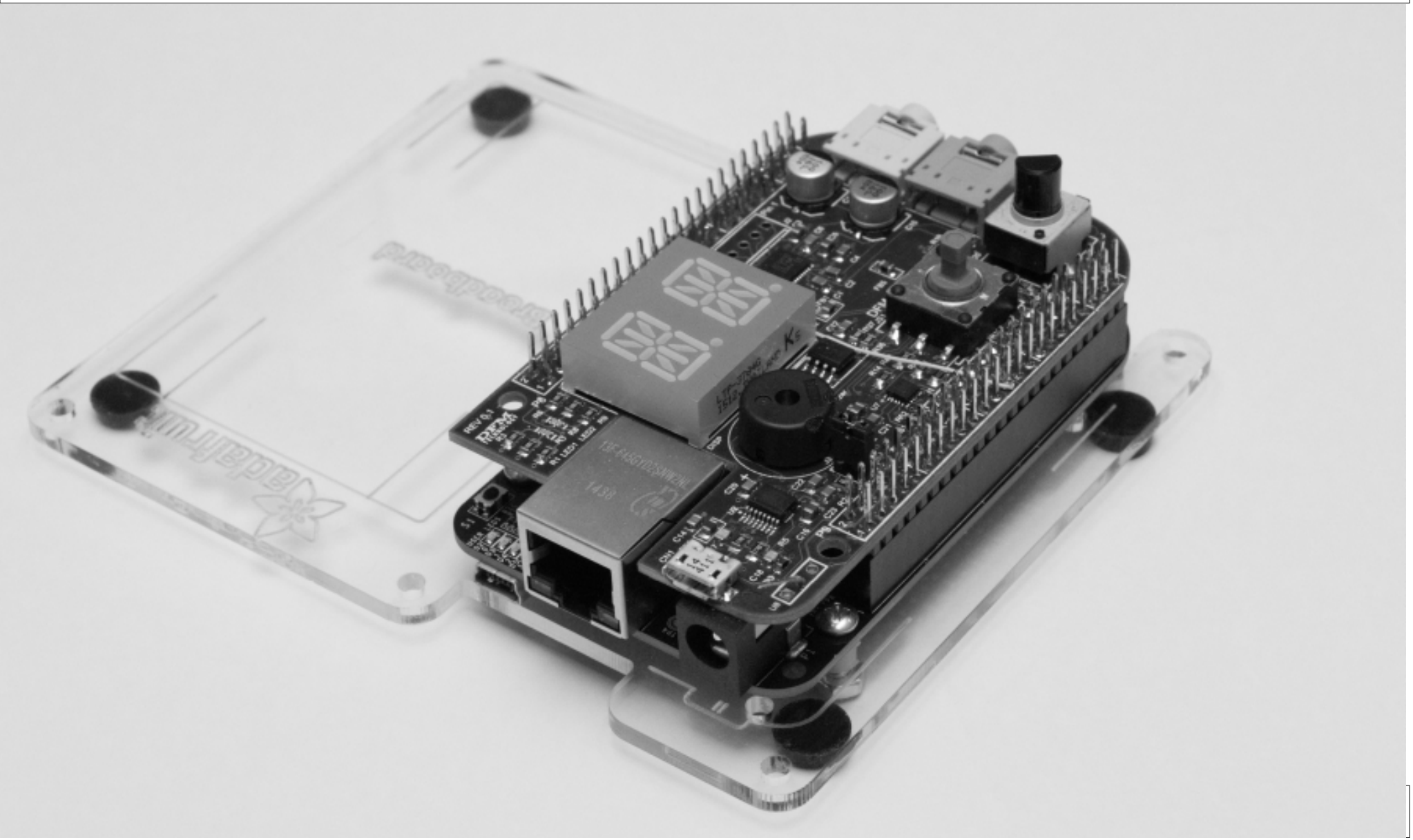
BeagleBone Green (BBG)



Zen Cape (Green or Red)



BeagleBone & Zen



Logistics

- Buying a Board Package
  - About $200 - $250; Package includes:
    BeagleBone, Zen cape, mounting board, 8-pixel display, anti-static bag, USB cables, electronics, box.
  - Billed directly to student accounts.
  - Pickup on this Wednesday (hopefully) or Friday
    Afterwards able to pickup during office hours
- Booster Pack
  - If using a previous kit, this year we have added the 8-pixel display. I will have a “booster” pack available for sale.
- Academic Honesty
  - Each student must have own board:
    sharing encourages *too much* cooperation.

Demo

- BeagleBone Black Demo
  - Boot & show in terminal
  - Linux commands: ls, cd, echo
  - Blink LEDs
  - Ethernet ping / web server

Summary

- Course is hands on:
  - Learning skills, not so much theory.
  - Expect to spend quite a bit of time figuring things out