# ECE 471 – Embedded Systems
# Lecture 34

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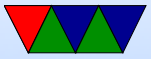
3 December 2025

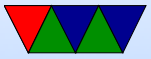
# Announcements

- HW#10 due Friday, will post solution after due date
- Project presentations start Friday
- Please return borrowed hardware.
- Don't forget course evals



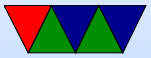
# Hand Back and go Over Midterm

- Average was 92%



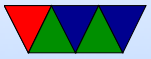
# Final Preview

- Monday, December 15th, 12:15pm - 2:15pm (Barrows 125)
- Can have one page (single side) notes 8.5"x11"
  There will be an energy question with some math, so you can use a calculator if necessary
- Is cumulative for whole class, but concentrates on material from latter half of class. *No assembly language*
- Know the definitions of an embedded system and be able

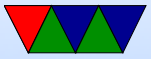


to say if a certain machine meets them.

- Know hard/soft/firm realtime
- Know the benefits/downsides of an operating system
- Security/Code Quality – mostly be aware of what things can go wrong if you are not careful when coding
- Embedded busses – know the relative tradeoffs between i2c, spi, and 1-wire. Mostly speed, distance, number of devices
- Power/Performance like HW10
- Give you some C code from one of the homeworks, comment it



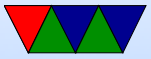
# HW#9 – Review



# HW#9 – Code

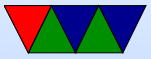
- C code review
- Do note, it's an LED display not LCD
- Error checking. Be sure not to segfault if dev not there!
- Heisenbug if not init buffer[0]
- How do you convert from float to decimal?
  - 45.9 print as 45.8?

    Floating point math is a pain! What do you get if you do `int result=10*(45.9-45);`? 9.000000? Print more digits 8.999999999999857891452847979963 for

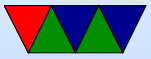


fp to int conversion just drops the floating point part, doesn't round

- Following a spec?
  - Corner cases
  - should shutdown_display() clear the display? Maybe, makes it harder to grade.
  - Single-digit temps, be sure to remove leading zeros
  - sig-figs for -1.0
  - right justified?
  - is Zero negative?
  - Rounding

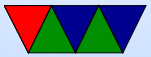


- Do you need a . after a three digit temp?
- Left/right justified for single digit
- Oddly placed minus sign
- Reporting error! Must be sure display not printing invalid info! (door on walk-in oven. If it goes from 70F to 1000F (off scale) between readings, don't want it to stay at 70F, you want ERR or HOT or some way to notify something is wrong) More realistically, probe wire broke, should it just report last reading? Or maybe go blank?



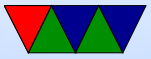
# HW#9 – Questions – General

- Test inputs: try to have one in each case. Also might be nice to check each digit 0..9 to make sure those are all printing well.
- List an *example* of poorly written embedded code.
- Why write good code?
  Cut-and-pasting, good practice, among other reasons.



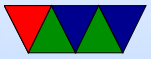
# HW#9 – Questions – Timestamps

- Why is touch useful? force make to rebuild



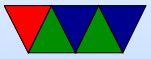
# HW#9 – 2038 problem

- Had to update assignment, can't trigger this if running 64-bit system
- Time in Linux/UNIX is seconds since 1-1-1970
- Around 1.76 billion (December 2025)
- Not a problem 64-bit machines, but signed 32-bit integer overflows in January 2038 for 32-bit.
- Can avoid with a 64-bit system or else a specially patched Linux system
- ** discuss y2k problem **



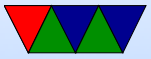
due to a lot of behind-the-scenes work the worst problem year 19100 on websites

- Problems like this crop up all the time with computers
- Note: tar can't handle timestamps out of range (?)
  Also ext4 filesystem seems to only handle 1901-2466



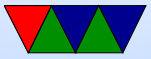
# HW#9 – Timestamps

- ctime – last status (metadata) change (originally create time) things like permissions change, ownership change, rename
  mtime – last modified (this is what `ls -l` shows)
  atime – last access
- Returned by `stat` syscall/command
- Why atime bad? Changes read to a write
  Unnecessary writes bad. Spin up disks. On flash storage might need to re-write entire block even if change just



timestamp.
Linux have noatime, relatime options

- `utime()` used by touch. Changes atime and mtime, Cannot change ctime, set to current time
- why not believe timestamp? maybe could look at ctime. also set clock back if own machine.
  HW assignment at Cornell



# Gave Sample Presentation of Chiptune Player

- Hopefully it worked this year
- The slides from this are on the website, with the project info