

CS 240: Programming in C
Lecture 26: Interfacing with Hardware

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Announcements

- Course Evaluations Available
- Homework 13 Extra Credit
- Lecture Wednesday will wrap up networking and include final exam review and discussion
 - Last lecture

Final Exam

- Thursday, May 8
- 10:30am – 12:30pm
- ELLT 116 (Main Auditorium)

Final Grade Computation

- Grade cutoffs may be adjusted at the end of the semester, depending on distribution
 - Will not raise them (90/80/70/60 A/B/C/D) is guaranteed
 - Often lower the C cutoff
- Grade computation
 - 50% HW/Quiz/Style
 - Sum all points for hw/quiz/style and divide by points possible
 - Don't forget HW13 is extra credit, HW0 is 25 points
 - 14% Midterm 1
 - 14% Midterm 2
 - 22% Final

Grade Determination

Hwk/Quiz Avg	Test Avg	Course Avg	Grade
>= 85% and	>= 85% and	>= 90%	A
>= 75% and	>= 75% and	>= 80%	B
>= 65% and	>= 65% and	>= 70%	C*
>= 55% and	>= 55% and	>= 60%	D
< 55% or	< 55% or	< 60%	F

* C threshold may be lowered

The Final Frontier: Interfacing to hardware

Ports

- Computers used to have things like serial and parallel ports
 - Great for (slow) communication, easy to interface
 - Rarely exist now
- Other ports are available...
 - Ethernet port – need the ethernet protocols
 - USB port – difficult due to transmission speed
 - Firewire port – more difficult than USB port
- Look in /dev on Linux



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Raspberry Pi

- Embedded systems are cheap
- Lots of Systems on a Chip (SoCs) out there
- Often with exposed pins
 - Easy to interface
- Many can run a full-fledged OS



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Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO2 (SDA1 - PC)		DC Power 5v	04
05	GPIO3 (SCL1 - PC)		Ground	06
07	GPIO4 (GPIO_CLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO16	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPL_MISO)		Ground	20
21	GPIO19 (SPL_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPL_CLK)		(SPL_CE0_N) GPIO18	24
25	Ground		(SPL_CE1_N) GPIO17	26
27	ID_50 (PC ID EEPROM)		(PC ID EEPROM) ID_5C	28
29	GPIO5		Ground	30
31	GPIO6		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

Early Models

Late Models

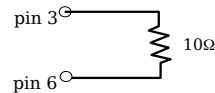
http://www.element14.com



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We can access those pins from a program...

- 3.3V
- Maximum 16mA (8mA default) per pin
- Maximum of 50mA total
- Don't do this:



- Hint: you'll lose more than electrons.



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Datasheet

- Sometimes called "spec sheet"
- Details technical characteristics of a component
 - Can be hardware or software
- Often includes...
 - Functional descriptions
 - Pin diagram
 - Voltage ratings and specs
 - Power consumption
 - I/O waveforms
 - Timing
 - Physical dimensions
 - etc



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BCM2835

- First generation Raspberry Pis use a 700MHz ARM11 processor (BCM2835)
- Newer Pis use BCM2836 (v2 1.1), then BCM2837 (v2 1.2, v3)



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Raspberry Pi GPIO access

- RPI.h
- pins.c
- pins.h
- traffic.h
- traffic.c



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Boiler Up!



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