Computer Systems from the Ground Up

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Learning Goal 1

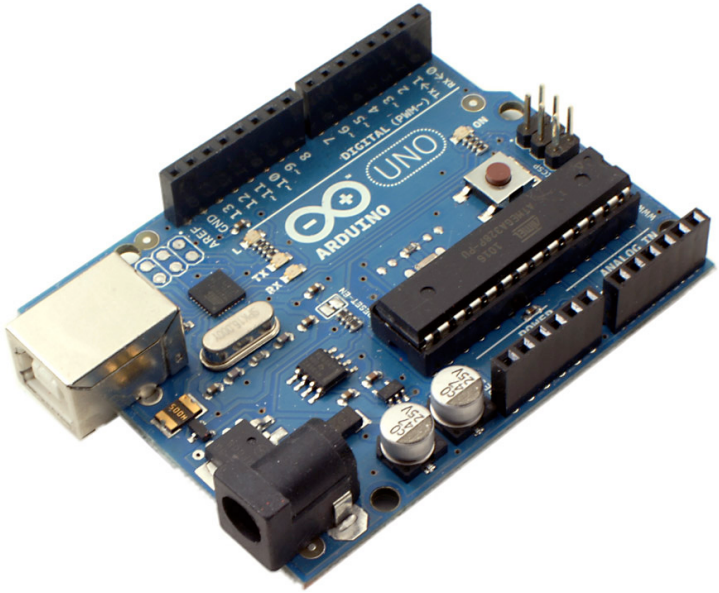
Understand how computers represent data and execute programs

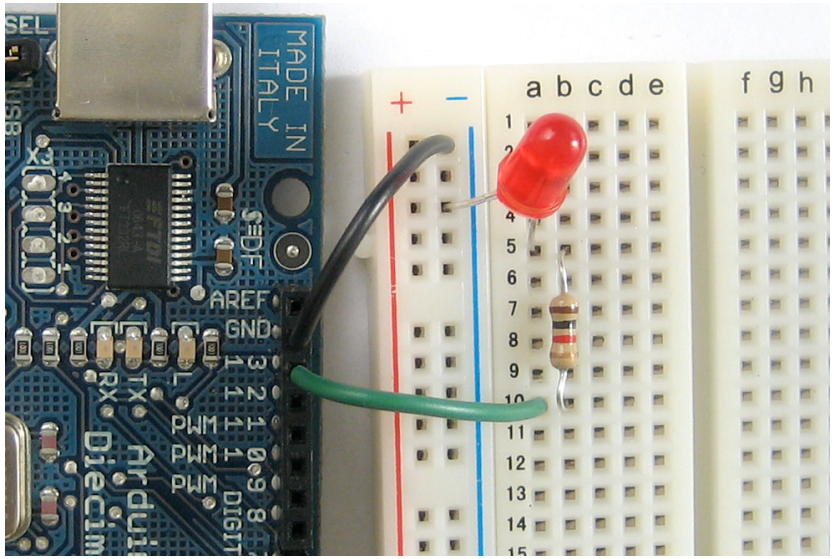
Arduino UNO

```
// Blink an led
int led = 13;

void setup() {
   pinMode(led, OUTPUT);
}

void loop() {
   digitalWrite(led, HIGH);
   delay(1000); // 1000 msec
   digitalWrite(led, LOW);
   delay(1000);
}
```





http://www.ladyada.net/learn/arduino/lesson3.html

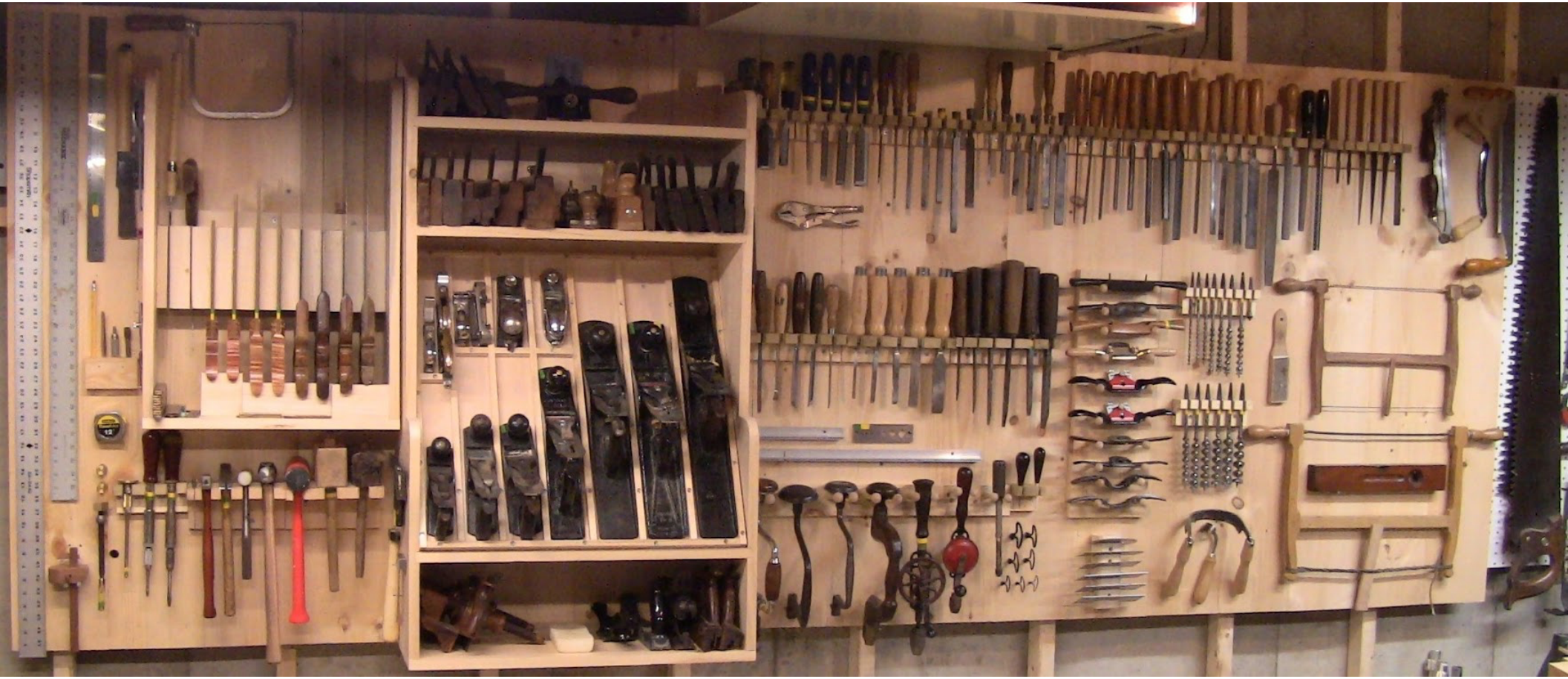
Quinn Dunki

http://quinndunki.com/blondihacks/

Learning Goal 2

Learn tools

Different Tools for Different Jobs



http://dans-woodshop.blogspot.com/


Mastery
https://paulsellers.com/tag/gouge/

Organize Your (Dev) Environment

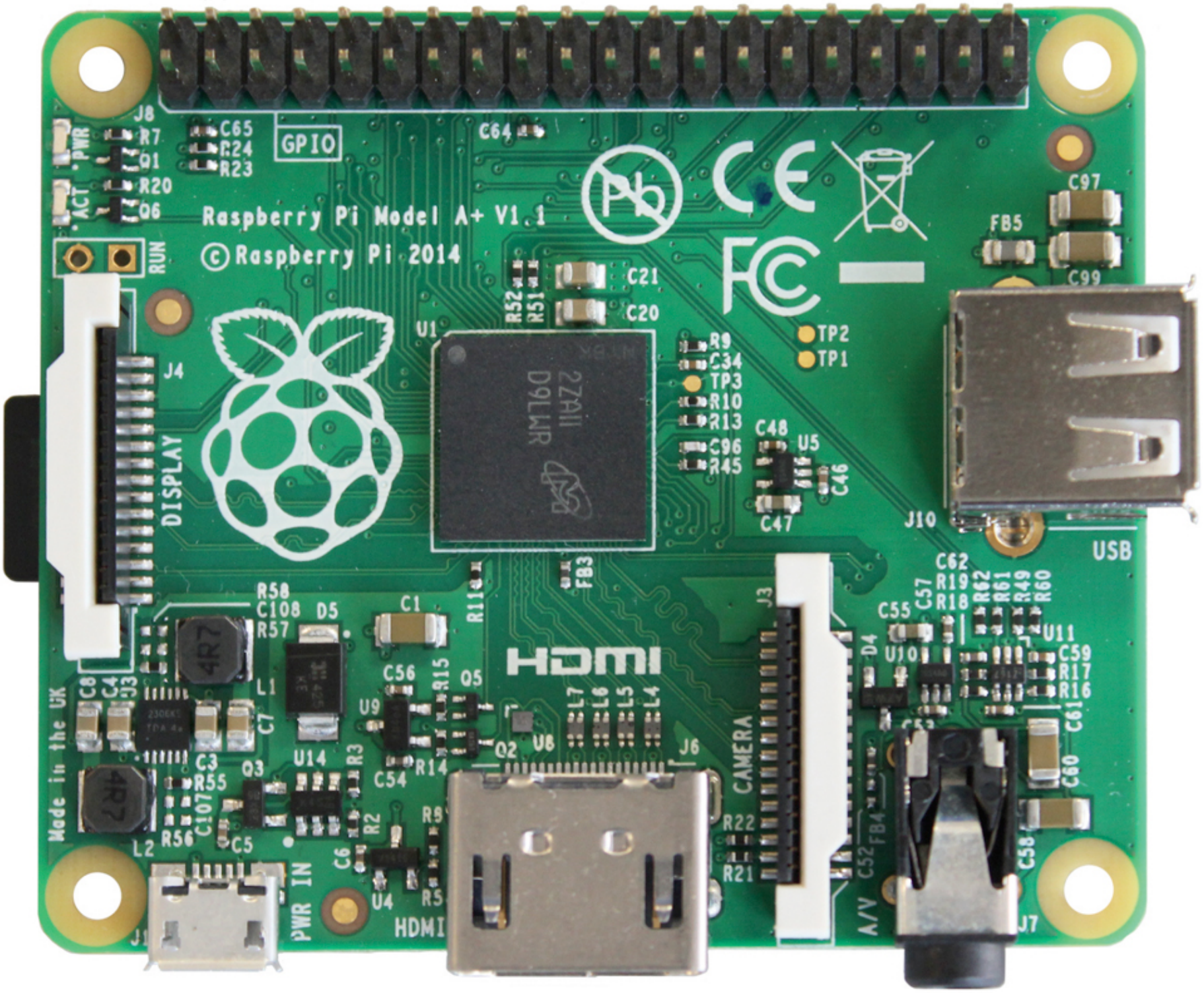
http://amhistory.si.edu/juliachild/

Approach

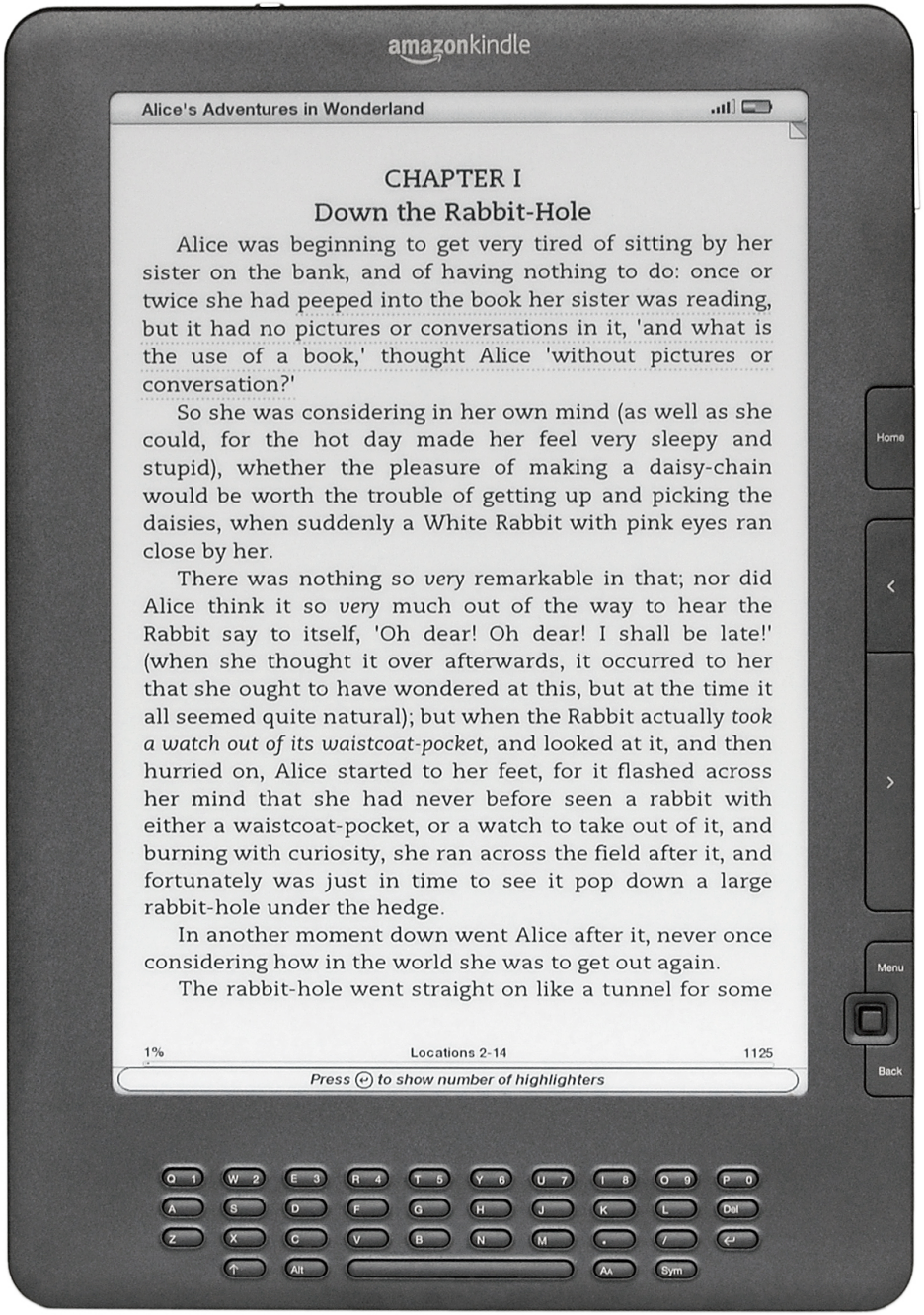
Bare Metal on the Raspberry Pi

Definition: Bare metal programming involves no operating system and minimal use of libraries.

Bare metal programs boot and startup on their own, and directly control peripherals.


GPIO
Raspberry Pi Model A+ V1.1
© Raspberry Pi 2014
DISPLAY
HDMI
CAMERA
USB
A/V
PWR IN
HDMI
Made in the UK

iPhone 3

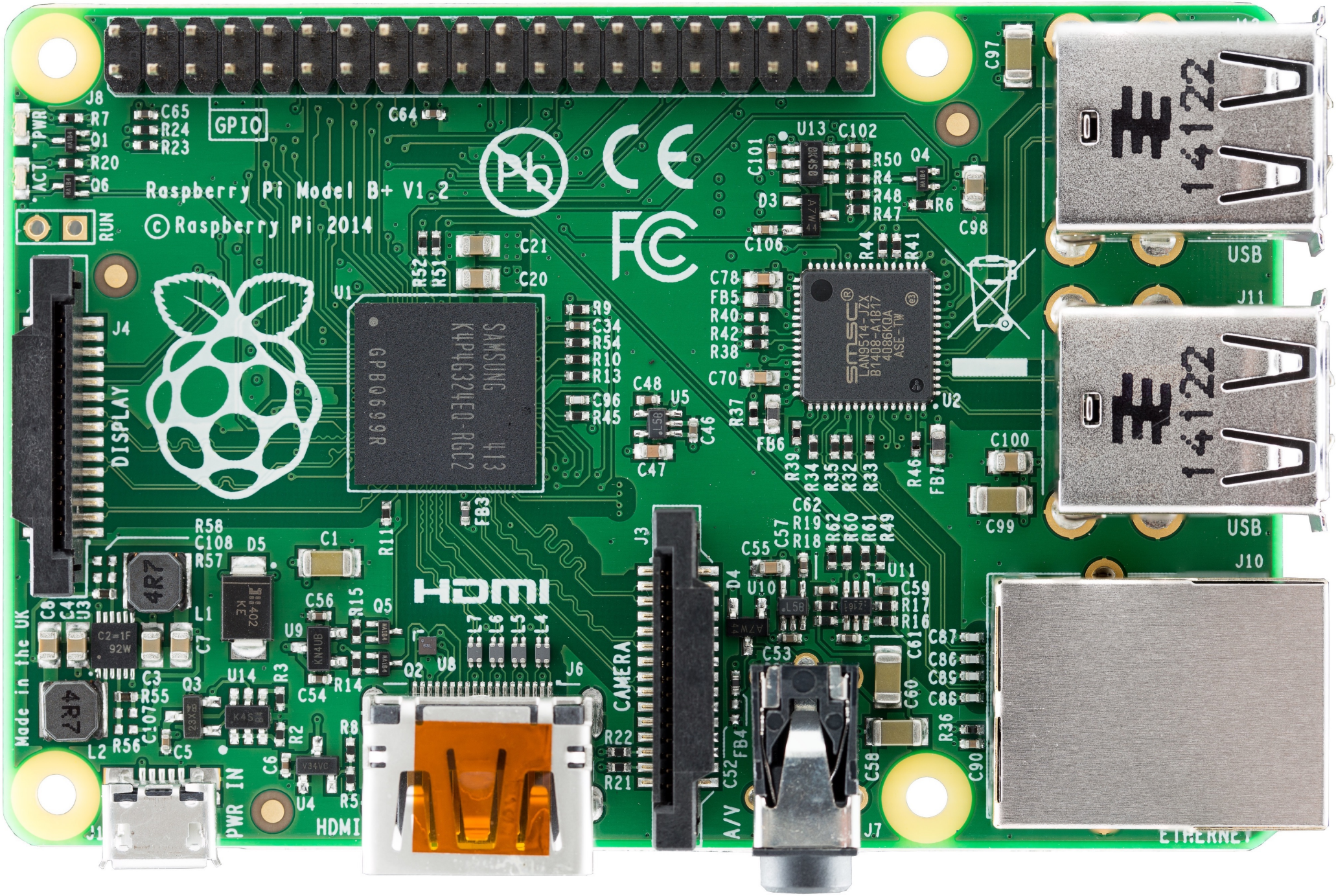


Kindle 2


V3.co.uk
The Pi Store

Exercise

Inspect Raspberry Pi


Raspberry Pi Model B+ V1.2
© Raspberry Pi 2014
GPIO
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HDMI
CAMERA
A/V
USB
USB
ETHERNET
PWR IN
Made in the UK
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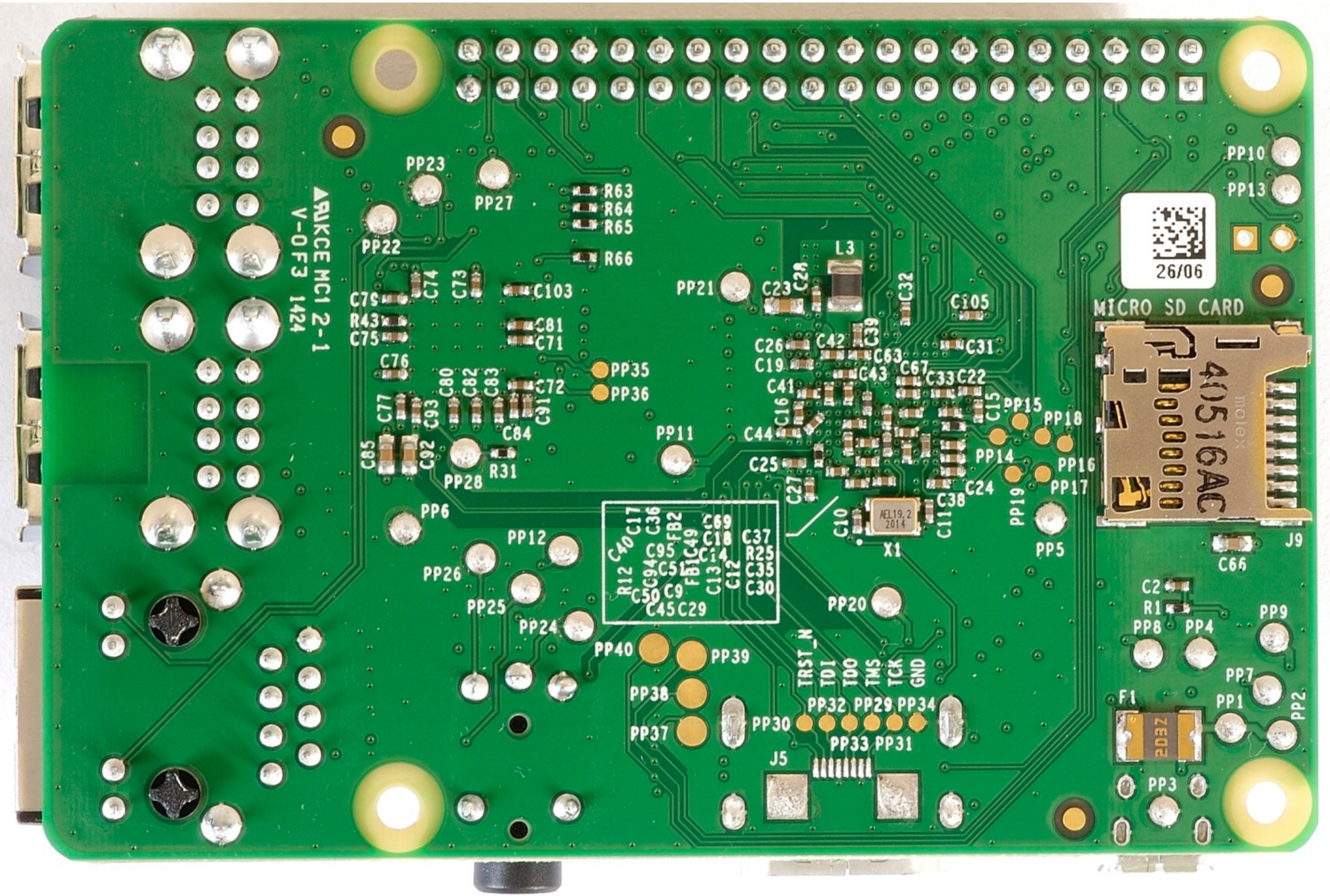
smsc
LAN9514-JZX
B1408-A1B17
4086KOA
ASE-TW


MICRO SD CARD
molex
40516AC
26/06
AEL19.2
2014
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L3
J5
J9
F1
2D3Z
TRST_N
TDI
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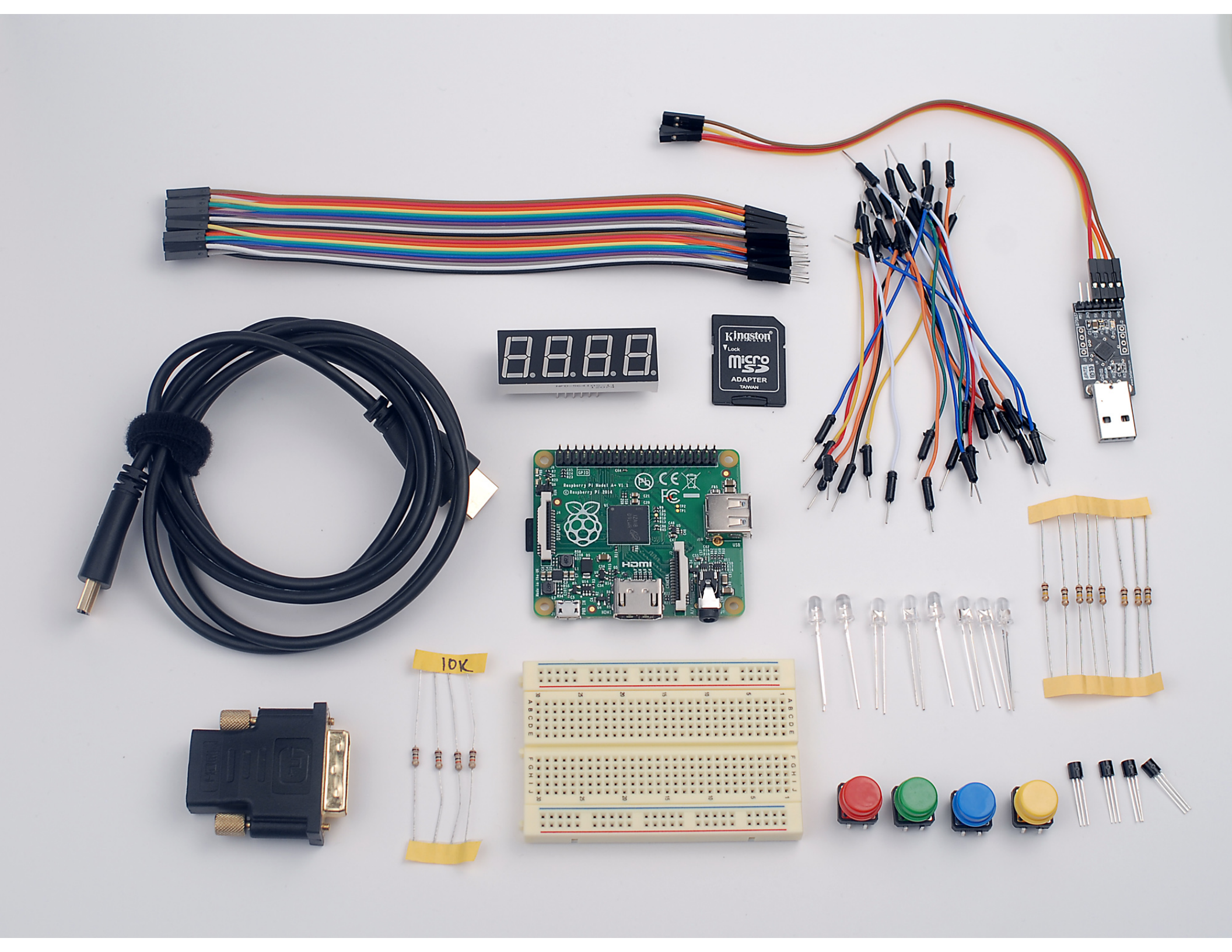
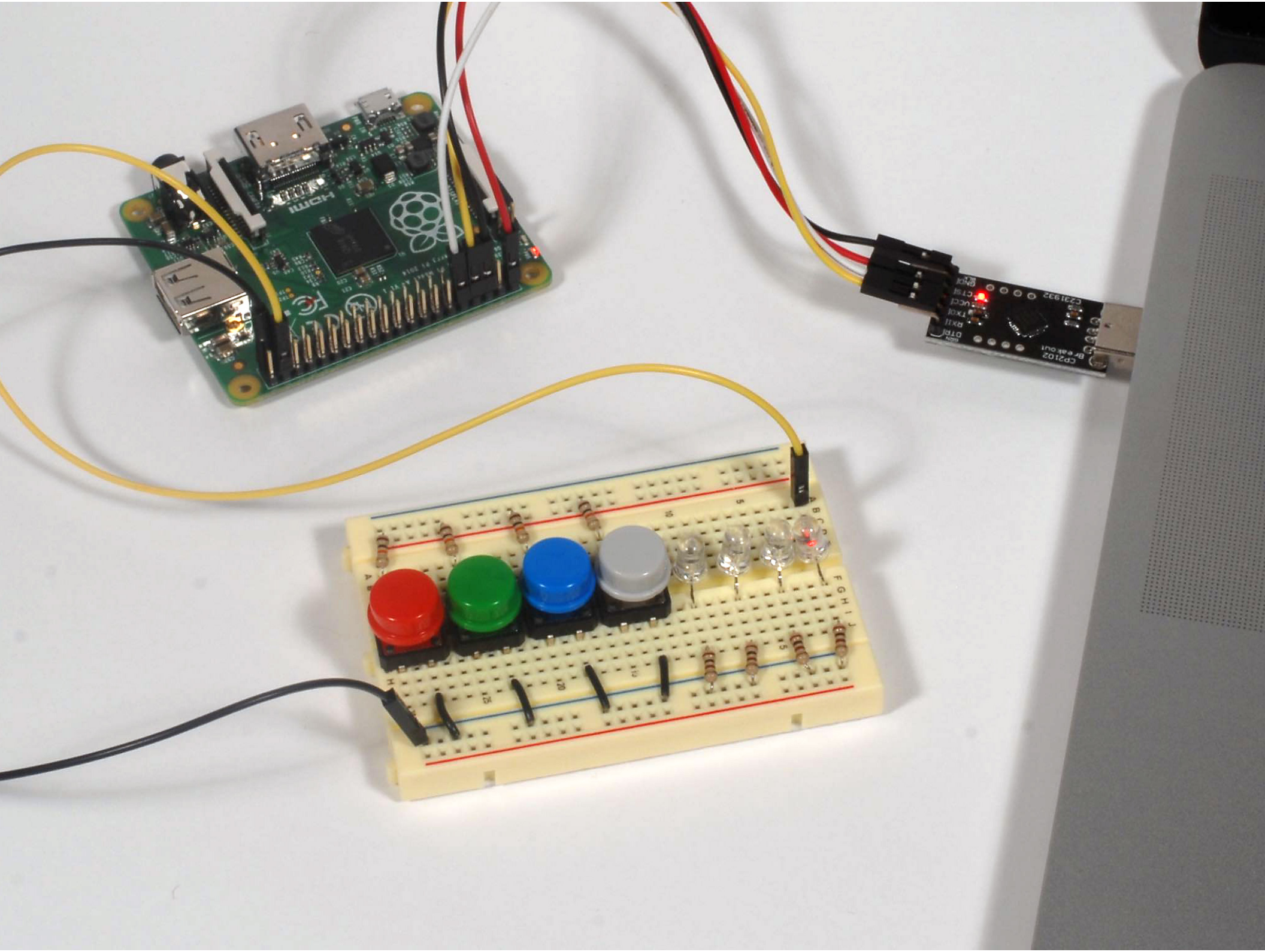
FB1
FB2

Pi Kit


Kingston
Lock
micro SD
ADAPTER
TAIWAN
Raspberry Pi Model A+ V1.1
HDMI
10K



Manifest

Raspberry Pi A+

4GB SD card

USB-Serial breakout board

Breadboard and jumpers

LEDs, pushbuttons, resistors, and transistors

HDMI cable and HDMI-DVI adapter

Keyboard

Policy

Lab fee of $50 (collected during 1st lab)

You break/lose it, you replace it

The lab has a collection of useful parts that you are free to take

Course Topics

cs107e.github.io

§1 Baremetal Programming

1. ARM architecture
2. ARM Assembly language
3. C
4. Functions
5. Strings and serial communication
6. Memory allocation
7. Linking and loading

§2 Personal Computer

1. Graphics and the framebuffer
2. Keyboard input
3. Sound and MIDI
4. Interrupts

Computer History Museum Tour

Guest Lecture

§3 Additional Topics

1. Signed and unsigned arithmetic
2. Tasks
3. Networking protocols
4. Python
5. Towards Linux and beyond

Administration

Weekly Modules

Cadence

- 2 lectures on Fri and Mon
- Mandatory lab on Tue or Wed evening from 7-9 pm in Gates 325
- Assignment due following Mon at 12 midnight

Laboratories

Gates 325

Attendance is mandatory

Hands-on exercises

Submit completed check-list

Leave ready to do assignment

Philosophy: lots-of-help, hands-on, collaborative

Lab: access to tools and supplies


Non-Contact Voltage Detector
EXTECH
INSTRUMENTS
NCV
REL
MODE
HOLD
RANGE
OFF
VAC
VDC
μA
mA
10A
°F
°C
EX330
AutoRanging
MultiMeter
CAT III - 600V
CAT II -1000V
COM
V/mA/μA/CAP
Ω/Hz/Temp
10A
600V MAX
600V
400mA
MAX
FUSED


Consolidated
ELECTRONIC WIRE & CABLE
100
FT
RoHs
36920
36822
36792
36856


SOLID
IDEAL INDUSTRIES
SYCAMORE IL U.S.A.

Assignments

7 assignments

- Build on each other

Two parts

- Basic
- Extensions

Final project

NO EXAMS

First Week

Basic Electricity

Voltage and current

Ohms Law : V = I R

Power : P = I V

Driving an LED

Transistor switches

Breadboarding

Guide: electricity.md

Number Representations

Binary representation

Hexadecimal

Bit operators

Guide: number.md

Unix Command Line

Moving around the file system

Creating, moving, and deleting files

Compiling and running programs

Guide: unix.md

Note: Attend cs107 labs this week

Assignment 0

Read basic guides

Subscribe to cs107e in piazza

Assignment 0

- Using git and github

- Submit your lab preference