Week 3 – Hardware

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Assignment 3.1: Examine your phone

- What processor is in your phone?
  - My phone (iPhone 13) uses the Apple A15 Bionic chip.
- To which architecture family does this processor belong? In other words, which Instruction Set Architecture (ISA) is used?
  - The A15 Bionic uses ARM architecture, specifically ARMv8-A (64-bit).
    So the ISA is ARM64.
- How much RAM is in it?
  - The iPhone 13 has 4 GB of RAM.
- How much storage does your phone have?
  - My phone has 128 GB of internal storage.
- What operating system is running on your phone?
  - It runs iOS (currently most iPhone 13 devices run iOS 17 or iOS 18, depending on updates).
- Approximately how many applications do you have installed?
  - Around 120 apps installed.
- Which application do you use the most?
  - I use the most WhatsApp.
- Can your phone be charged with what type of plug?
  - The iPhone 13 charges with a Lightning connector.
- Which I/O ports can you visually see on your phone?
  - On the iPhone 13, you can visually see:
    - Lightning port (charging + data)
    - Speaker grills
    - Microphone holes
      - The phone does not have a headphone jack or USB-C port.

Assignment 3.2: Examine your laptop

- What processor is in your laptop?
  - My laptop uses the Apple M2 chip.
- To which architecture family does this processor belong? In other words, which Instruction Set Architecture (ISA) is used?
  - The Apple M2 chip uses the ARM architecture, specifically ARM64 / AArch64.
- How much RAM is in it?
  - My laptop has 16 GB of RAM.
- How much storage does your laptop have?
  - My laptop has 994.66 GB of internal storage (1 TB class SSD).
- Which operating system is running on your laptop?
  - It is running macOS (latest version)
- Approximately how many applications do you have installed?

    - I have around 100 applications installed.
- Which application do you use the most?
    - I use Safari the most.
- Can your laptop be charged with what type of plug?
    - The 13-inch MacBook Pro (M2, 2022) is charged with USB-C.
- Which I/O ports can you visually see on your laptop?
    - On this model, I can see:
        - Two USB-C / Thunderbolt 3 ports (left side)
        - One 3.5 mm headphone jack (right side)

Assignment 3.3: Power to the laptop

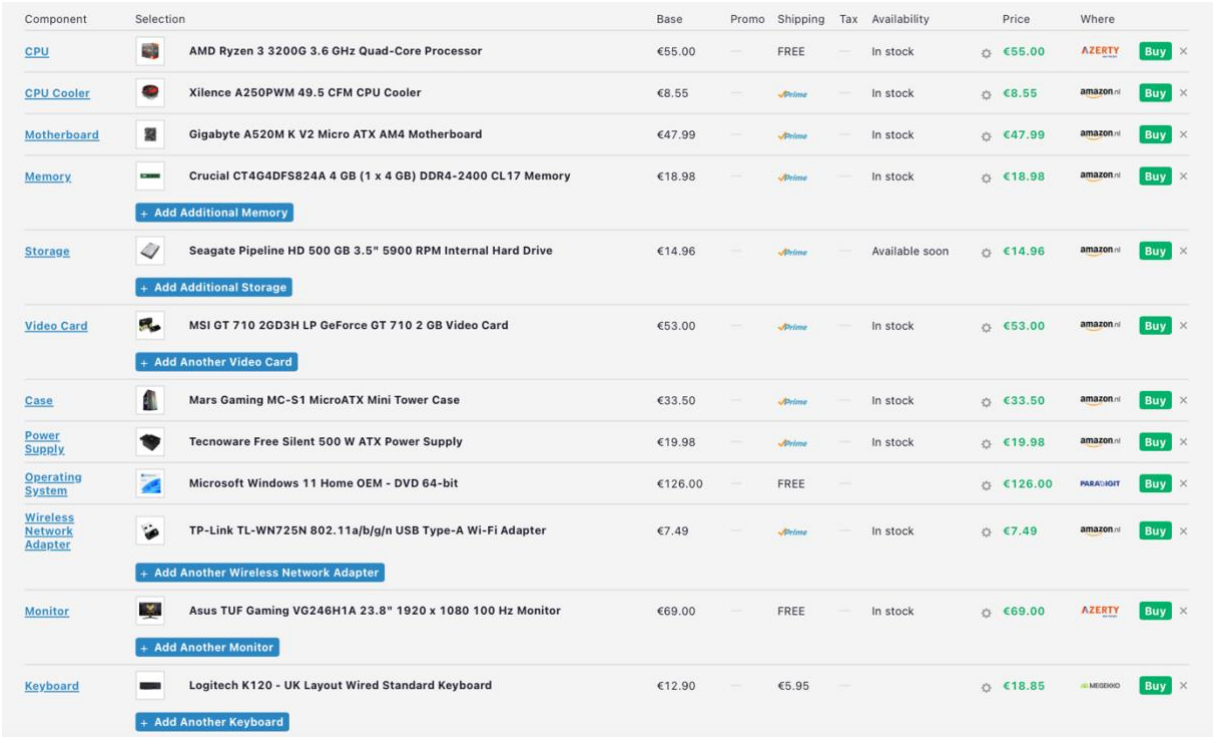
- What is the input voltage?
    - For Apple USB-C power adapters, the input voltage is: 100–240 V
- What is the output voltage?
    - USB-C power adapters output *variable* voltage depending on what the device requests. Typical Apple USB-C outputs include:
        - 5 V
        - 9 V
        - 15 V
        - 20 V
    - Your MacBook usually uses 20 V for charging.
- How many watts can your power adapter deliver?
    - The MacBook Pro 13-inch (M2) typically comes with a 67 W USB-C Power Adapter.
- Is the input voltage AC or DC?
    - The input voltage is AC (Alternating Current).
- Is the output voltage AC or DC?
    - The output voltage is DC (Direct Current).
- AC/DC what is that?
    - AC = Alternating Current
        - The direction of electrical flow switches back and forth many times per second.
        - This is what comes from wall outlets.
    - DC = Direct Current
        - Electricity flows in one constant direction.
        - All electronic devices (phones, laptops, tablets) need DC to run.
    - The power adapter converts AC → DC so your laptop can use it.
- If you reverse the polarity of the output voltage, is that bad for your laptop?
    - Yes, very bad.
    - Reversed polarity can:
        - Short-circuit internal components
        - Permanently damage the charging circuitry
        - Potentially destroy the battery or logic board
    - USB-C chargers prevent this electronically, but traditional barrel chargers *can* be destroyed by reversed polarity.
- You forgot your power adapter, your laptop normally needs 15 watts. You will be loaned a power adapter that can deliver 50 watts. Voltage, polarity, etc. are all the same compared to

the original power adapter. You can connect the borrowed power adapter to your laptop. What will happen? Also explain why you think that.

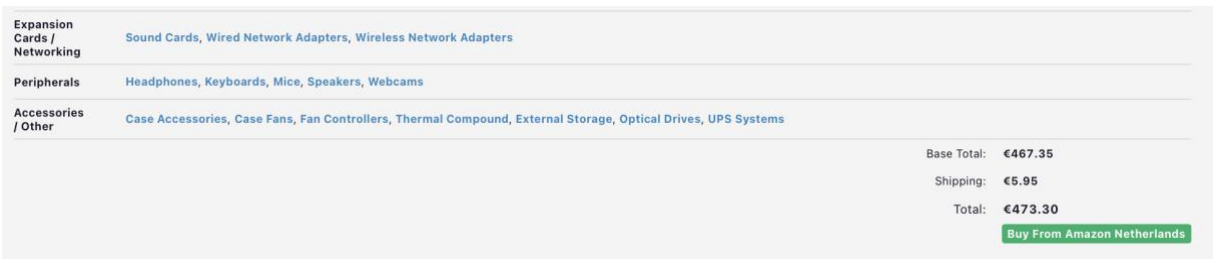
- Nothing bad happens. Your laptop will charge normally.
- Why?
- Because power adapters do not “push” wattage into the device.
  Instead, the laptop pulls only the amount of power it needs.
  - Your laptop needs 15 W
  - The charger *can supply up to* 50 W, but only if asked
  - Since the voltage and polarity are correct, the laptop safely draws the amount it needs
- This is exactly how USB-C Power Delivery works.
- Analogy:
  - A 50 W charger is like a big water tank — it *can* supply a lot of water, but your laptop opens the tap just enough for 15 W, so it only takes what it needs.

Assignment 3.4: Build your dream PC

Screenshots PC configuration + motivation:



Component	Selection	Base	Promo	Shipping	Tax	Availability	Price	Where
CPU	AMD Ryzen 3 3200G 3.6 GHz Quad-Core Processor	€55.00	—	FREE	—	In stock	€55.00	AZERTY Buy
CPU Cooler	Xilence A250PWM 49.5 CFM CPU Cooler	€8.55	—	Prime	—	In stock	€8.55	amazon.nl Buy
Motherboard	Gigabyte A520M K V2 Micro ATX AM4 Motherboard	€47.99	—	Prime	—	In stock	€47.99	amazon.nl Buy
Memory	Crucial CT4G4DFS824A 4 GB (1 x 4 GB) DDR4-2400 CL17 Memory	€18.98	—	Prime	—	In stock	€18.98	amazon.nl Buy
	+ Add Additional Memory							
Storage	Seagate Pipeline HD 500 GB 3.5" 5900 RPM Internal Hard Drive	€14.96	—	Prime	—	Available soon	€14.96	amazon.nl Buy
	+ Add Additional Storage							
Video Card	MSI GT 710 2GD3H LP GeForce GT 710 2 GB Video Card	€53.00	—	Prime	—	In stock	€53.00	amazon.nl Buy
	+ Add Another Video Card							
Case	Mars Gaming MC-S1 MicroATX Mini Tower Case	€33.50	—	Prime	—	In stock	€33.50	amazon.nl Buy
Power Supply	Tecnoware Free Silent 500 W ATX Power Supply	€19.98	—	Prime	—	In stock	€19.98	amazon.nl Buy
Operating System	Microsoft Windows 11 Home OEM - DVD 64-bit	€126.00	—	FREE	—		€126.00	PARAGHIT Buy
Wireless Network Adapter	TP-Link TL-WN725N 802.11a/b/g/n USB Type-A Wi-Fi Adapter	€7.49	—	Prime	—	In stock	€7.49	amazon.nl Buy
	+ Add Another Wireless Network Adapter							
Monitor	Asus TUF Gaming VG246H1A 23.8" 1920 x 1080 100 Hz Monitor	€69.00	—	FREE	—	In stock	€69.00	AZERTY Buy
	+ Add Another Monitor							
Keyboard	Logitech K120 - UK Layout Wired Standard Keyboard	€12.90	—	€5.95	—		€18.85	MEGEKKO Buy
	+ Add Another Keyboard							



Expansion Cards / Networking	Sound Cards, Wired Network Adapters, Wireless Network Adapters
Peripherals	Headphones, Keyboards, Mice, Speakers, Webcams
Accessories / Other	Case Accessories, Case Fans, Fan Controllers, Thermal Compound, External Storage, Optical Drives, UPS Systems

Base Total: €467.35
Shipping: €5.95
Total: €473.30
Buy From Amazon Netherlands

Motivation:

I selected these components due to the low cost and remaining functionality. This computer can be utilized for study work, internet browsing, video viewing, and casual games. The objective is to prove that it is possible to make a functional computer with a very limited budget.

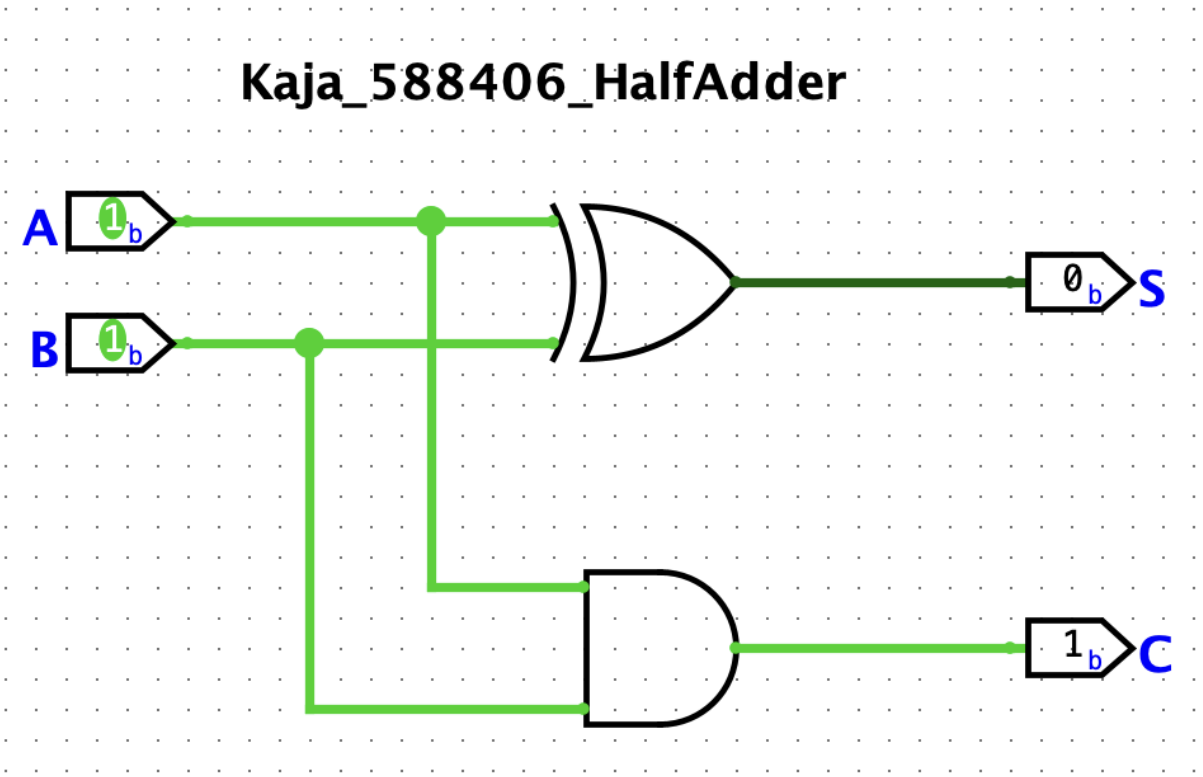
Comparison with my current laptop:

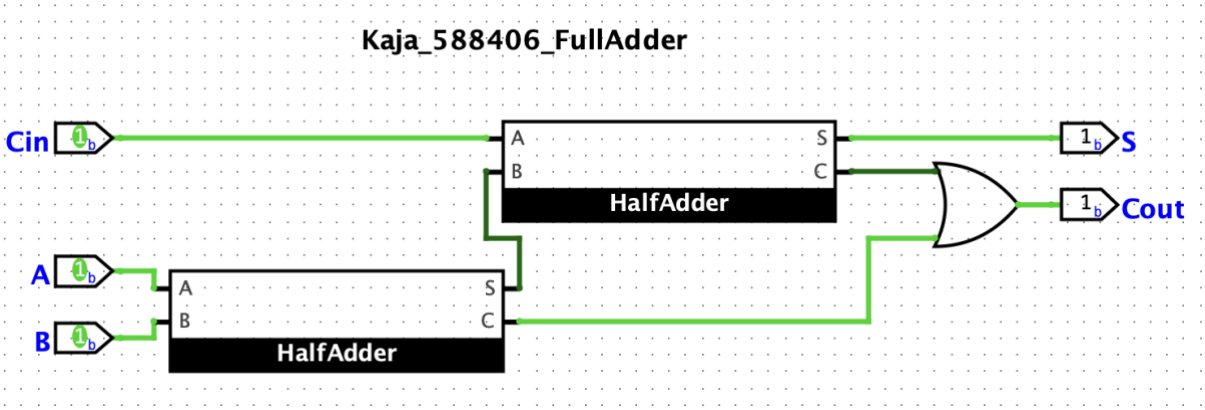
My personal laptop is a MacBook. My laptop has an Apple M2 chip that it's much faster and more power-efficient than this PC. The PC is more affordable to upgrade, while on the other hand, my laptop is more portable, quiet, and easier to use.

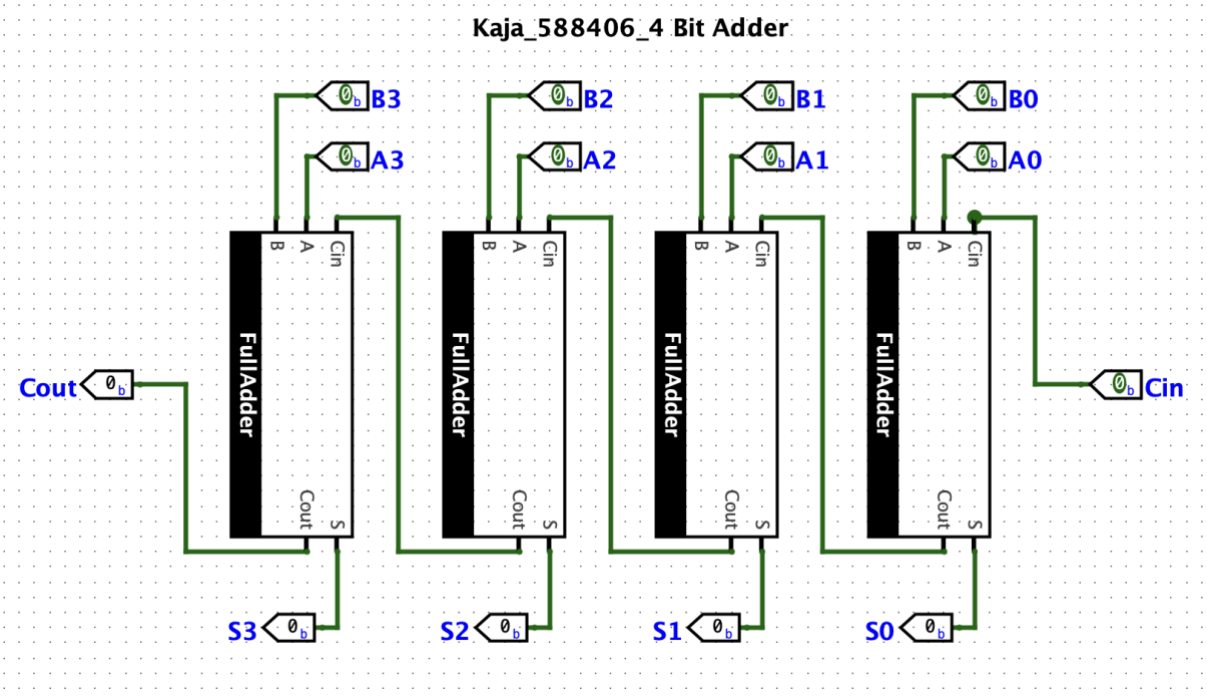
Assignment 3.5: Adders

Complete the **half adder**, **full adder** and **4-bit adder** assignment as described in the PowerPoint slides of week 3 in Logisim. Save the chip design and also export three PNG pictures of the separate finished designs. See the PowerPoint slides of week 3.

Paste the three exported PNG pictures in here.







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