CS312 :: Lab Week 3 :: Laptop Disassembly and Reassembly

In this lab, we'll disassemble a typical laptop and then put it back together. Every laptop is different, though most are like this HP EliteBook 840. Unlike Lab 1, instructions aren't given step-by-step for this Lab. You'll need to figure out how the components come apart, though the required outline is provided below along with a few hints. You'll need to work quickly to finish everything in the allotted 110 minutes!

Our objectives are two-fold: to gain experience working with actual laptop hardware and to gain experience dismantling a device when no instructions are present. Don't be afraid to experiment, though remember that *there isn't much time to finish!*

To gain full credit for this lab, your laptop must be disassembled and reassembled, with no parts left over, with no missing parts, before you leave the lab.

Perform the Tasks and Problems in order, as given below. There are 30 points possible (1 point = 3.33%); see the breakdown below.

Supplies needed

- Paper to answer the questions on
- Spudgers/pry tools
- Philips 1 screwdriver
- Anti-static wrist strap
- Thermal paste
- Paper towels

General Rules

Read the following rules carefully:

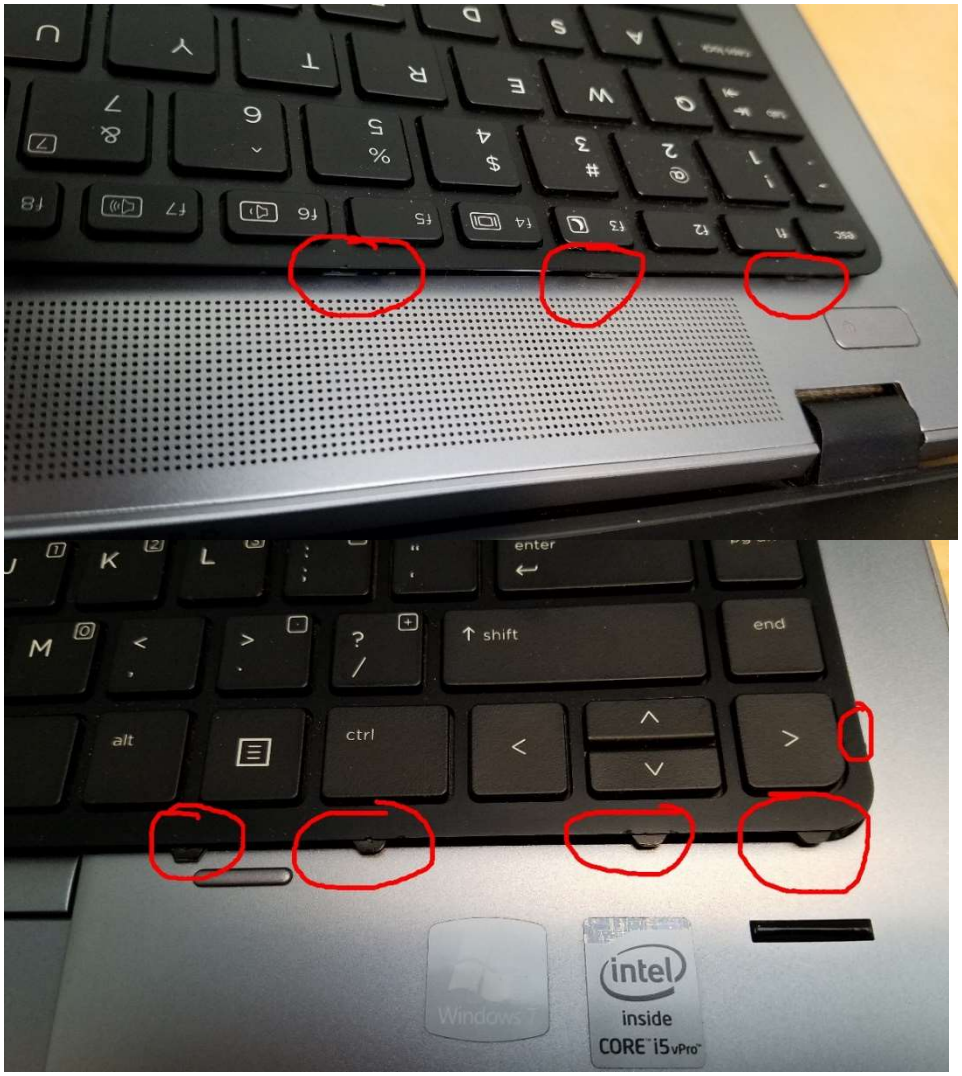
- The little rubber nubbin in the middle of the keyboard is easy to pry out: be careful you don't drop and lose it!
- Pull plugs straight up and out – try not to bend them too far out of alignment. That said, a little wiggle can help unseat them.
- Try not to touch the electrical pins and connectors on the edges of RAM, cards, and the CPU.
- Before disconnecting any plug, removing any screw, or routing a cable out of its holders, ***take a picture of it***. This will help you attach it later in the correct place and orientation.
- Whenever you unscrew screws, bundle the related ones together, write on a piece of tape where they came from, and then use that tape to stick them to your desk.
- When removing tight connections from the motherboard, brace it so that it doesn't flex too much as you push or pull.
- Be careful not to drop the screwdriver onto the motherboard: the sharp blade can cut an electrical trace - those straight and diagonal wires embedded on the surface of the motherboard - destroying it.
- **Safety note:** Avoid touching the silver thermal paste squished between the CPU and heatsink. It is often poisonous if you ingest it. If you accidentally get some on you, just wash it off with soap and water.

Abbreviations

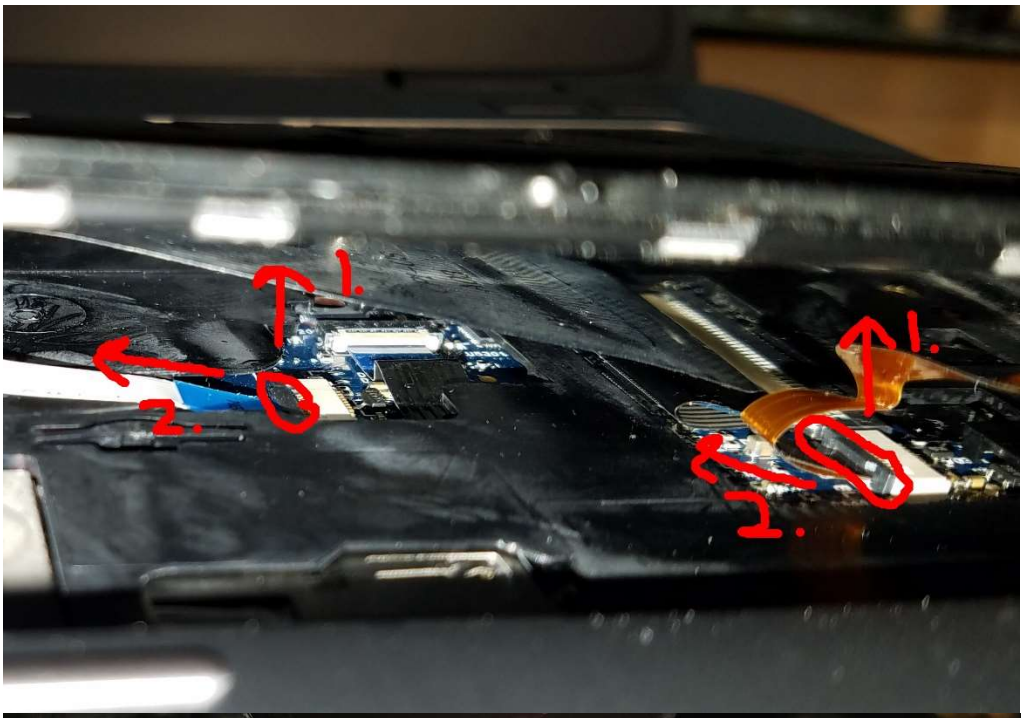
- MOBO: Motherboard
- GPU: Graphics Processing Unit; video card
- RAM: Random Access Memory; memory stick
- PSU: Power Supply Unit
- HDD: Hard Disk Drive
- CPU: Central Processing Unit; processor; chip

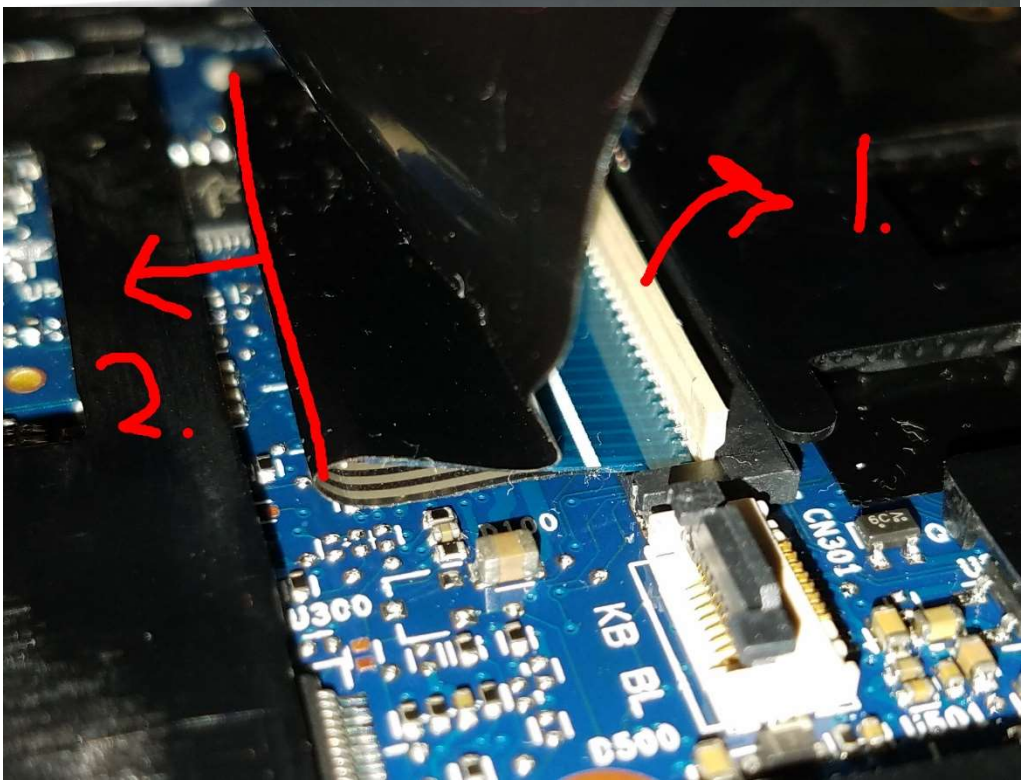
Task A – Disassemble the Laptop

1. Remove the back panel from the laptop. Hint: you'll need to slide the lock catch as far away from the lock icon as it can go.
2. Remove the battery, if your laptop has one.
3. Remove the tiny wifi card from the case. Hint: first remove the two antennae by pulling extremely gently upwards on the wires, close to the brass connector terminals. To reconnect them, just align them and then push straight-down until you hear the click. Note which goes where!
4. Remove the hard drive, if your laptop has one.
5. Remove the RAM sticks, if your laptop has any. Hint: carefully push the two metal retention arms outwards simultaneously. Note which slot it's in!
6. Remove the keyboard from the laptop:
    a. On the underside of the laptop, loosen the two keyboard screws, but don't fully unscrew them. They are attached to springs, and will pop up when they disengage from the laptop, yet will stay in the frame.
    b. There is a hole on the underside of the laptop that has a keyboard symbol next to it, but yet there's no screw in there. Insert a screwdriver through the hold and gently push against the metal on the other side. This is the underside of the keyboard, along its upper edge, on the left. Push until the keyboard at that point snaps out of the frame.
    c. Now, extremely carefully, use the spudgers to pry each keyboard tab out of the frame (see pictures below), starting at the one place that's already out (from the previous step). It will take pressure, but do it slowly. Be careful not to bend the keyboard, or move it away from the laptop frame: there are fragile cables underneath holding it to the laptop (see next step).



d. Lift the bottom edge of the keyboard gently up, and look in between it and the laptop frame: you'll see several cables that need to be disconnected. To remove them, carefully rotate the ribbon cable retention tab on their zero-insertion force (ZIF) connectors upwards, then gently pull the cable out of the slot it's in. These cables are very fragile, so try not to bend them. The largest cable has a large retention tab to lift, and you'll notice that it has a built-in loop that you should use to pull it out.





7. Remove the outer black plastic case on the underside
    a. ***Remember to take a picture of all these elements before proceeding!*** Close the laptop.
    b. On the underside, remove the 8 screws marked “M2.5x5”
    c. Remove the 6 screws marked “M2.0x2”. Note that there are two additional screws of this type that you don’t have to remove (look carefully to see if they’re holding the black plastic case).
    d. Carefully pry out the 8 plastic “feet” around the edges of the bottom of the plastic case to reveal 8 more M2.5.5 screws.
    e. Remove the 8 new M2.5.5 screws you’ve just found.
    f. Remove the SD-card blank from the SD card reader, if it has one, then remove the long black screw underneath it
    g. Carefully pry/pull the entire black plastic frame piece up and away!
8. Remove the screen from the base
    a. ***Remember to take a picture of all these elements before proceeding!*** Put the laptop on the table upside down. Locate the hinges at the top: note how a piece of steel is connected to the rotating piece of each hinge, and that these two steel pieces are attached to the frame with two black screws each.
    b. The video cable emerges from the left hinge (upper-right from your perspective) and travels a short ways to the left before plugging into the motherboard with a wide plug. Carefully peel back the black tape that holds it in, if any. Using your fingernails, one on each side of the white plastic protrusion on each edge of the plug, push the plug towards the back of the laptop (top from your perspective), then guide the cable out of the channel, leaving it hanging for now.
    c. Emerging from the right hinge (upper-left from your perspective) are four black wires. Two of these are for the wifi card and are already unplugged. Two more are for temperature probes. For this step, carefully guide these four fragile wire out of their holders, peel back any tape as needed, and leave them hanging for now. There is a fifth, thicker wire in this same bundle that goes to a small black plug/white jack: leave this one alone for now.
    d. Open the laptop up to 90 degrees, and stand it on edge like a book.
    e. Remove the four black screws that are holding the steel hinge pieces to the frame.
    f. Carefully remove the base from the hinge. Note: do not attempt to force the hinges to rotate by hand, if the screws have already been removed. They are extremely stuff, and require the leverage of the screen to move.
9. Remove the fan and heatsink from the frame
    a. Unscrew the two silver captive screws on top of the fan: these secure the fan to the frame. Do not unscrew the screws all the way, since they will stay in the fan.
    b. Unscrew the four black captive screws from the long black heat sink assembly, and put it aside. It is coated in thermal paste. Like our first lab, wipe this off with a paper towel, and throw the paper towel away. Wash your hands if your get the thermal paste on you. Note how much paste was on there! Wipe the thermal paste carefully off of the joint CPU+GPU chip on the MOBO, as well.
    c. Detach the fan cable from the MOBO, and put the fan on the table. This connector is very hard to disconnect: you’ll need to put a fingernail on each side of it, and wiggle it back and forth as you push away/out to remove it. Do not try to pull it out by the wires! Another method is to put your left thumbnail against the left plug edge (pushing it out away from you) and a small sharp screwdriver against the other side. Push/wiggle it out.
10. Remove the MOBO from the frame
    a. ***Remember to take a picture of all these elements before proceeding!*** Turn the laptop base back over, so that it’s right-side up. The mouse pad should be in front of you.
    b. There are two small ribbon cables that have the same kind of zero-insertion force (ZIF) connector on this side to connect. Each is marked with a blue tab marked with “MB”. Rotate each connector up, carefully remove the ribbon cables, then rotate the connectors back down for safety. Pay special attention to how they are routed, as these can be hard to get back in later if you have the route wrong.
    c. Turn the laptop base back upside down, with the fan in the upper-right.

d. Find the small MOBO-like circuit board just below the fan that has the standard VGA jack in it: this is the VGA daughtercard. If you look carefully, you'll see that this is not part of the MOBO. Connecting this circuit board to the MOBO is a wide orange ribbon cable. Both ends of this cable have a rotating ZIF connector. We need to disconnect the orange ribbon cable on both ends: carefully rotate the ZIF connectors holding the orange cable and wiggle/pull the cable out, then rotate the connectors back down. Put the orange ribbon cable on the fan so you remember to put it back in first later.
e. There is one more small ribbon cable on top (on the hinge edge) that connects to a daughtercard that has the power switch on it. Remove this cable and set it aside. Note which end of the cable goes in which ZIF connector. Put it on the fan again, to help remind you to put it in before the fan.
f. Back near that right hinge (upper left, since the laptop is upside down) is the small white jack with the black plug in it, attached to a wire that goes around and under the motherboard. Remove that plug from the connector, and leave it hanging out. Again, like the fan cable, this will be a hard connector to remove.
g. Remove three small black screws from the motherboard: each is marked with a small white triangle and the label "M2.5x4". Do not remove the two black screws from the VGA daughtercard.
h. Lift the right edge of the MOBO up (the side where the fan is) about an inch and kind of wiggle it up and down as you pull out. The left side has a bunch of jacks that are caught by the frame: by wiggling and pulling gently, it will come out! Set the MOBO aside.
i. There are two devices still attached to the MOBO. We will leave these attached; one is the battery that enables the system to keep time when power is disconnected, and the other is a little 32GB, M.2 interface SSD. This SSD could be where the boot or recovery partition is stored. If you were ordering this laptop MOBO separately it would not have these two parts.

Problems A

1) There is a Media Access Control (MAC) address printed on a white sticker on the MOBO. This is the MAC address of the built-in Ethernet interface. What is the MAC address for your MOBO? *(3 Points)*
2) There is a tiny gray momentary push-button switch on the MOBO labeled SW154. What does it do? (*25 Points)*
3) Where is the credit-card sized "Smartcard" reader located? *(3 Points)*
4) What Operating System was this laptop designed for? *(3 Points)*
5) On the black plastic bottom frame is listed the input voltage for this laptop. What is the required voltage? *(3 Points)*
6) Just under the required voltage are the amperage requirements. A connected power charger needs to be able to provide at least the smaller of the two numbers. What is the smaller amperage listed? (*3 Points)*

Task B – Reassemble the Laptop

Read these notes, then follow the disassembly steps in reverse to reassemble the laptop!

1. When you get to the step where you need to reattach the CPU+GPU heatsink, apply the same amount of thermal paste that you removed previously to the top of the CPU *and* the GPU (both chips are right next to each other on the green PCB). When you squish the paste down by tightening the four black captive screws on the heatsink, it squishes out the air bubbles. If you remove the heatsink to look, you'll likely need to wipe it all off and re-apply. In general, if the paste squishes out the sides of the contact area between heatsink and CPU, you've used too much.
2. When tightening the CPU screws down, you only need to make the connection be "tight", which is far more than finger tight, but not so far that the MOBO splits or the CPU breaks. Don't over tighten the screws!
3. Check for extra parts. If you have any, take it back apart again until you can add the extra parts into the computer, then reassemble fully.

You're done! To receive credit for this lab, you must turn in all tools and this fully-assembled laptop. If the laptop is not fully assembled, this lab is worth zero points.