Prospective PI Checklist
Version 8.1 (Spring 2024)

Instructions: Name: ____________________

Train
• Grab a copy of the Prospective PI Checklist or save a digital version. Make sure to write your name!
• Ask any Invention Studio Prototyping Instructor (called a PI) to train you on a category of equipment and sign off on your checklist. Taking notes is highly recommended!
• The Introductory training must be completed first, but the rest can be done in any order.

Test
• Wait at least 1 day after getting trained on a section. You can still do other trainings in the meantime!
• Ask a full PI (yellow-green armband) to test you on the section. The same PI who trained you on a section cannot administer that section’s test.
• Certain tests must be completed sequentially:
  o Wood Room Processing -> Laser -> Wood Room Finishing -> Paint Booth
  o Waterjet -> Metal Room
• For every test, you should know the tools well enough to give a training yourself - take time to practice! You can’t use notes on your test.
• If you fail a test, don’t worry – it’s perfectly normal! The PI will provide retraining, and you can attempt the test again the next day. There’s no limit on the maximum number of attempts.

Interview
• After completing all tests, scan your checklist and turn it into the box at the front desk. Follow the instructions posted there to schedule a Prospective PI Interview!
• If you are hired as a PI, you will receive further information about beginning the provisional period and the steps to becoming a Full PI.
• If you are not hired as a PI, you may reattempt the checklist and interview the following semester.

General Notes:
• Because this checklist changes each semester, you must start and complete it during the same semester.
• PIs are expected to uphold the highest standards of professional conduct when interacting with anyone on campus, in addition to the Institute’s Code of Conduct. Prospective PIs are being qualitatively evaluated during their interactions throughout their progress on the checklist.
• DO NOT LEAVE A MESS. You must take your parts home with you and clean up.
• For further information visit www.inventionstudio.gatech.edu/become-a-pi or email ops@inventionstudio.gatech.edu.

Disclaimer: The completion of this checklist does not guarantee that you will be hired as an Invention Studio Prototyping Instructor.
<table>
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1. Identify each of the Invention Studio’s tool groups, their locations, and how to tell which group a particular tool belongs to.
2. Explain masters’ role in the space and how they can be contacted.
3. Explain the role of the Exec Board and how they can be contacted.
4. Explain what SUMS is, how it is used, and when it should be used.
5. Locate the Montgomery Machining Mall (MMM) and explain its role and relationship to the Invention Studio.
6. In the Hub, Metal Room, and Wood Room, locate the following:
   a. First aid kits
   b. Fire extinguishers
   c. Emergency exits
   d. SUMS terminals
   e. Eyewash/shower (in Hub and Metal Room)
7. Describe how to handle major and minor injuries.
8. Describe how and when to use the incident reporting form. Explain who should be contacted following an emergency incident.
9. Identify the four Tool Safety Categories and give examples of 2 tools from each.
10. Explain Stop Work Authority and how it applies to users and PIs.
11. Explain the steps to extinguish a laser cutter fire.
12. Explain the steps to extinguish an electrical fire.
13. Explain what to do if the fire alarm goes off.
14. Explain what to do during a tornado warning.
15. Describe how to determine what materials are acceptable to use with a certain set of tools, e.g. laser cutters or wood room tools.
16. Describe what PPE or clothing is required for different areas/tools.
17. Identify which materials in the Studio are hazardous and what precautions should be taken when handling/disposing of them.
18. Explain how to submit feedback regarding PIs or the Invention Studio.
1. Sign into SUMS.

2. From the checklist materials drawer retrieve a 13” long 2x4 board and a 14” x 14” plywood sheet. Note these are rough dimensions and subject to error.

3. Explain to a PI the process of milling wood to be “Four-Square”.

4. Show how to turn the ventilation on (including vents for each machine).

5. Using the jointer, joint a face and an edge of the 2x4 board so that you end up with the two surfaces flat and perpendicular to each other.

6. Explain to a PI the correct direction to send wood through the planer to minimize tear-out.

7. Use the planer to plane down the opposite face of the 2x4 board to 1¼” thickness. Now you should have two faces flat and parallel to each other, and a finalized thickness.

8. Explain what causes kickback on the table saw and how to avoid it. Also explain where it is safest to stand.

9. Using the table saw, perform a rip cut so that you end up with a 3” wide board. You should now have a four-square board with the dimensions 1¼” x 3” x 13”.

10. Using the miter saw, cut an 8” long piece from your board. Make sure to square both ends.

11. Using the table saw again, cut a 10” x 7” piece of plywood from your 14”x14” plywood sheet stock.

12. Use the bandsaw to cut a 5” x 3 ¼” plate from an offcut of the previous step.

13. Show how to turn the ventilation off.

14. Vacuum and clean the area you worked in and sign out of SUMS.

15. Show a PI the following parts to be signed off:
   a. 10”x 7” plywood sheet
   b. 3 ¼ ” x 5” plate with holes and sanded
   c. 1 ¼ ” x 3” x 8” planed and sanded board (Faces will be checked for squareness)
   d. A clean workspace
1. Sign into SUMS and turn on ventilation.

2. Use the drill press and a 3/32" drill bit to drill two holes in the 5" x 3 ¼" plate at the coordinates (1 ¾", 1 ⅝") and (3 ¼", 1 ⅝").

3. Use one of the mounted sanders to round the corners of the plate.

4. Use the orbital sander, working your way up from 120 grit to 320 grit, to smooth your 8" board.

5. Use the air hose to clean off dust from parts.

6. Explain the different applications of the impact driver, hand drill, and drill press.

7. Countersink the holes in the GT and base plate.

8. Use powered hand tools to attach the GT to 2x4 using #6 x1" wood screws.
   a. Explain what pilot holes are & why they are used. Use them to aid in your trophy construction.
   b. The top left corner of the T should be flush with the top left corner of the 2x4.

9. Use powered hand tools to attach the base plate to the 2x4.
   a. There should be a 1" border around the base of the 2x4.

10. Vacuum and clean the area you worked in.

11. Show the assembled trophy to a PI to be signed off.

12. Turn off ventilation and sign out of SUMS.
Laser

Note: Before you start the Laser test you must complete the Wood Room Processing test.

Part 1: Inkscape Setup

**Item #1: GT**
1. Using Inkscape, import the file IS_laserchecklist_GT.png.
2. Trace the image and remove everything except the outline of a single GT (hint, the node tool is your friend).
3. Resize the GT so that its overall dimensions are 9” x 5.75”.
4. Move the GT so the bottom left corner is at the origin.
5. Remove the fill and set a red stroke.
6. Place 0.15” diameter circles at (5”,1.5”) and (5”,3”) to be cut out.

**Item #2: Guide**
1. Open a new document and import the file Guide.dxf. Show the PI on duty the correct manual scale factor and remove all the SolidWorks text.
2. Select the 4 lines and combine the nodes to form a single rectangle.
3. Convert the rectangle to a path to be engraved (there should be no stroke).
4. Insert your Name, Major, Class of 20xx inside the guide. Make sure that the font is small enough to fit all the necessary text and ensure it is properly centered within the rectangle.
5. Convert all text to path to ensure proper upload to Ruby.
6. Show the PI the Inkscape files before moving on to Part 2. If approved, save the Inkscape files to the computer.
Part 2: Laser Operation
1. Demonstrate signing into SUMS and explain how the laser cutter queue works.
2. Show how to turn on and off the laser and how to focus the lens with both auto focus and the focus tool.
3. Demonstrate uploading Inkscape files to Ruby.
4. Explain how to navigate Ruby & what is done in each menu from upload to laser operation.
5. Demonstrate turning on ventilation and opening relevant machine vents.
6. Using the 10"x7" plywood sheet from the Wood Room test, cut out the GT with holes:
   a. Demonstrate selecting material settings and explain what steps should be taken to ensure the settings are correct.
   b. Explain the importance of test cuts and when they should be used.
   c. Perform a test cut on an appropriate part of your material.
   d. Position the job on your material.
   e. Show how to start a job on the laser cutter (and run the cut).
   f. Explain when it is necessary to abort a cut and how to do so.
7. Engrave both the text AND rectangular guide on the 2x4 from the Wood Room test.
   a. Show to select the correct material and edit the engrave power/speed settings.
   b. Show how to change which color is performing an engrave or cut.
   c. Position the job on your material. Ensure the GT cutout will not cover the engraving when assembled.
   d. Perform a test cut on an appropriate part of your material.
8. Show the following parts to a PI to be signed off:
   a. GT cutout
   b. Engraved 2 x 4
9. Sign out of SUMS.
In Hub:
1. Sign into SUMS.
2. Demonstrate how to properly check out supplies for use in the paint booth.
3. Demonstrate how to prepare a new can of spray paint for use.
4. Select an appropriate can of clear coat for the job. You may also want a pair of latex gloves.

In Paint Booth:
1. Demonstrate turning on and off the vents and lights. Explain when the vents and lights should be on.
2. Explain when the doors of the paint booth should be opened or closed.
3. Demonstrate how to properly put on a respirator. Explain when a respirator is to be used in the paint booth and any cases where a user can refuse to wear a respirator.
4. Explain why you should shake a can of spray paint before use.
5. Using proper technique, apply a clear coat to your part.
6. Properly store and label your piece for drying.
7. Explain the state in which the paint booth is to be left.
8. Explain what to do if a can of spray paint runs out.
9. Demonstrate how to properly close the door to the paint booth.
10. Return the supplies to the proper section in the paint supply cabinet, retrieve your Buzzcard, and sign out of SUMS.
11. Let your part dry.
12. Retrieve your trophy! Abandoned trophies will be thrown away.
1. Sign into SUMS and demonstrate MAXIEM startup.

2. Explain the process of diagnosing and clearing a pump fault error.

3. Open the IS_waterjetchecklist.dxf on the waterjet computer and identify which units the software is operating in.

4. Prepare the file for cutting. Use tabs for both parts. Make sure the parts are positioned to minimize waste area.

5. Export to OMAX Make and set proper material settings. Explain what type of materials can be cut on the waterjet and explain why that is the case.

6. Explain the process of diagnosing and clearing a movement fault error.

7. Demonstrate usage of ballast tanks and explain how to rectify the situation when water level cannot be lowered sufficiently.

8. Secure the material in the waterjet using an appropriate method for the sheet you are cutting. **Note: The material you are cutting is thin, so be careful on how you clamp it so it doesn't bow or shift during cutting. If this happens, your cut was not successful.**

9. Demonstrate how to home the machine.

10. Explain why it is important to set the z-axis zero correctly.

11. Set path start and zero the x-axis, y-axis, and z-axis appropriately, keeping in mind the following:
   a. The z-axis zero point should be the highest spot on the cut area.
   b. Make sure that your cut doesn't go off the edge or collide with any weights or clamps.
   c. Reduce the amount of material wasted by locating your piece near previous cuts.

12. Demonstrate how to go to a point along the cutting path.

13. Explain why it is important to home the machine before cutting.

14. Cut out the part. Remove it and any remaining material from the waterjet.

15. Close OMAX Make and Layout, making sure not to save any changes made to the file.

16. Turn off the machine and explain why it is important to do so.

17. Keep both parts. They will be used to complete the metal room checklist.

18. Show the finished parts to a PI to be signed off.
Part 1: Blanking
0. Sign into SUMS.

GT Logo Piece
1. Use shears to remove all tabs from the GT plate made during the Waterjet checklist.

Aluminum Standoff
2. Retrieve a 1/2" diameter aluminum rod and mark a 3/4" long segment of it.
3. Secure the rod in a vise and cut off the 3/4" piece using a handsaw or portable bandsaw.

Triangle Base
4. On a piece of checklist steel (NOT ALUMINUM), mark out a 3.5x3.5x4.94" right triangle (3.5" isosceles - legs). Make sure to preserve as much of the stock as possible.
5. Securely clamp the sheet metal to a table.
6. Explain how to safely use an angle grinder and what to check before turning it on.
   a. Identify at least 3 alternatives to using an angle grinder.
7. Use an angle grinder with a cut-off wheel to cut out your marked triangle.

Part 2: Making Holes
8. Explain what size drill bit(s) to use for the following holes:
   a. In the aluminum standoff:
      i. 1 for a 1/4"-20 tap
   b. In the triangle base:
      i. 2 on the perimeter, for a 1/4"-20 tap
      ii. 1 on the perimeter, for a 1/4"-20 fastener
      iii. 2 in the center, for 1/8" rivets
9. Using a center punch, mark 3 holes on the perimeter of the plate, about 0.5" from each corner. Why is it necessary to use a center punch?
10. Punch a hole in the center of each aluminum standoff.
11. Transfer the 2 holes from the GT plate onto the triangle.
12. Use a hand drill to drill at least 2 appropriately sized holes in the triangle plate.
13. Use the drill press for at least 1 appropriately sized hole (recommended for the aluminum standoff).
   a. Explain how to secure the work piece. How and when would you adjust the RPM of the drill press?
Part 3: Post-Processing
14. Deburr the edges of your parts with the belt sander.
   a. Explain how to hold your workpiece safely.
   b. Name at least 3 alternatives to using a belt sander.
15. Use the sheet metal brake to bend the GT plate at a 90-degree angle.

Part 4: Tapping
16. Retrieve a tap wrench and a 1/4"-20 UNC (Unified Coarse Threads) tap.
17. Tap the 2 holes at the corners of the triangle plate.
18. Tap the aluminum standoff after placing the piece in a vise – be sure not to overtighten it as it can squish the drilled piece!
   a. Explain proper technique - what should you do to minimize the chance of your tap breaking?

Part 5: Assembly
19. Use 2 1/8" rivets to fasten the GT to the top of the triangle plate.
20. Retrieve 3 1/4"-20 screws, one shorter than the standoff and the other two slightly longer than the standoff.
   a. Using the shorter screw, attach the standoff to the base of the triangle plate.
   b. Screw the other 2 into the base of the triangle plate – these allow you to adjust its angle of inclination.
21. Clean up your workspace: dispose of scraps, vacuum chips, recharge batteries, only if necessary, return drill bits, and sign out of SUMS.
22. Show the finished part to a PI to be signed off.
Part 1: Breadboard Circuit
1. Find and set aside an LED, 330-ohm resistor, 2 different color spools of wire, a few jumper cables, a spool of solder, a breadboard, and a protoboard.
2. Explain the differences between solid and stranded wire and when to use them.
3. Set up the circuit on the breadboard; use two male-to-male jumper cables, one for the positive side and the other for the negative side, to serve as attachment points to test the circuit.
4. Configure the power supply to 3 volts and connect it to your circuit so the LED turns on.
5. Show the lit LED to a PI before proceeding.

Part 2: Protoboard Circuit
6. Cut a two-inch length of wire from each spool to use as power connection leads to the protoboard circuit. Strip both wires at both ends.
7. Transfer the components to the protoboard (replacing the jumper cables with the prepared wires), lining them up in the manner you want to solder them in place. Pay attention to the polarity of the LED!
8. Explain why the soldering iron tip oxidizes, how to tin the tip, and when to do so.
9. Explain the difference between leaded and unleaded solder.
10. Put on safety glasses and explain their purpose while soldering.
11. Turn on one of the three ventilation systems and explain the purpose of ventilation.
12. Turn on the soldering iron and set the iron to the correct temperature for the solder in use.
13. Solder the components to the board, tinning the iron when needed. If the iron’s tip is clean but the solder isn’t flowing well, apply flux to the board to improve solder flow.
14. Explain the bridging technique and use it to complete the circuit.
15. Tin the iron and turn it off.
16. Using the same power supply configuration as before, power your board and show the lit LED to a PI to be signed off.
17. Explain the use cases of both methods of desoldering (solder sucker and wick).
18. Turn the soldering iron back on and desolder all parts from your board using your preferred method; clear any solder-filled holes with the solder sucker.

19. Tin the iron, turn it off, return the breadboard and protoboard, and return any cords and jumper cables; the LED, resistor, and power wires can be discarded.

20. Explain a few of the most common ways users damage soldering iron tips.

21. Explain why one should always wash their hands after soldering, then wash your hands!
General Information

1. Locate each type of 3D printer (Bambu Lab X1E, Ultimaker S3/ S5, Form 3/3L, Markforged Mark Two, Fuse 1+) and briefly describe the use cases of each.

2. Explain the differences between FDM, SLA, and SLS printing.

3. Explain what parts cannot be printed at the Invention Studio. When should you reject someone’s print? What should be done if someone refuses to let their print be rejected?

Hardware

4. Describe the differences between the Bambu X1-series and Ultimaker S-series.

5. Identify the AMS, briefly explain how it works, and describe the materials that cannot be used with it.

6. Demonstrate changing filament in the AMS.

7. Explain the auto-refill system on the AMS, and what it means for partially used spools.

8. Show where partially used spools are stored. When can you remove spools from the AMS?

9. Identify the build plate(s) used with Bambu Lab printers. Explain which ones glue is used with, why it is used, and how to clean excess glue from the plate.

10. Explain how and when to mark a printer down.

Slicer

11. Launch Bambu Studio. Explain what file type(s) are used as inputs and outputs.

12. Show where to set build plate type and choose the correct one.

13. Demonstrate setting the correct filament type and AMS slot.

14. Identify which system preset is used for most prints.

15. Open Puzzle.stl and Skull.stl on the same build plate. Explain which parts require supports, how to switch between tree and normal supports, and how to manually add supports.
16. Remove all files from the build area. Open IS_kiwi.stl and scale the model to 17%.
17. Identify the following settings, their purpose, and their recommended ranges:
   a. Layer Height
   b. Wall Thickness
   c. Infill Density
18. Explain what a brim is and what types of parts it should be used for.
19. Select the invention studio profile. Set wall thickness to 0.8mm and infill density to 10% gyroid.
   Enable normal supports with a 7mm brim.
20. Slice the plate and export the resulting gcode.

3DPrinterOS
21. Log into 3DPrinterOS using your GT account. Upload your file and add it to the print queue.
22. Using the PI’s account, demonstrate starting a print.
23. Demonstrate how to abort a print, and explain why you should not abort a print on the printer itself.
24. Explain when to use the in-person queue and how to start a print from it.
25. Show how to quickly look at a preview of a part and that part’s history.

Post-Processing
27. Explain the completed print bucket policy.
28. Show the printed kiwi to a PI to be signed off.
1. From the vinyl drawer, retrieve two colors of vinyl and the vinyl cutter mat.

2. Open Silhouette Studio and create a new blank file. In page setup, select the correct machine model and mat type for the machine currently being used. Additionally, explain which machine models and mat sizes are available in Craftland.

3. Import the file IS_CraftlandChecklist_png which is located on the desktop.

4. Resize the image to have a width of 4".

5. Trace the image by using the 'Area Trace' function to create a vector file. (Note: This step could be accomplished in multiple different ways.)

6. Delete the image and keep the vector file.

7. Separate the path into (1) the outline of the overall shape and (2) everything else such that (1) and (2) can be cut on separate pieces of vinyl. (Note: This can be accomplished in multiple different ways.)

8. Show a PI your prepared file.

9. Show how to specify the material type being sent to the vinyl cutter. Explain what materials can be cut by the machine with the auto-blade insert and which of those materials are supplied in Craftland.

10. Cut out both colors of the design.

11. Use transfer tape to layer the top path over the bottom path.

12. Either trim the unneeded transfer tape or remove the transfer tape. Explain in what situations you might trim the transfer tape vs. remove it.

13. Show your sticker to a PI to be signed off.
Craftland – Sewing

2. Iron the fat quarters to remove any wrinkles in the fabric.
3. Using tailor’s chalk and a ruler, mark off a 6”x6” (15.25 cm x 15.25 cm) square of each of your two fabrics.
4. Identify fabric scissors from general purpose scissors. Use the pinking shears to cut the two 6” x 6” (15.25 cm x 15.25 cm) squares out.
5. Pin the squares together with the “right sides” of the fabric facing each other.
6. Mark a ¼” (.6 cm) seam allowance around the edges of the fabric.
7. Explain the purpose of the different threads and which to use for sewing.
8. Demonstrate the proper way to wind a bobbin to a PI. (If there are no empty bobbins available, explain the process.)
9. Demonstrate the proper way to thread the sewing machine to a PI.
10. Check sewing settings (tension, length, width, etc.)
11. Use a straight stitch to hem the pillow along the seam allowance, leaving about a 2” gap at the end. (Remember to start and stop with a reverse/locking stitch. You must pivot at the corners. Once finished, turn the dial until the thread take-up lever is fully raised before removing fabric.)
13. Flip the pillow inside out through the gap.
15. Use a ladder stitch to close the 2” gap.
16. Show your pillow to a PI to be signed off.