Invention Studio
A Student Organization at Georgia Tech

Prospective PI Checklist
Version 8.0 (Fall 2023)

Instructions: Name: _______________________

Train
- Grab a copy of the Prospective PI Checklist. 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:
  - Wood Room Processing -> Laser -> Wood Room Finishing -> Paint Booth
  - Waterjet -> Metal Room
- For the test, you should know the tools well enough to train another user - take time to practice! You can’t use notes on your test.
- If you fail a test, don’t worry! The PI will provide retraining, and you can attempt the test again the next day. Like the best Canvas quizzes, 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 through 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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Reason for Completing Checklist (circle): Become a PI | Limited SCC Access | SCC Team: ___
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 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.
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.
Note: Before you start the Paint Booth test you must complete the Wood Room Finishing test.

**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.
1. Sign into SUMS.

2. Use shears to remove the extra flange on one side of the large plate. After you do this, all four sides will be the same height.

3. Remove tabs and deburr the edges using a belt sander.

4. Place the smaller GT plate on the center of the larger plate. Use a center punch to mark the locations of the two holes in the GT plate on the larger plate.

5. Demonstrate how to change the speed on the drill press and explain how to select an appropriate speed.

6. Use the drill press and an appropriately sized drill bit to create holes for a ⅛" diameter rivet (provided). Drill these holes where you marked them.

7. Using the sheet metal brake, bend all four sides of the large plate into a box.

8. Use two rivets to fasten the GT plate to the inside of the box. Use the ⅛" rivets that are provided.

9. Clean up your workspace and sign out of SUMS.

10. Show the finished box 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!
1. Locate each type of 3D printer (Ultimaker 3/S3/ S5, Form 3/3L, Markforged Mark Two, Bambu Lab X1C, Creality CR30) and briefly describe the use cases of each.

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

3. Describe how a user can have a part printed on the professional printers (Stratasys Dimension 1200ES/EOS Formiga P110).

4. Demonstrate changing filament on an Ultimaker. Explain how the process differs between the 3 and S-line.

5. Explain the purpose of glue and when it should be reapplied to the glass plate.

6. Launch Cura. Explain what file type(s) are used as inputs and outputs.

7. Open Puzzle.stl and Skull.stl on the same build plate. Explain which parts require support, how to enable supports, and how to exclude certain areas from using supports.

8. Open IS_kiwi.stl and scale the model to 17%.

9. Identify the following settings and their purposes and state their recommended ranges:
   a. Layer Height
   b. Wall Thickness
   c. Infill Density

10. Explain what a brim is and what types of parts it should be used for.

11. Select a profile with a 0.2mm layer height. Set wall thickness to 0.8mm and infill density to 10% gyroid. Enable normal supports with a 7mm brim.

12. Slice the kiwi and upload the prepared gcode file to your own 3DPrinterOS account.

13. Add the print to the Uploads queue.

14. Using a PI’s 3DPrinterOS account, start your print from the queue.

15. Explain how to use the In-Person Queue and when it is necessary to do so.

16. Show how to abort a failed print and how to mark a printer down.

17. Demonstrate how to safely remove a print, brim, and supports. Explain what to do with finished and failed prints.

18. 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 5”.

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 retain 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.
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.