Team 1418's Ultimate 3D Printing Guide:

What is 3D printing?

3D printing is a type of additive fabrication. Additive, being the contrary to subtractive fabrication, is the process in which platform starts out with nothing but adds layer by layer of a substance until you have a solid 3D object. Subtractive Fabrication such as CNC milling, is a process in where you start out with a solid block of material and a blade cuts away until all that is left is the solid shape that was required.

A 3D printer works by taking a computer file and printing on a build platform with nothing and an object is made by the addition of very thin layers added on top of each other over and over again. The material could be heated plastic or a fine layer of dust held together by a thin layer of glue

Types of 3D Printing:

Extrusion: A continuous string of colored plastic filament is pulled through a heated nozzle as it is moved across a build platform. When a layer is completed the extruder is raised by a fraction of millimeter and the process starts again

Resin: A small tank is filled with an ultraviolet light reactive resin and the build platform is lowered until it just touches the surface. From underneath the tank a series of mirrors reflect a uv laser into many different places at many different angles.

Tools/Material

What do I need in a 3D printing tool bag?

-Kapton Tape
- Acetone
- Pallet Knife
-X-Acto Blade
-Wire Cutters
-Screwdrivers.
-etc…

Steps to Print

1. CAD Model or Download
2. Export as a .stl and .obj
3. Slice File => Gcode
4. Upload to Printer Control
5. Prepare Printer
6. Print
7. Post Processing

Some Printers can print from an SD Card, which means you don't need a printer

Software:

Developing a File:
File Formats:

.stl   => (STereoLithography)

A file type specifically for computer manufacturing. Breaks down surface geometry into triangle - Can allow for higher and lower surface resolution.

.obj   => (Object File)

A file type made for 3D graphics. Breaks down files into geometric shapes and defines them by tracking vertices.

Mesh Repair:
Some files are damaged during downloads or exports and the mesh need fixing.
NetFabb Cloud Service; Instant fixing in the cloud, I suggest using this for every file you make.

CAD Programs:

Program Name:	Pros:	Cons:
AutoCAD	Very Easy to export Lots of support Very Open; Versatile software Easy to use Direct Printing capability	Can be expensive* Learning Curve
Google SketchUp	Free	Need plug ins for .stl export Not as open
OpenSCAD	Free/Open source "Perfect" models Good support community	Coding based; large learning curve
Tinkercad	Free So easy to use	Not for Advanced users

Print Software

Software	Pros	Cons
Pronterface/Slic3r	Ultimate Control	Two programs
Cura	All in one Very Clean; Easy to use	Can be limited
ReplilcatorG	All in once	Hard to understand Basic
MakerWare	Easy to use Connected to internet; Thingiverse	MakerBot; Proprietary Buggy

Slicers and Printers
Hardware:
Vocab:

Axis (x,y,z) - The different directions the part/system moves.
("X"; left/right "Y"; front/back "Z"; up/down)

Print - The object being made

Build Plate - The surface the print is being printed on.

Print head - The entire assembly the pulls and extrudes the plastic; moves along the X

Build Space/Build Area -The area the the print can fill; the general space inside the printer

Extruder - The part that is hot, and deals with the melting plastic

Nozzle - The hole the the plastic is extruded out of

Thermistor - Heating element

Filament - The plastic string; Comes in different materials, sizes, and colors

Controller - could be the computer, the arduino, or the LCD

Picking a Printer:

Questions to ask:

What do I want to print?

Final Parts? Prototypes/Models? Toys?

What materials do I want to print in?

ABS? PLA? Nylon? Print temps will impact hardware

How big a build space so I really need?

What am I going to be Printing? large or small objects, save $$$

What to look for:

Good reviews -Durability -Versatility

Good Support Team

Open Source / Non-Proprietary

Filaments:

Most 3D printing filaments come in 1.75mm and 3.0mm diameters, Your printer will determine which one you use

ABS- (Acrylonitrile Butadiene Styrene) -Your average plastic (think LEGO)

Requires a Heated Bed w/ Kapton Tape

Durable plastic parts, Very strong and highly machinable

210C-230C Print Temperature

PLA- (Polylactic Acid) -Corn Based Biodegradable Plastic

Does NOT Need a heated bed w/ Blue Painters Tape

Durable Parts, however it can be brittle, I would not suggest lots of machining
175C-190C Print Temperature

Flexible- Thermoplastic Polystyrene
New type of filament, Prints are rubbery and flexible.
Does NOT Need a heated bed w/ Blue Painters Tape.
NinjaFlex

Nylon- Nylon Thermoplastic
Extreme Durability and strength
230C _ 265C

HIPS- (High Impact PolyStyrene)
PC- (Polycarbonate)
Polymer- Laybrick Laywood

Resources:

Thingiverse.com
URL: www.thingiverse.com
Thingiverse is a FREE database of user contributed things uploaded to the internet
that is run by Makerbot. All downloads are free and can be 3D Printed.
Its great place to get Ideas. Theres a lot of stuff on the site, but not everything
we upload our files we make as part of the open source movement.**

**Check out Team 1418's Thingiverse page at:

OpenSCAD
http://www.openscad.org/index.html

TinkerCAD
https://tinkercad.com/

Filament Information:
http://www.matterhackers.com/3d-printer-filament-compare

NinjaFlex:
http://www.ninjaflex3d.com/