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Preliminary Report

Problem Statement:

With the growth of 3-d printed building materials, strength has come into question when using these components. In the same design, one of the factors of 3-d printing is the infill density. The 3-d printers are able to produce a variety of infill densities which can be used to create different strengths, stability, weight, and time for printing. While there are many factors to consider, strength can be very important for the function and safety of a product.

Hypothesis:

If the infill density in the same 3-d printed design is increased, then the shear strength will increase, because the shear force will be distributed among the inner structures. (Sample mean of weight supported by 40% infill > by 30% infill > by 20% infill > 10% infill)

Sample:

This experiment will be performed on 20 separate samples. Each sample will be a circular rod with the same cross-sectional area and length. 5 samples will be created for each of 10, 20, 30, and 40% infill density. There will also be two brackets printed to affix the end of the rods and make sure all of the rods are tested in the same manner. The samples will be tested by forming a "bridge" with the rod supported by the two brackets and suspended between two tables. A basket will be suspended from the middle of the rod with a string, and then weights will be added to the basket until the rod fails. The amount of weight sustained will be the dependent variable, with the infill density being the independent variable. It is important to note that this test applies to shear strength only, and does not draw any conclusion about axial strength.

Hypothesis can be tested using three two-sample t-tests.

$H_0 = \bar{x}_{40} > \bar{x}_{30} > \bar{x}_{20} > \bar{x}_{10}$

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