# Step-by-Step Guide to the Jupyter Notebook Code

## Step 1 — Load Required Tools

* Import Python libraries needed for data handling, calculations, and combinations:
* - pandas: Work with tables of data.
* - numpy: Perform numerical operations quickly.
* - math: Access mathematical functions.
* - itertools.combinations: Generate all possible combinations of items.

## Step 2 — Create Example Bag Data

* Define bag types and their example models.
* Assign typical dimensions (length, width, height) and weight to each bag type.
* Generate a sample dataset by repeating each bag model multiple times.
* Save the dataset to 'bags\_example.csv' for testing.

## Step 3 — Build the BagInventory Class

* Create a class that can store and manage an inventory of bags.
* Automatically determine the bag type based on dimensions when adding a bag.
* Load existing inventory from 'bags.csv' if available.
* Save inventory back to CSV for persistence.

## Step 4 — Create Box Data for Carriers

* Define available box sizes for FedEx, USPS, and UPS, including their dimensions and costs.
* Combine all carrier boxes into a single dataset.
* Calculate volume in cubic inches and cubic centimeters for each box.
* Save the combined box list to 'box.csv' for later use.

## Step 5 — Classify Bags by Size

* Use a Bag class to sort dimensions and determine bag type based on size thresholds.
* Create a classifier class to read 'bags.csv', classify each bag, and output a table of results.

## Step 6 — Assign Bags to Boxes

* Build the BoxAssigner class to match bags to a limited number of box types.
* Allow choosing boxes from one carrier, all carriers, or creating custom-sized boxes using clustering.
* Optimize selection to minimize total box volume while ensuring all bags fit.
* Provide visualizations and tables of assignments.

## Step 7 — Run Assignments

* Load the bag and box data from CSV files.
* Run the BoxAssigner in 'mixed' mode to use all carriers.
* Run the BoxAssigner in 'customized' mode to design new box sizes.
* View results through plots and assignment tables.