Optimize, Design, and Minimize

Mathematics

(Worksheet V1.0)

# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| Note |
| * Anaconda (Python version 3.7 or above) and PuLP library are required for this practice. If they have not been installed, please refer to Installation and Troubleshooting Guide. * Download and Extract the ‘Working Files’ folder for this hands-on practice. * If you encounter any difficulties along the way, please refer to Installation and Troubleshooting Guide. |

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| **Step 1: Simplifying with Assumptions** | |
| **Instructions** | **Screenshot** |
| Notice that the dimensions of a 13" laptop box on the right side are actually larger than the actual size of the laptop it contains. What factors contribute to this extra size in the packaging for laptops in general? | *Image: Dieline for a 13” laptop box* |
| Laptop boxes are generally larger in size to account for factors like cushioning and protection. The dieline for such a box can be approximated as a rectangle that needs to be cut from the cardboard sheet. This rectangle is then folded and assembled to form the final box.  Therefore, the dimensions can be approximated as:   * *For a 13" laptop box: 23.315 inches by 25.685 inches* * *For a 15" laptop box: 25.315 inches by 27.685 inches*   For the charger box we will assume the dimensions as: *11.5 inches by 7.25 inches* | *Image: Dieline for a 15” laptop box* |

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| **Step 2: Setup Notebook** | |
| **Instructions** | **Screenshot** |
| 1. Run the Jupyter Notebook program (included in Anaconda). This will automatically open your default web browser and display the Jupyter Notebook web application.   *You can also use the Windows search bar. Just type 'Jupyter Notebook' and launch it.* | A screenshot of a computer  Description automatically generated  *Image: Jupyter Notebook Program* |
| 1. In the web application, navigate to the ‘Files’ tab at the top left corner besides running. 2. At the ‘Files’ tab, click on the ‘Upload’ button at the top right corner. 3. Select the file Optimize\_Design\_Minimize.ipynb from the ‘Working Files’ folder and upload it. 4. Once uploaded double click on the file to open it. | *Image: Navigating Jupyter Notebook* |

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| **Step 3: Setup LP using Jupyter Notebook** | |
| **Instructions** | **Screenshot** |
| 1. This notebook contains comprehensive details about the code used and the underlying logic behind it. It is structured to guide you through each step of the process. To fully understand and execute the examples, please follow these steps: 2. Review the code and explanations provided before each cell to grasp the methodology and logic. 3. Run each cell sequentially by pressing Shift + Enter to execute the code 4. Begin by executing the first code cell. |  |
| In LP, we either minimize or maximize. For our problem, where we cut boxes from a cardboard sheet, what should we minimize? |  |

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| **Questions** |
| 1. How can optimization techniques be applied in real-world situations outside of packaging? |
| 1. Reflect on the role of constraints in optimization problems. How do they affect the possible solutions? |
| 1. What ways can optimization contribute to sustainability in various industries? |