Building a Mega Constellation for Solar Energy Harvesting: To harvest the Sun's energy in immense quantities, planning for construction of a Dyson ring (a smaller version of a Dyson sphere) is underway. To acquire the material to build such a mega structure, many near-Earth asteroids will be transferred to 12 "building stations." Figure 1 depicts a schematic of the overall mission, which consists of sending a number of mother-ships to visit certain clusters of asteroids, rendezvous with some asteroids, and deploy a mechanism that is capable of transferring the asteroids to the 12 stations using advanced low-thrust electric propulsion systems. The 12 stations will move on a circular orbit around the Sun on a representative Dyson ring. The propellant required for performing the time-optimal maneuvers are generated in-situ from the asteroid material itself, and thus the delivered asteroid mass is dependent on the time of transfer. Fortunately, a group of mission designers have already solved a major part of the problem in which they have designed many time-optimal continuous-thrust transfers from a list of 1000 asteroids to all the 12 stations.

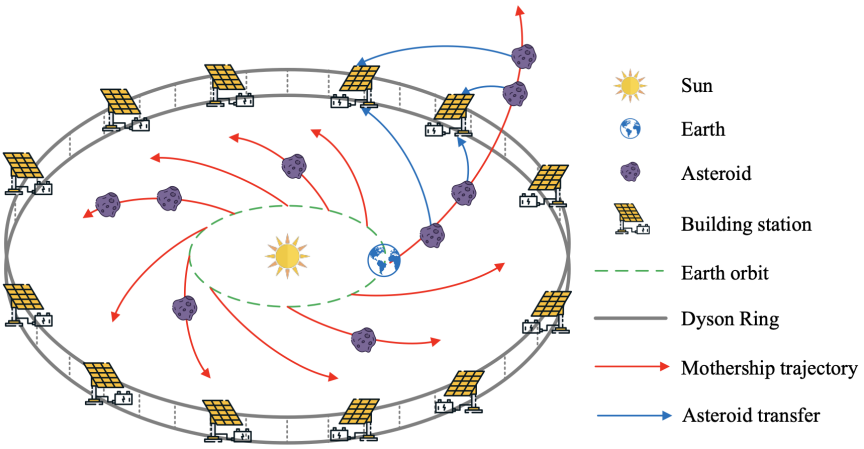

Figure 1: Illustration of the Dyson ring and asteroid trajectories to the 12 stations.

You are a member of an optimization team. Your colleagues are struggling with a problem, however, they recall that you have taken an *Advanced Trajectory Optimization* course at Auburn University. At this moment, you realize that you are in a big big trouble! ☺

Objective: To distribute the resources equally among all stations, the following cost is considered:

$$J = 10^{-10} M_{\min} \ [kg],$$

where $M_{\min}$ is mass of the station with the minimum total asteroid mass. Your task is to develop a code to *maximize* the value of J, which is equivalent to maximizing $M_{\min}$. We currently don't know the ID of the station with the least amount of mass, but your algorithm will determine the ID of the station and the optimal cost, J^*.

Asteroid Data: Mission designers have provided a data file (`AsteroidDataFile.txt`). The first row denotes station ID, the first column denotes asteroid ID, and the rest denotes the mass (in kilograms) of an asteroid delivered to all stations.

Final Report: Your report should be typeset in Overleaf and submit it as one pdf. Upload your code as a zip file with its main function named as 'MainAsteroidAllocation-YourName.m'. Consider these items: **Item 1:** Summarize the key steps in formulating the problem. **Item 2:** Include a bar chart that shows the total sum of the asteroid mass in each station. **Item 3: Conclusion/Summary:** Summarize what you learned from this project and if you encountered any challenges. Report the total number of hours spent on this project.