Astronomy Club, IITK
SnT Summer Project
Blast Off
Assignment 3

Submission Deadline: 23:59:59, 27/06/2022

Try to attempt all the questions

1. Continuing our discussing in the session regarding launching of rockets and them achieving orbits, plot the following graphs for the rocket (assuming a SSTO model):

   - Thrust (in N) v/s Altitude (in km)
   - Angle w.r.t normal (in radians) v/s Altitude (in km)
   - Altitude (in km) w.r.t. Time (in s)
   - Radial Velocity (in m) w.r.t. Time (in s)
   - Radial Acceleration (in ms^{-2}) v/s Time (in s)
   - Drag (in N) v/s Altitude (in km)
   - Rocket Mass (in kg) v/s Time (in s)

   Hence, also calculate the payload mass that such a rocket model could carry to LEO (400 km). You can use the paper on Multiobjective Optimization of Two-Stage Rockets for Earth-To-Orbit Launch as a reference. The relevant data to be used:

   - Thrust Vector (in MN) = [10.2, 9.79, 10.1, 3.77, 0.003]
   - Angle Vector (in km) = [0.40, 327.1]
   - Cone Half Angle = 0.108 radians
   - Radius = 3.98 m
   - Initial Wet Mas = 958.8 tons
   - Specific Impulse = 400 s
   - Space Shuttle Engine Mass = 3500 kg
   - Space Shuttle Thrust Force (at sea level) = 2.15 MN

2. Let's assume that 100 people want to become an Astronaut. In order for them to be selected, we calculate their capability level. The more the capable an individual is, the more is their chances of getting selected. Capability turns out is dependant on 2 factors:

   - Skill (95%)
   - Luck (5%)

   Using a Genetic Algorithm written in python (as demonstrated in the session), simulate the ideal capability level that the candidate must have to be selected into Astronaut training program.

   Hint: The answer should come out to be 100% Capability (95% Skill + 5% Luck)