Computer Project 1: Explicit Euler Equation Solver
Handed out 16^{th} April ; due by 27^{th} April

Write a computer program to solve the Euler equations (1) using explicit, finite-volume techniques.

$$\frac{\partial \vec{U}}{\partial t} + \frac{\partial \vec{F}}{\partial x} = 0 \tag{1}$$

The extents of your 1-D domain are from $x = -1$ to $x = 1$ with 40 intervals. The initial condition consists of a single discontinuity at x = 0, with uniform conditions on either side of it. The working fluid can be assumed to be air.

- $[\rho\ u\ T] = [1\ 0\ 500]$; $x \leq 0$; $[\rho\ u\ T] = [2.5\ 0\ 200]$; $x > 0$;
- $[\rho\ u\ T] = [1\ 574\ 250]$; $x \leq 0$; $[\rho\ u\ T] = [2.0\ 287\ 412]$; $x > 0$;
- $[\rho\ u\ T] = [2.5\ 0\ 500]$; $x \leq 0$; $[\rho\ u\ T] = [1.0\ 0\ 250]$; $x > 0$;

Close your system of equations with the assumption of an ideal gas. Assume $R = 287 J/kg \cdot K$ for air.

Your code should construct the flux at the interfaces using the van Leer scheme and either of LDFSS or AUSM scheme (discussed in class). Integrate the equations with a first and fourth order time integration.

Your output should include ϕ vs. x plots, where $\phi = \rho, u, p$, **for your choice of total time**.

You need to present your report in a technical paper format.

- In your title page please write your names and roll numbers. At the end of your report include the code as an Appendix item.
- Provide some description/explanation for any plot you present in the write up. You should not just post a figure without commenting on it.
- Please submit a pdf copy of your report with the following naming convention: AS5460-Group-xx-Project-1.pdf where xx refers to your group number.
- **I would expect each group to write their own code. No sharing of code is acceptable between groups and absolutely no collaboration on the reports is permitted. This can result in getting a U grade in this course.**