

AE339: High-speed aerodynamics
Tutorial 4

1. A c-d- nozzle is designed to operate with an exit Mach number of 1.75. The nozzle is supplied from an air reservoir at $68 \times 10^5 \text{ N/m}^2(\text{abs})$. Assuming one-dimensional flow, calculate the following:
 - (a) Maximum backpressure to choke the nozzle,
 - (b) Range of backpressure over which a normal shock will appear in the nozzle,
 - ☒ (c) Backpressure for the nozzle to be perfectly expanded to the design Mach number,
 - ☒ (d) Range of backpressure for supersonic flow at the nozzle exit plane.
2. A supersonic converging-diverging diffuser, is designed to operate at a Mach number of 1.7. To what Mach number should the inlet be accelerated in order to swallow the shock during the start-up?
3. A c-d- diffuser is to be used at Mach 3.0. The diffuser has to use a variable area throat so as to swallow the starting shock. What percentage increase in throat area will be necessary?