Problem 1: Consider a thin ribbon of steel that is 1 inch wide and 0.05 in thick, with yield stress equal to 200 ksi and perfectly plastic post-elastic response. Imagine that the ribbon has a crack at its edge. Using expressions for the stress intensity factor at the tip of an edge crack in a finite width plate generate a plot of the strength of the ribbon versus crack length. Consider both fracture and net section yield in generating your plot.

Problem 2: Consider a large plate with an edge crack of initial length 0.1 in. The plate is made of material with Paris model parameters \( C = 7 \times 10^{-10} \) and \( n = 4 \). Calculate the crack length after a deformation history that consists of 2000 cycles with \( \sigma_{\text{max}} = 20 \text{ ksi} \) and \( \sigma_{\text{min}} = 0 \text{ ksi} \), followed by 2000 cycles with \( \sigma_{\text{max}} = 10 \text{ ksi} \) and \( \sigma_{\text{min}} = 0 \text{ ksi} \).

Problem 3: A long cylindrical pressure vessel is shown in cross section below. The hoop stress is given by \( \sigma_h = \frac{pr}{t} \), and the longitudinal stress is given by \( \sigma_l = \frac{pr}{2t} \). Let there be a small crack on the inside surface of the pressure vessel of length \( a = 0.1 \). If \( r \gg t \) you can use one of the stress intensity solutions given in class to approximate the stress intensity factor at the crack tip. The vessel is made of steel with yield stress of \( \sigma_y = 100 \text{ ksi} \) and fracture toughness \( K_{\text{f,c}} = 50 \text{ ksi}\sqrt{\text{in}} \). The geometric dimensions are \( r = 12 \text{ in} \), \( t = 1 \text{ in} \).
(a) Determine the pressure at which the structure will become susceptible to crack propagation.
(b) Determine whether, at this internal pressure, the structure is safe against yielding using the von-Mises criterion.

Problem 4: Approximately how many hours did you spend on this assignment?