Name:

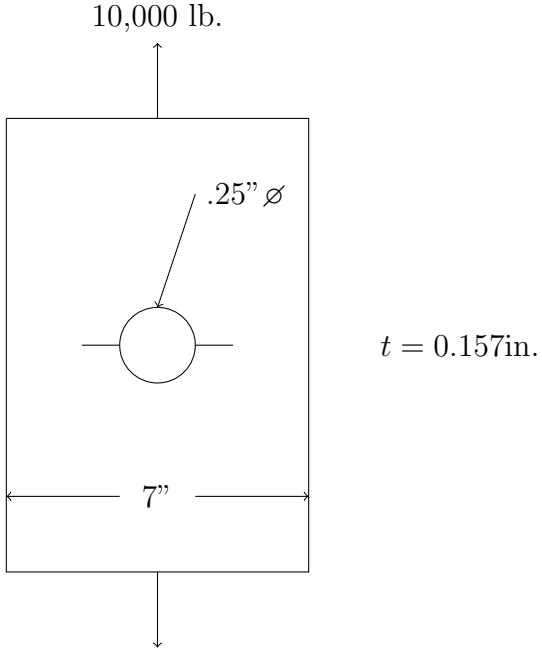
Homework 1

Due 2 Feb 2016

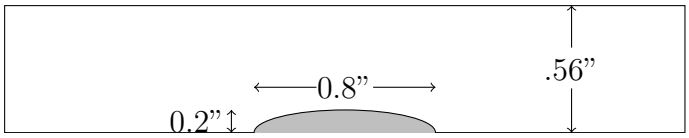
1. Define *stress intensity*

2. (a) Determine the value of K_I for a center-cracked panel with $W/2a = 5$ and a uniformly applied remote stress, σ.
   (b) Determine the value of K_I for an edge-cracked panel with $W/a = 5$ and a uniformly applied remote stress, σ.
   (c) Compare these two results. Note that in both cases the panel width to crack length ratio is the same. Why do you think these results are different?

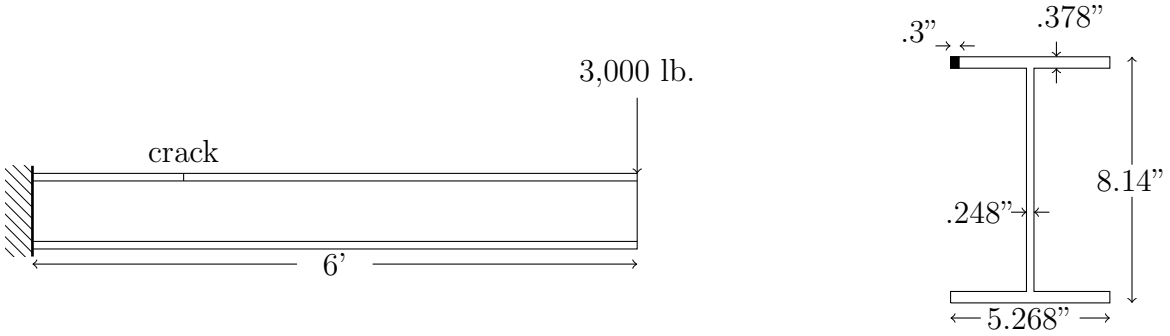
3. For the plate shown below, determine K_I for the following conditions
   (a) There is a .085" thru crack on one side of the hole.
   (b) There are .085" thru cracks on both sides of the hole.
   (c) There is a quarter circular crack of .085" radius on one side of the hole.



4. The panel shown below has a semi-elliptical surface flaw. Determine the maximum value for K_I if the normal stress in the crack opening direction is 17,700 psi.

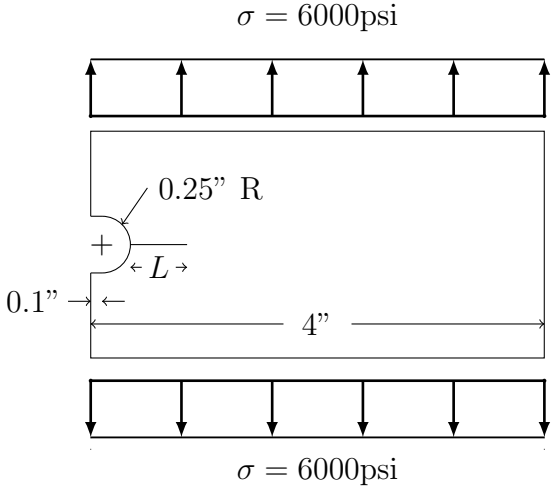


5. An aluminum beam has a 0.3” crack in the upper flange as shown. Estimate the stress intensity.

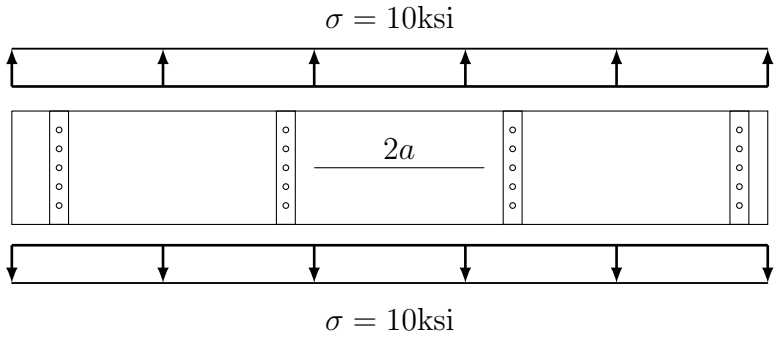


6. Estimate the stress intensity if the crack at the notch has a length L of
   (a) 0.5”
   (b) 0.025”

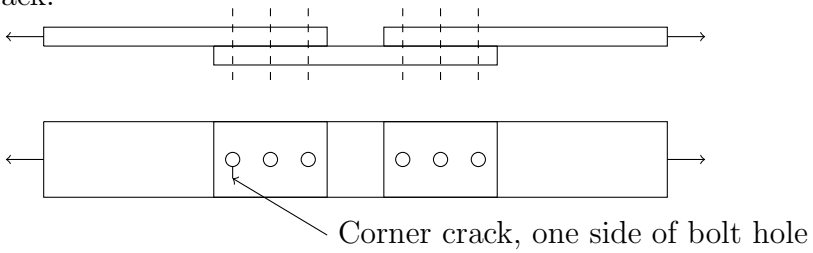
   The thickness is 0.375”



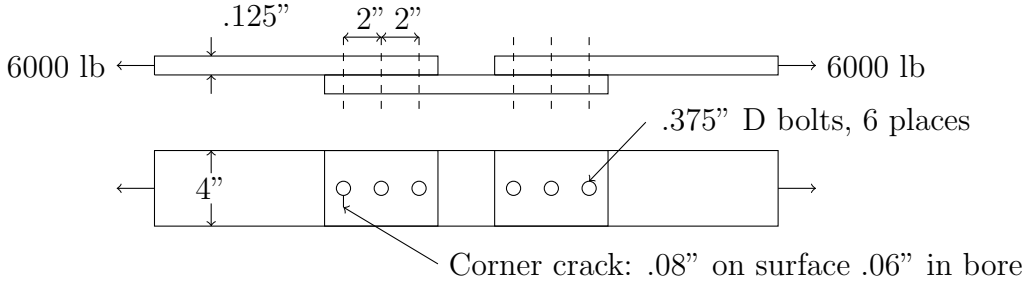
7. A stiffened skin panel has a 10" crack between stiffeners as shown. The distance between stiffeners is 12", rivet pitch is 2", and tensile stress is 10 ksi. Skin thickness is 0.6" and stiffener cross sectional area is 3.1 in^2. Determine the stress intensity.
   How much do the stiffeners increase the strength?
   Note: In this problem, assume the edge effect for stiffeners is $\beta_S = 0.9$



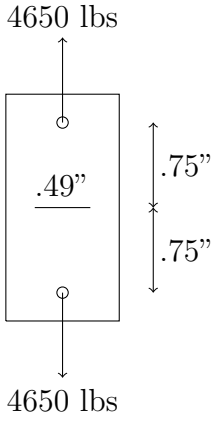
8. For the splice shown, use superposition and suggest a method to estimate the stress intensity at the corner crack.



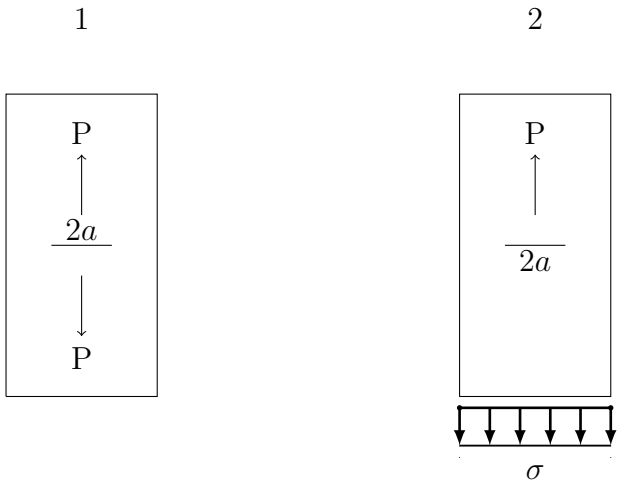
9. For the splice shown, estimate the stress intensity at the corner crack in the 2014-T6 plate.



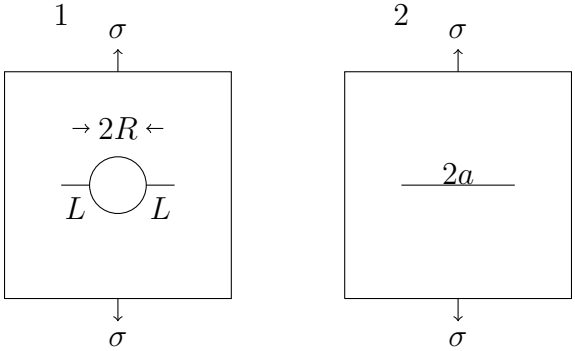
10. Calculate the stress intensity in the splice plate shown, which is loaded by steel bolts at their single shear capacity of 4650 lbs. The plate has a thickness of 0.2" and a center crack of 0.49", with $\nu = 0.33$. Assume the plate is very wide relative to the other dimensions.



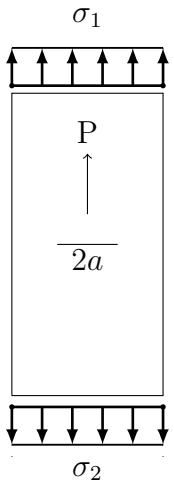
11. Determine the expression for stress intensity
    (a) In panel 1
    (b) Use superposition to determine the stress intensity in panel 2



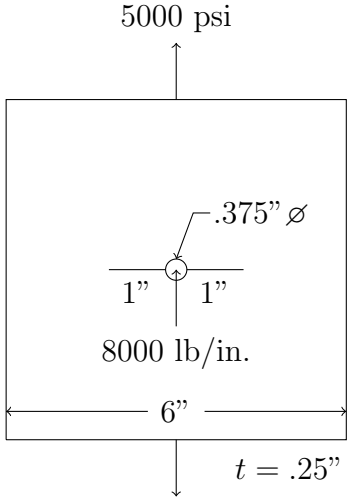
12. Compare the stress intensities of the two cases where $2a = 2L + 2R$.



13. Determine the stress intensity for the panel shown



14. The panel shown has a remote bypass stress of 5000 psi and a fastener load of 8000 lb/in. of thickness. Determine the stress intensity.



15. Quite often, and sometimes in poor judgment, the expression

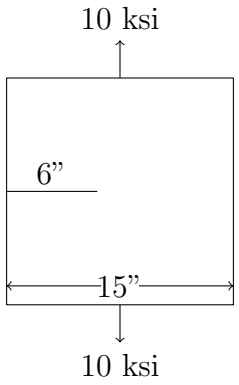
$$K_I = 1.12\sigma\sqrt{\pi a}$$

is used for the configuration shown, where 1.12 is called the back surface correction. Determine the stress intensity for

(a) $K_I = 1.12\sigma\sqrt{\pi a}$

(b) $K_I = \sigma\sqrt{\pi a}\beta$

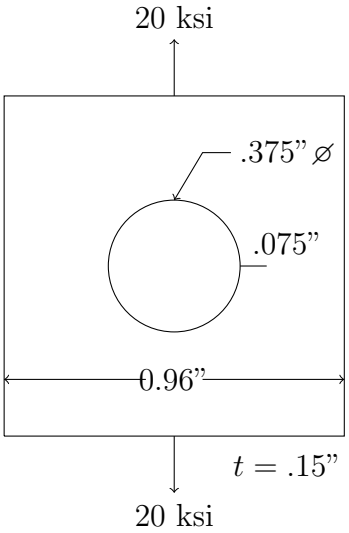
and compare results.



16. Determine the stress intensity if:

(a) The crack is a thru crack

(b) The crack is a quarter circular corner crack



17. Use superposition to derive the expression for stress intensity for the case shown. There is a fastener load at the hole and the hole is small compared to the crack length.