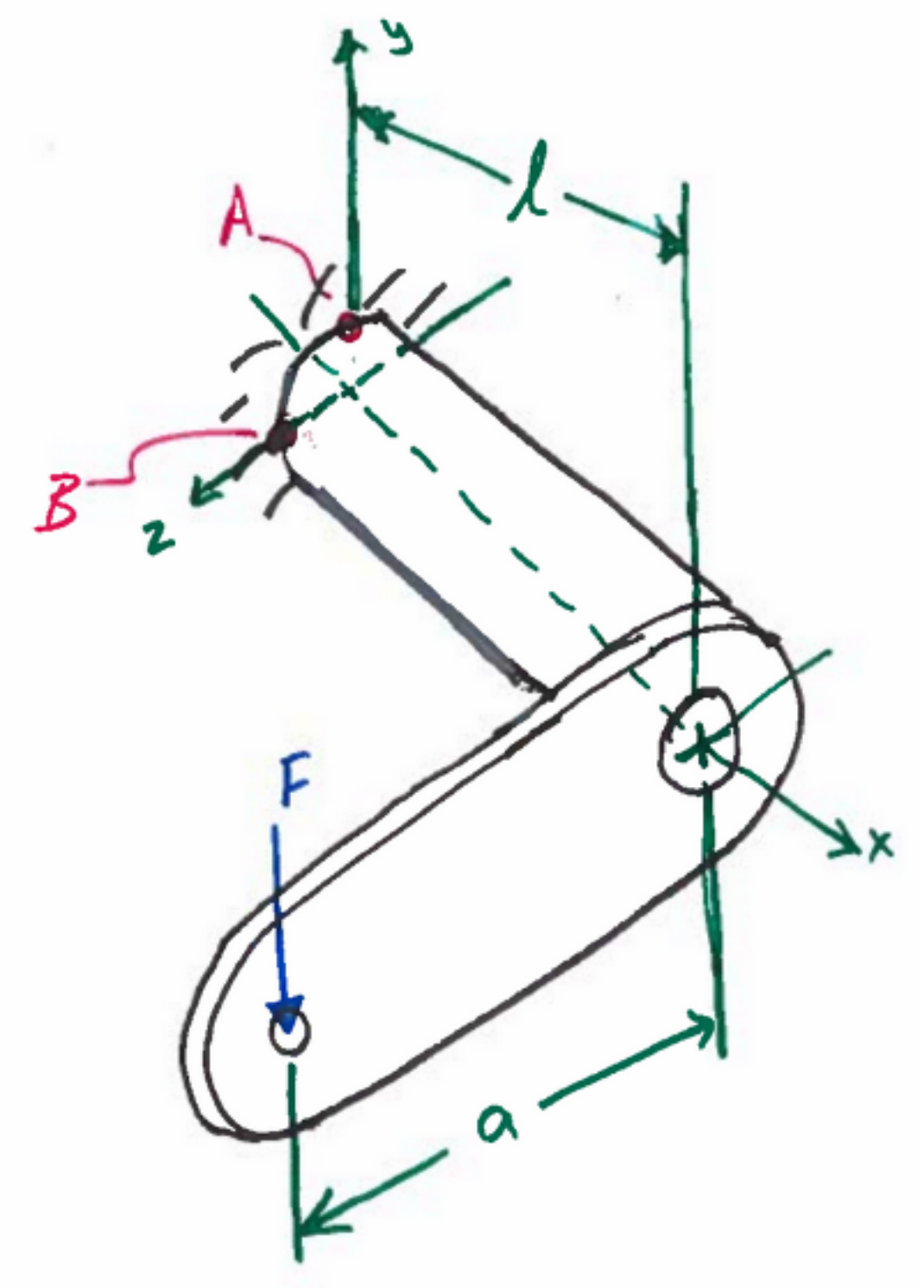
EME 150A Fall 2016 Homework #07

DUE: Monday, November 21, 2016 before class in Box B in the MAE department.

Problem 1

Determine the safety factors at points A and B for the bracket shown below. It is made of ASTM Class 50 Cast Iron (Table A-24). The variables have the following values: l = 6in, a = 8 in, d = 1.5 in, F = 1000 lb. Use the modified Mohr Theory.



Problem 2

(1) Estimate the endurance limit and the low cycle fatigue strength for an axially loaded ground steel specimen with $S_{ut} = 150$ksi, $d = 1.0$in, and $T = 70°$F. (2) Determine the expected life for $\sigma_a = 75$ksi and $\sigma_m = 0$ksi.

Problem 3

Determine the required diameter for a round steel element that is axially loaded from -2500 to 2500 lb in fully reversed cycles. Assume it is ground, $S_{ut} = 150$ksi, and is loaded at $T = 70°$F. Determine the diameter for infinite life and 10^3 cycles.

Problem 4

Given a 2024-T3 aluminum specimen forged to 2.0in round, determine the fatigue strength for 3×10^7 cycles of loading for fully reversed torsion. Note that for non-ferrous metals, the unmodified fatigue strength is taken at $N = 5 \times 10^8$ cycles (see Table A-24).

Problem 5

A simple hot rolled 1020 steel cantilever beam of length 0.6 m is loaded transversely at the end with a fully reversing load of $\pm$5kN. The beam has a rectangular cross section with a width of 40mm. What is the required height of the beam's cross section to guarantee safe operation up to $N = 10^4$cycles with a design factor of 2? Neglect any stress concentrations.