CH 14 HWK
14.7 NORTON

ME 340
11/19/98

½ UNC CLASS 7 (THEY MEAN GRADE 7)
ROLLED THREADS
80% PRELOAD
3in THICK STEEL JOINT
1000 lb EXTERNAL LOAD
FIND FOS AGAINST YIELD AND SEPARATION

NOTE: 99% RELIABILITY APPLIES TO FATIGUE ONLY - NOT USED HERE.

SINCE THE JOINT AND BOLT ARE BOTH STEEL, $k_m = 8k_b$; $C = \frac{1}{9}$

$$F_i = 0.8 A_t S_p = 0.8(0.1419\,in^2)\,105\,kpsi = 11{,}920\,lb$$

$$F_b = CP_{ext} + F_i = \frac{1}{9}(1000lb) + 11{,}920lb = 12{,}031\,lb$$

$$F_m = (1-C)P_{ext} - F_i = (1-\tfrac{1}{9})(1000lb) - 11{,}920lb = -11{,}031\,lb$$

$$\sigma_{b,max} = \frac{F_{max}}{A_t} = \frac{12{,}031\,lb}{(0.1419\,in^2)} = 84{,}785\,psi$$

$$N_{y,b} = \frac{115kpsi}{84{,}785\,kpsi} = 1.36$$

JOINT WILL SEPARATE WHEN $F_m = F_i$ ...

$$(1-C)P_{ext} = 11{,}920lb \rightarrow P_{ext,sep} = \frac{11{,}920\,lb}{(1-\frac{1}{9})} = 13{,}410\,lb$$

$$N_{sep} = \frac{13{,}410\,lb}{1{,}000\,lb} = 13.4$$

NOTE: THESE FACTORS OF SAFETY VARY FROM THE TEXT ANSWERS BECAUSE THE TEXT SOLUTION USES THE CONE FRUSTRA METHOD TO FIND THE JOINT STIFFNESS AND CONSIDERS ACTUAL THREAD LENGTH FOR BOLT STIFFNESS. THIS METHOD USES EFFECTIVE CYLINDER AND NOMINAL BOLT DIAMETER.