Design exercise 1

A 40mm diameter bar has been machined from AISI-1045 CD bar. The bar is subjected to a fluctuating tensile load varying from 0 to 100kN. Due to the ends fillet radius, fatigue stress concentration factor $K_f = 1.85$ is to be used. Find the critical mean and alternating stress values S_a and S_m and the fatigue factor of safety according to the modified Goodman fatigue criteria

1 UNS No.	2 SAE and/or AISI No.	3 Process-ing	4 Tensile Strength, MPa (kpsi)	5 Yield Strength, MPa (kpsi)	6 Elongation in 2 in, %	7 Reduction in Area, %	8 Brinell Hardness
G10400	1040	HR	520 (76)	290 (42)	18	40	149
		CD	590 (85)	490 (71)	12	35	170
G10450	1045	HR	570 (82)	310 (45)	16	40	163
		CD	630 (91)	530 (77)	12	35	179
G10500	1050	HR	620 (90)	340 (49.5)	15	35	179
		CD	690 (100)	580 (84)	10	30	197

Design exercise 2

Given $D = 42$mm, $d = 28$mm, fillet radius $r = 2.8$mm with the following material properties: $S_{ut} = 735$MPa, and $S_{yt} = 574$MPa. The part is cold drawn and required reliability is 99%. It is subjected to completely reversed bending moment of 142.4Nm and a steady torque of 124.3Nm. Estimate the factor of safety using the modified Goodman failure criteria for the smaller section Given $K_f = 1.68$ and $K_{fs} = 1.38$