PROBLEM 14-1

Statement: **Compare the tensile load capacity of a 5/16-18 UNC thread and a 5/16-24 UNF thread made of the same material. Which is stronger? Make the same comparison for M8 x 1.25 and M8 x 1 ISO threads. Compare them all to the strength of a 5/16-14 Acme thread.**

Variable Sheet for part (a):

St	Input	Name	Output	Unit	Comment
		Ffine	5 810.	lb	allowable load with fine bolt
		Fcoarse	5 240.	lb	allowable load with coarse bolt

Variable Sheet for part (b):

St	Input	Name	Output	Unit	Comment
		Ffine	39 170.	N	allowable load with fine bolt
		Fcoarse	36 610.	N	allowable load with coarse bolt

PROBLEM 14-7

Statement: **A 1/2-in-dia UNC, class 7 bolt with rolled threads is preloaded to 80% of its proof strength when clamping a 3-in-thick sandwich of solid steel. Find the safety factors against static yielding and joint separation when a static 1 000-lb external load is applied. Use 99% reliability.**

Assumptions: **The finish is machined. Assume room temperature.**

		Ny	1.36		safety factor in static yielding
L		Nsep	12.61		safety factor against separation

PROBLEM 14-9

Statement: **A 7/16-in-dia UNC, class 7 bolt with rolled threads is preloaded to 70% of its proof strength when clamping a 2.75-in-thick sandwich of solid steel. Find the safety factors against fatigue failure, yielding and joint separation when a 5 000-lb (peak) fluctuating external load is applied. Use 99% reliability.**

L		Nf	2.41		safety factor in fatigue
		Nf_pl	2.41		safety factor – fatigue – no separation
L		Nsep	1.65		safety factor against separation
L		Nfyield	1.25		safety factor against dynamic yielding
		Ny	1.28		safety factor in static yielding
		Nf_no_pl	0.36		safety factor if no preload
		torque	718.	in–lb	required tightening torque

PROBLEM 14-10

Statement: **An M12 x 1.25, class 9.8 bolt with rolled threads is preloaded to 85% of its proof strength when clamping a 5-cm-thick sandwich of aluminum. Find the safety factors against fatigue failure, yielding, and joint separation when a 20 kN (peak) fluctuating external load is applied. Use 99% reliability.**

L		Nf	1.05		safety factor in fatigue
		Nf_pl	1.05		safety factor – fatigue – no separation
L		Nsep	3.21		safety factor against separation
L		Nfyield	1.17		safety factor against dynamic yielding
		Ny	1.27		safety factor in static yielding
		Nf_no_pl	0.52		safety factor if no preload
		torque	129.	N–m	required tightening torque

PROBLEM 14-13

Statement: **Find the tightening torque required for the bolt in Problem 14-9.**

Solution: **Also see *the TKSolver* files P14-13.**

Rule Sheet:

See the Variable Sheet for Problem 14-9. It includes the solution to this problem.

Variable Sheet:

St	Input	Name	Output	Unit	Comment

See the Variable Sheet for Problem 14-9. It includes the solution to this problem.

PROBLEM 14-14

Statement: **Find the tightening torque required for the bolt in Problem 14-10.**

Statement: **Also see *the TKSolver* file P14-14.**

Rule Sheet:

See the Variable Sheet for Problem 14-10. It includes the solution to this problem.

Variable Sheet:

St	Input	Name	Output	Unit	Comment

See the Variable Sheet for Problem 14-10. It includes the solution to this problem.

PROBLEM 14-20

Statement: **A single-cylinder engine head sees explosive forces that range from 0 to 18.5 kN each cycle. The head is 10-cm-thick aluminum, the unconfined gasket is 1-mm-thick copper-asbestos, and the block is cast iron. The piston is 75 mm dia and the cylinder is 140 mm outside dia. Specify a suitable number, class, preload, tightening torque, and bolt circle for the cylinder head cap screws to give a minimum safety factor of 1.5 for any possible failure mode. Use fine-thread screws.**

L	Nf	35.2		safety factor in fatigue
	Nf_pl	35.2		safety factor – fatigue – no separation
L	Nsep	2.0		safety factor against separation
L	Nfyield	1.5		safety factor against dynamic yielding
	Ny	1.5		safety factor in static yielding
	Nf_no_pl	0.75		safety factor if no preload
	torque	8.	N–m	required tightening torque
	Dcirc	6.88	cm	bolt circle dia for 6 times bolt dia spacing
	Csurf	0.76		surface finish factor (machined)

THE ABOVE USES 6 6x1 mm BOLTS 16 cm LONG
MACHINED THREADS
99% RELIABILITY