4. The design requirements demand that a joint should have a stiffness coefficient C less than 0.32 or a failure will occur. The joint consists of a 1-in thick steel plate between two identical 1/2-in thick aluminum plates held together by a 3/8-in 16 UNC bolt and a nut. All the stiffness constants are random variables as shown in the table. Assume that all stiffness constants are independent. Find the probability of failure for the joint using Monte Carlo Simulation.

Answer: $p_f = 4.920(10^{-5})$

Random Variable	Type	Mean (μ)	Variance (σ^2)	Units
K_B (bolt stiffness)	Normal	2	0.01^2	Mlb/in
K_{M1} (member 1 stiffness)	Normal	8	0.5^2	Mlb/in
K_{M2} (member 2 stiffness)	Normal	45	1^2	Mlb/in
K_{M3} (member 3 stiffness)	Normal	8	0.5^2	Mlb/in

Bolt: SAE Grade 5, 3/8-in 16 UNC

Member 2: AISI 2020 Steel

Members 1 & 3: 2024 Aluminum