

7. An axial force $F \sim N(18, 1^2)$ kN is applied to a round shaft with a length of $l \sim N(600, 0.6^2)$ mm. The modulus of elasticity is $E = 200$ GPa and the allowable axial extension is $\delta = 0.01$ mm. If the maximum probability of failure is designed to be $p_f = 10^{-5}$, determine the minimum diameter of the shaft and then select a preferred one. Assume that F and l are independent.

Answer: $d_{min} = 97.93$ mm, $d_{preferred} = 100$ mm