

14. A torque  $T \sim N(5000, 500^2)$  N·m is applied to a hollow steel shaft. The allowable torsional stress is  $\tau_a \sim N(150, 15^2)$  MPa. If the inside diameter is designed to be 70% of the outside diameter and the probability of failure is designed to be  $p_f = 1 \times 10^{-5}$ , determine the size of shaft and choose a preferred one using FOSM. Note that  $T$  and  $\tau_a$  are independent.

**Answer:**  $d_{preferred} = 80$  mm