4-4. Two vertical random forces $P_1 \sim N(400, 35^2)\,\text{lb}$ and $P_2 \sim N(750, 50^2)\,\text{lb}$ act on a shaft as shown in the figure. The sleeve bearings at A and B support only vertical forces. The diameter of the shaft is $d = 2\,\text{in}$, and the allowable bending stress of the shaft is $S_a \sim N(16, 0.8^2)\,\text{ksi}$. P_1 and P_2, and S_a are independent. Determine the probability of failure of the shaft.

(**Ans.** $p_f = 1.68 \times 10^{-6}$)