Exam 2

Please put your answers in the following table.

1	2	3	4	5	6	7	8	9	10

1. A specimen of steel was tested in tension and loaded by an axial force $F \sim N(\mu_F, \sigma_F^2)$ kN. The yield strength of steel is $S_y \sim N\left(\mu_{S_y}, \sigma_{S_y}^2\right)$ MPa. And the modulus of elasticity and modulus of rigidity are E and G, respectively. Which of the following statements is true about the Poisson's ratio ν?
   A. The larger is μ_F, the larger is the mean of ν
   B. The smaller is μ_F, the larger is the mean of ν
   C. The larger is μ_{S_y}, the larger is the mean of ν
   D. ν is related to E and G

2. For the above problem, which of the following statements is not true about the distribution of the resilience u_R?
   A. u_R is normally distributed with $u_R \sim N(\mu_{u_R}, \sigma_{u_R}^2)$
   B. The smaller is μ_F, the smaller is the mean of u_R
   C. The larger is μ_{S_y}, the larger is the mean of u_R
   D. The smaller is σ_{S_y}, the smaller is the standard deviation of u_R

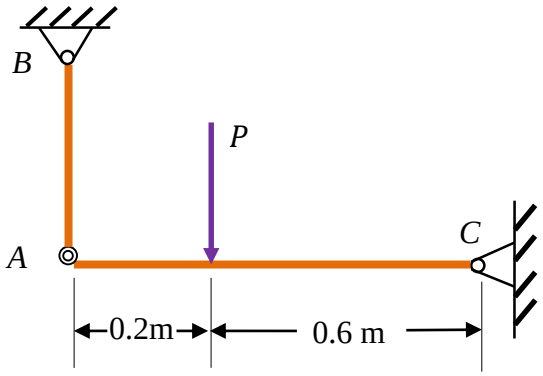
3. A solid circular bar is twisted by a torque $T \sim N(1000, 100^2)$ N·m. The diameter and length of the bar are $d = 80$ mm and $l = 800$ mm, respectively. Determine the mean and standard deviation of the maximum shear stress $\tau_{\max}$.
   A. $\mu = 9.95$ MPa, $\sigma = 9.95$ MPa
   B. $\mu = 9.95$ MPa, $\sigma = 0.0995$ MPa
   C. $\mu = 9.95$ MPa, $\sigma = 0.995$ MPa
   D. $\mu = 9.95$ MPa, $\sigma = 0.990$ MPa

4. For the above problem, if the modulus of rigidity is $G = 60$ GPa, what is the mean and standard deviation of the angle of twist θ?
   A. $\mu = 0.017, \sigma = 1.7 \times 10^{-4}$
   B. $\mu = 0.017, \sigma = 1.7 \times 10^{-2}$
   C. $\mu = 0.017, \sigma = 2.9 \times 10^{-6}$
   D. $\mu = 0.017, \sigma = 0.0017$

5. For problem 3, if the allowable shear stress is $\tau_a = 12$ MPa, what is the probability of failure?
   A. $\Phi(2.06)$ B. $\Phi(-2.06)$ C. $\Phi(20.6)$ D. $\Phi(-20.6)$

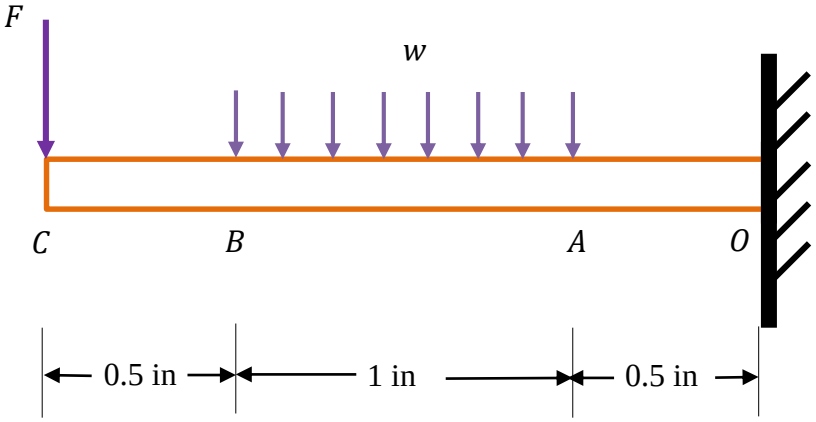
6. For problem 4, if the allowable angle of twist is $\theta_a = 0.022$, determine the reliability of the bar.
   A. $\Phi(29.4)$ B. $\Phi(-2.94)$ C. $\Phi(2.94)$ D. $\Phi(-29.4)$

7. If $P \sim N(4000, 400^2)$ N, what is the distribution of the load acting on rod AB?
   A. $F_{AB} \sim N(1000, 100^2)$ N
   B. $F_{AB} \sim N(2000, 200^2)$ N
   C. $F_{AB} \sim N(3000, 300^2)$ N
   D. $F_{AB} \sim N(4000, 400^2)$ N



8. For the above problem, if the maximum allowable load of rod AB is $P_a = 3600$ N, determine the probability of failure of the rod.
   A. $\Phi(0)$ B. $\Phi(-7.28)$ C. $\Phi(-2)$ D. $\Phi(2)$

9. A circular cross-section beam is cantilevered at O and subjected to a concentrated force $F \sim N(2000, 200^2)$ lbf and an uniform load of $w \sim N(3000, 300^2)$ lbf/in. Determine the distribution of the bending moment at point O.



   A. $M_O \sim N(5000, 500^2)$ lbf·in B. $M_O \sim N(4500, 450^2)$ lbf·in
   C. $M_O \sim N(4000, 400^2)$ lbf·in D. $M_O \sim N(3500, 350^2)$ lbf·in

10. For problem 9, if the diameter of the beam is $d = 2$ in and the maximum allowable bending stress is $\tau_a = 8$ kpsi, what is the reliability of the beam?
    A. $\Phi(-2.57)$ B. $\Phi(-3.23)$ C. $\Phi(-2.26)$ D. $\Phi(2.57)$