

Quiz 3

Please put your answers in the following table.

1	2	3	4	5	6	7	8	9	10

- A component is subjected to two independent forces X_1 and X_2 , and the resultant force is given by $Y = g(X_1, X_2) = X_1 + X_2$ where $X_1 \sim N(50, 3^2)$ kN and $X_2 \sim N(-30, 4^2)$ kN. What is the mean value of Y ?
A. 80 kN
B. 20 kN
C. -20 kN
D. 40 kN
- In problem 1, what is the standard deviation of Y ?
A. 5 kN
B. 7 kN
C. 1 kN
D. Cannot be determined
- In problem 1, the failure event is defined by $Y < 0$. What is the probability of failure?
A. $\Phi(20/7)$
B. $\Phi(-4)$
C. $\Phi(4)$
D. $\Phi(-20/7)$
- In problem 1, what is the probability that Y is less than 20 kN?
A. $< 50\%$
B. $> 50\%$
C. $= 50\%$
D. Cannot be determined
- For a beam, the factor of safety is defined by $n_s = \mu_Y/\mu_X$, where μ_X and μ_Y are the means of the stress X and strength Y of the beam, respectively. The reliability of the beam is defined by the probability $R = \Pr\{Y > X\}$. Also denote σ_X and σ_Y as the standard deviations of X and Y , respectively. Which of the following actions cannot improve reliability?
A. Increase n_s and keep σ_X and σ_Y constant
B. Keep n_s constant and increase σ_Y
C. Keep n_s constant and decrease σ_X
D. Keep n_s constant and decrease both σ_X and σ_Y .
- In problem 5, the factor of safety n_s has no relation with the reliability of the beam. (True or False)
- 100 failure samples are obtained out of 1,000,000 samples. The probability of failure estimated is
A. 0.9999 B. 0.0001 C. 0.5 D. 0

8. In problem 7, if 1000 failure samples are obtained, the reliability will be decreased. (True or False)
9. If the forces acting on a component follow independent normal distributions, the resultant force also follows a normal distribution. (True or False)
10. A design team designed two cantilever beams. The deflection of the tip of each beam is normally distributed as shown. If a smaller deflection is preferred, which design is better?
- A. Design 1 B. Design 2
C. Equally good D. Cannot determine

