

University of Colorado
Department of Civil, Environmental and Architectural Engineering
CVEN 5454 Quantitative Methods

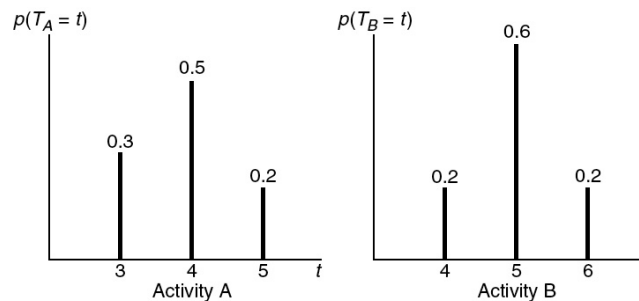
Homework #2

Due October 14th, 2025

Topics: Discrete and Continuous RVs and, extreme value distributions – Chapters 3 and 4 and additional resources. If you use R-commands to solve any of the problems include them in your solution. You have to use R for the last 2 problems.

PDF / CDF / Mean and Variance

1.



The duration in days of two activities A and B in a construction project are denoted as T_A and T_B , whose PMFs are given graphically above.

- (i) Assume the durations are statistically independent, and activity B will begin as soon as activity A has been completed. Determine and plot the PMF of the total time T required to complete both activities.
- (ii) What is the expected total time of completion of both activities and its variance?
- (iii) What is the probability that the total time of completion is within one standard deviation of the expectation?

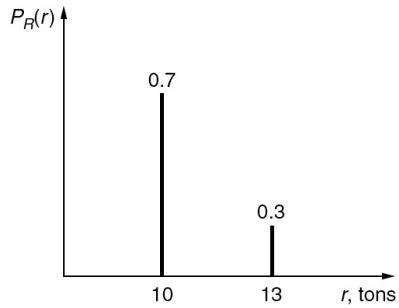
2. 3-72

3. 4-8

4. The maximum load S (in tons) on a structure is modeled by a continuous random variable S whose CDF is given as follows

$$\begin{aligned} F_S(s) &= 0 && \text{for } s \leq 0 \\ &= (-s^3/864) + (s^2/48) && \text{for } 0 < s \leq 12 \\ &= 1 && \text{for } s > 12 \end{aligned}$$

- (i) Determine the mode, mean and variance of S
- (ii) What is the probability that the load is within two standard deviations of the expected value?
- (iii) The strength R of the structure can be modeled by a discrete random variable with the probability mass function. Determine the probability of failure, i.e. the probability that loading S is greater than the strength R



Continuous Distributions

5. 4-66

6. 4-133. Also compute the 100-year return period event (use R)

7. The daily average concentration of pollutants in a stream follows a lognormal distribution with a mean of 60 mg/l and a c.o.v. of 20%.

- (i) What is the probability that the average concentration of pollutant in the stream will exceed 100 mg/l (a critical level) on a given day?
- (ii) Suppose the pollutant concentration between days is statistically independent. What is the probability that the critical level of pollutant concentration will not be reached during a given week?

Discrete Distribution

8. 3-92

9. 3-93

10. 3-103

11. 3-105

12. 3-104

13. 3-125

14. 3-139

15. 3-158