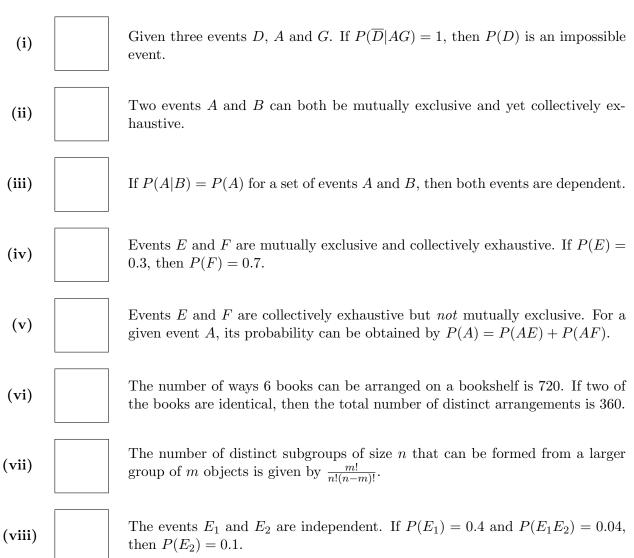
CEE 260/MIE 273: Probability & Statistics in Civil Engineering

09.16.2025

Due September 23, 2025 at 1:00 PM as PDF and .ipynb/.m files uploaded on Canvas. If it helps and if possible, you can write your responses directly on this document and upload it instead. Show as much work as possible in order to get FULL credit. There are 4 problems with a total of 31 points available.

Problem 1 (8 points)

Respond "T" (*True*) or "F" (*False*) to the following statements. Use the boxes provided. Each response is worth 1 point.



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Problem 2 (8 points)

Data collected at elementary schools in DeKalb County, GA, suggest that each year roughly 25% of students miss exactly one day of school, 15% miss 2 days, and 30% miss 3 or more days due to sickness.

Example

Let X be the number of school days missed in a year. The probability that a student chosen at random misses 2 or more days of school in a year is given by:

$$P(X \ge 2) = P(X = 2) + P(X \ge 3) = 0.15 + 0.30 = 0.45$$

(a) What is the probability that a student chosen at random does not miss any days of school due to sickness this year?

(b) What is the probability that a student chosen at random misses no more than one day?

(c) What is the probability that a student chosen at random misses at least one day?

(d) What is the probability that a student chosen at random misses one or two days of school a year?

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Problem 3 Bayes' Theorem (8 points)

Given an earthquake of intensity

$$X : { light (L), moderate (M), important (I) }$$
 (0.1)

and a structure that can be in a state

$$Y : \{ \operatorname{damaged}(D), \operatorname{undamaged}(\overline{D}) \}$$
 (0.2)

The likelihood of damage given earthquake intensity is given by the following conditional probabilities:

$$P(D|L) = 0.01$$
$$P(D|M) = 0.10$$
$$P(D|I) = 0.60$$

and the prior probability of each intensity is given by

$$P(L) = 0.90$$
$$P(M) = 0.08$$
$$P(I) = 0.02$$

(a) Draw and label a Venn diagram illustrating the given events.

(b) Find the total probability P(D).

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Problem 4 Bayes' Theorem (continued; 7 points)

Use the quantities provided and the results from Problem to answer the following questions.

(a) Use Bayes' Theorem to find the posterior probabilities P(L|D), P(M|D) and P(I|D).

(b) Show that the probabilities P(L|D), P(M|D) and P(I|D) sum up to 1.

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