HW 4

STAT 461 FALL 2026

SOA exam P problems 18, 19, 20, 21.

Problem 1. A common infection has prevalence rate 2% among the general population. The false positive rate is 15% (the probability that the test is positive, given that the person was not infected). The false negative rate is 10% (the probability that the test is negative, given that the person is infected). We picked a random person and tested.

- Find the conditional probability that the person is infected, given that the result was positive.
- If we tested once again and the result is negative, in light of these two tests, what is the conditional probability that the person is infected?

Problem 2. A collateralized debt obligation (CDO) is backed by 12 subprime mortgages. Four of them are from California, each of which defaults with probability 40%. Five mortgages are from Florida, each of which defaults with probability 65%. Three mortgages are from Nevada, each of which defaults with probability 30%. A senior tranche in this CDO defaults only if all mortgages default. Find the probability that the senior tranche does not default in the following cases:

- all mortgages default independently.
- all mortgages from the same state default simultaneously, but mortgages in different states are independent.
- in the event of a growing economy (with probability 80%) we have situation A, and in the event of a financial crisis (with probability 20%) we have situation B.

Problem 3. Pick a positive integer N. Consider a randomly (uniformly) selected number from 1 to N. Find the probability that:

- This number is divisible by 2.
- This number is divisible by 3.
- This number is divisible by 2 or 3.
- Are the events from A and B independent?