**MTH 422**
**Exam 3 In-Class Part**
**Spring 2024**

40 points possible on the in-class part.

**1.** An insurance company's profit for one year is normally distributed with probability 0.8888 of being positive.

The company's profit the next year is normally distributed with probability 0.9505 of being positive.

The yearly profits are independent with the same mean but different standard deviations.

Calculate the probability that the insurance company earns an overall positive profit in this two-year period.

**2.** Sections of rope are cut from a spool, after which each of the rope's two ends are cleanly trimmed and capped with a metal guard. The following information is known:

i) The lengths that result by cutting a section of rope from the spool are normally distributed with mean 1408 inches and variance 6.
ii) The pieces trimmed from the two ends each have lengths that are normally distributed with mean 3 inches and variance 0.60.
iii) Without variation, each of the two guards extends exactly one inch beyond the end of the rope to which the guard is attached.
iv) The three lengths mentioned in i) and ii) are mutually independent.

Calculate the probability that the finished product, measured guard tip to guard tip, is at least 1400.

**3.** A patient must undergo hospitalization and surgery. The hospitalization and surgery charges are uniformly distributed on the intervals $[0, b]$ and $[0, 3b - 9]$, respectively, where $b$ is a constant larger than 3.

The standard deviation of the hospitalization charge is 10.80.

Calculate the standard deviation of the surgery charge.

**4.** An insurance company categorizes its policyholders into three mutually exclusive groups: high-risk, medium-risk, and low-risk. An internal study showed that 55% of the policyholders are low-risk and 30% are medium-risk. The probability of death over the next year for a high-risk policyholder is three times that for a medium-risk policyholder. The probability of death over the next year for a medium-risk policyholder is four times that for a low-risk policyholder. The probability of death of a randomly selected policyholder over the next year is 0.008.

Calculate the probability of death over the next year for a high-risk policyholder.