

## M378K Introduction to Mathematical Statistics

### Problem Set #1

#### Named discrete random variables.

---

**Problem 1.1.** Source: Sample P exam, Problem #125.

*An electronic system contains three cooling components that operate independently. The probability of each component's failure is 0.05. The system will overheat if and only if at least two components fail. Calculate the probability that the system will overheat.*

**Problem 1.2.** Source: Sample P exam, Problem #462.

*Each person in a large population independently has probability  $p$  of testing positive for diabetes where  $0 < p < 1$ . People are tested for diabetes, one person at a time, until a test is positive. Individual tests are independent. Determine the probability that  $m$  or fewer people are tested, given that  $n$  or fewer people are tested, where  $1 \leq m \leq n$ .*

**Problem 1.3.** Source: Sample P exam, Problem #355.

*The number of calls received by a certain emergency unit in a day is modeled by a Poisson distribution with parameter 2. Calculate the probability that on a particular day the unit receives at least two calls.*

**Problem 1.4.** Source: Sample P exam, Problem #481.

*The number of days required for a damage control team to locate and repair a leak in the hull of a ship is modeled by a discrete random variable  $N$ .  $N$  is uniformly distributed on  $\{1, 2, 3, 4, 5\}$ .*

*The cost of locating and repairing a leak is  $N^2 + N + 1$ .*

*Calculate the expected cost of locating and repairing a leak in the hull of the ship.*