

BLOCK PRINT YOUR NAME:

PROBABILITY AND STATISTICS, SPRING 2010, QUIZ 2  
SECTIONS 1.5, CHAPTER 2, 3.2-3.3, DISCRETE AND CONTINUOUS RVs, EXPECTATION, ESTIMATION

- No resources are allowed, except for a calculator/computer for basic arithmetic; do not use any pre-programmed formulas.
- You may use the probability tables uploaded to Blackboard.
- Explain your answers in order on additional sheets of paper as needed.
- Take no more than 90 minutes for this quiz.

Initial Quiz Download/View (Time and Date):

End of Quiz (Time and Date):

1. A test can detect organic pollutants (OP) with 99.7% accuracy, volatile solvents (VS) with 99.95% accuracy, and chlorinated compounds (CC) with 89.7% accuracy. Test samples taken for calibration showed 60% of samples are contaminated with OP, 27% are contaminated with VS, and 13% are contaminated with CC. Assume these comprise all of the possible organic pollutants. A test sample is selected randomly. What is the probability that it will signal positive? If the signal is positive, what is the probability that the sample is contaminated with CC?
2. Five balls, numbered 1, 2, 3, 4 and 5, are placed in an urn. Two balls are randomly selected from the five and their numbers are noted.
  - (a) Find the probability distribution for the *largest* of the two sampled numbers
  - (b) Compute the mean and the variance
3. Let  $X_1, X_2, \dots, X_n$  be a random sample of size  $n$  where each  $X_i$  follows a geometric distribution with parameter  $p$ . Use the Method of Maximum Likelihood (ML) to find the the ML estimator for  $p$ .
4. A random sample of 985 likely voters was taken. 592 indicated that they approved of a reduction in the federal income tax. Construct a 95% confidence interval for the true proportion  $p$  of voters who approve of reducing the income tax.
5. Patients with congestive heart failure typically have low *cardiac ejection fractions* (CEFs), which is the proportion of blood pumped out of the heart during a single beat. Let the RV  $Y$  denote the CEF of such patients, which has probability distribution given by

$$f(y) = \begin{cases} 30y^2(1-y)^2 & 0 \leq y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Patients with acute congestive heart failure have CEFs below 25%. What is the probability that a randomly selected patient has acute congestive heart failure?
- (b) Ten patients admitted to a local hospital are examined for acute congestive heart failure. What is the likelihood that fewer than two have acute congestive heart failure?