

### Mean, Median and Variance of Continuous RVs

- For each PDF, calculate the mean and the median and the variance:
  - $f(x) = x^{-2}$  for  $\frac{1}{2} \leq x \leq 1$  and  $f(x) = 0$  otherwise.
  - $f(x) = x(3x^2 + \frac{1}{2})$  for  $0 < x \leq 1$  and  $f(x) = 0$  otherwise.
  - $f(t) = \lambda e^{-\lambda t}$  for  $t \geq 0$  and  $f(t) = 0$  otherwise.
  - $f(x) = c(1 - x^2)$  for  $-1 < x < 1$  and  $f(x) = 0$  otherwise. Does the answer depend on  $c$ ? Why?
- Chromosomal recombination** is a process by which two chromosomes join together and exchange DNA. The point along the DNA at which the join occurs is randomly located. Suppose  $X$  is a RV denoting the location with  $0 \leq X \leq 2$ . In an experiment,  $E[X] = 1$  and  $Var[X] = \frac{1}{3}$ . Are the findings consistent with the hypothesis that all locations along the chromosome are equally likely to contain the join point? Explain.

### Midterm 2 Review

- Find  $a, b$  or  $c$  given the PDF, then find the CDF.
  - $f(x) = c(1 - x^2)$  for  $-1 < x < 1$  and  $f(x) = 0$  otherwise.
  - $f(x) = c/x^2$  for  $x > 10$  and  $f(x) = 0$  otherwise.
  - $f(x) = a + bx^2$  for  $0 \leq x \leq 1$  and  $f(x) = 0$  otherwise, given  $E(X) = \frac{3}{5}$ .
- Suppose you take a random sample of 10 tickets without replacement from a box containing 20 red tickets and 30 blue tickets.
  - What is the chance of getting exactly 4 red tickets?
  - Repeat (a) for sampling with replacement.

Hint: identify the distributions first.
- Suppose that we observed 10 frogs in a pond during the observation period of 100 days. Find the Poisson approximation to the probability of observing  $X = k$  frogs each day. Using that approximation to calculate the probability that
  - you observe precisely one frog today?
  - you observe more than one frog today?
  - you observe no frogs today?
- Suppose that a test for opium use has a 2% false positive rate and a 5% false negative rate. That is, 2% of people who do not use opium test positive for opium, and 5% of opium users test negative for opium. Furthermore, suppose that 1% of people actually use opium.
  - Find the probability that someone who tests negative for opium use does not use opium.
  - Find the probability that someone who tests positive for opium use actually uses opium.

Source: some from Stewart's *Biocalculus*, the others from internet.