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Chapter 3

Discrete Random Variables

- 3.1 Random Variables
- 3.2 Probability Distributions
- 3.3 Expected Values
- 3.4 The Binomial Probability Distribution**
- 3.5 Hypergeometric and Negative Binomial Distributions
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Binomial Experiment

1. Each trial can result in one of the same two possible outcomes, success or failure
2. The trials are independent
3. The probability p of success is constant from trial to trial
4. The experiment consists of a sequence of n smaller experiments, called trials

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Example

A coin that has been changed to have the probability of head equal to $1/3$ is tossed (independently) three times. Let X be the number of heads in the three trials.

Find the pmf of X .

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Binomial RV

The **binomial random variable X** associated with a binomial experiment is defined as the number of successes in the experiment. It's pmf is given by

$$p(x) = b(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x}$$

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Example

Each of seven randomly selected cola drinkers is given a glass containing cola S and one containing cola F. The glasses are identical in the appearance. Suppose the probability that a randomly selected individual prefers cola S to cola F is 0.6. Find the probability that

- Exactly four cola drinkers prefer cola S
- At least four cola drinkers prefer cola S
- At most one cola drinker prefers cola S.

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Expectation and Variance of the Binomial RV

If X is a binomial rv with parameters n and p , then

$$E(X) = np$$

$$V(X) = np(1-p)$$

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Example

Suppose that 75% of all purchases at a certain store are made with a credit card and let X be the number among ten randomly selected purchases made with a credit card.

- Find $E(X)$
- Find $V(X)$

