3.4 The binomial probability distribution

- Definition 3.6 A "binomial experiment" possesses the following properties:
  - A fixed number, n, of trials
  - Each trial results in one of two outcomes, Success and Failure (or S and F) [dichotomous or binary]
  - Each trial has the same success probability, p [identical]
  - The trials are independent [independence]
- Let Y=# of successes observed during n trials
- Example 3.5 and 3.6.

  Y1 = # of radar units (out of 4) that do not detect the plane

  Y2 = # of persons favoring a candidate in a random sample of n=10 voters

  Do they follow binomial distribution?
- Conditional/unconditional probabilities ;
  - The notion of hypergeometric distribution
- Definition 3.7 A random variable Y is said to have a "binomial distribution" based on n trials with success probability p if and only if

  $p(y) = nCy\ p^y q^{n-y}$, $y=0,1,\ldots,n$ and $0 \le p \le 1$
  - Histograms? (Use R)
- Example 3.7 5000 fuses contain 5% defectives; for a sample of 5 fuses, what's $P(Y\ge1)$=?

  How about $P(Y\ge4)$=?
- Notation: Y~bin(n,p)
- Theorem 3.7 Let Y~bin(n,p). Then,

  $\mu=E(Y)=np$ and $\sigma^2=V(Y)=npq$
  - Proof: definitions and 'binomial' trick
- In practical application, carefully define 'successes!
- HW. Some of the exercises 3.25~49
- Keywords: binomial experiment; Y~bin(n,p)