

Math 20340 — Statistics for Life Sciences

Topics covered

Fall 2009

Chapter 4

Basics of probability

- Experiments with measurable outcomes
- Simple events and the sample space
- Events
- Assigning probabilities to simple events
- Calculating probability of an event

Counting

- mn -rule
- Arranging items — $n!$
- Choosing items in order — P_r^n
- Choosing items without order mattering — C_r^n

Combining events

- Union, intersection and complement
- Probability of a union
- Venn diagrams

Conditional probability

- Definition
- Independence
- Multiplication rule
- Calculating conditional probabilities using a tree diagram

Chapter 5

Random variables

- Requirements for a discrete distribution
- Histogram of probability values
- Mean, variance, and standard deviation

Special discrete distributions

- Binomial and Poisson
- Probabilities, mean and variance for each
- Reading binomial and Poisson tables
- Poisson approximates binomial

Chapter 6

Normal random variable

- Calculating probability as area
- Mean and variance
- The standard normal
- Converting an arbitrary normal to a standard normal
- Reading a standard normal table
- Normal approximates binomial, with continuity correction

Chapter 7

Central Limit Theorem

- Average of readings from population is approximately normal if $n \geq 30$
- $n \geq 3$ is enough if distribution symmetric
- $np > 5, nq > 5$ if population is binomial
- Sample mean exactly normal if population is normal
- Sum of normals is normal, mean is sum of means, variance is sum of variances

Sample statistics

- Expected value and standard deviation (standard error) of the sample mean
- Expected value and standard deviation (standard error) of the sample proportion
- Sample variance and standard deviation

Chapter 8

Point estimators

- Sample mean (for population mean)
- Sample proportion (for population proportion)
- Sample variance (for variance)
- Large sample margin of error for sample mean and sample proportion

Large sample confidence intervals

- One sided and two sided intervals
- Different confidence levels
- Changing (and choosing) sample size

Specific instances

- Population mean
- Population proportion
- Difference of population means
- Difference of population proportions

Chapter 9

Elements of large sample hypothesis testing

- Null and alternative hypothesis
- One tailed and two tailed tests
- Significance level
- Test statistic and standardized test statistic
- Region for rejection of null
- p -value
- Types I and II error
- Power and β (calculating for a given actual value of mean)
- Language of significance (not significant, significant, very significant, etc.)

Specific large sample tests

- Population mean
- Population proportion
- Difference of population means
- Difference of population proportions (using pooled estimator when null is $p_1 = p_2$)

Chapter 10

Specific small sample tests and confidence intervals

- Population mean (t -test)
- Difference of population means (t -test using pooled estimator for variance)
- Paired difference test (t -test)
- Variance (χ^2 -test)
- Difference of variances (F -test)
- Reading t -, χ^2 - and F -tables