

Probability and Statistics Professor Simon

Syllabus

Jan. 12 Lecture 1. Sets

Jan. 19 Holiday – no class

Jan. 26 Lecture 2. Introduction to Probability

Feb. 2 Lecture 3. Conditional Probability

Feb. 9 Lecture 4. How to Count

Feb. 16. Holiday – no class

Feb. 23 Lecture 5. A Day in Las Vegas

Mar. 2 Lecture 6. Random Variables

Mar. 9 Lecture 7. A Little Statistics

LECTURE 1. SETS

- Problem 1.** Flip a fair coin once: probability of a heads = $\frac{1}{2}$
Flip a fair coin twice: probability 1 head, 1 tail = $\frac{1}{2}$
Flip a fair coin four times: probability of 2 heads, 2 tails = ?

Problem 2. A survey of all students at Low High found that 100 were taking French, 123 were taking Spanish, 85 were taking Chinese, 40 were taking French and Spanish, 57 were taking French and Chinese, 30 were taking Spanish and Chinese, 17 were taking all three and 90 were not taking any of them. How many students are there at Low High?

- Problem 3.** Let N be the set of all *natural numbers*: 1, 2, 3...
E be the set of all *even numbers*: 2, 4, 6...
Q be the set of all *quotients (fractions)*: $\frac{1}{4}$, $\frac{3}{7}$, $\frac{9}{2}$...
R be the set of all *real numbers (decimals)*

Two sets are said to have the *same number of elements* if there is a one-to-one correspondence between them.

- (a) Do sets N and E have the same number of elements? Answer: Yes.
(b) Do sets N and Q have the same number of elements? Answer: Yes
(c) Do sets N and R have the same number of elements? Answer: **NO!**
 R has MORE elements than N !

Problem 4. *Russell's Paradox* (Bertrand Russell (1872-1970)). Most sets are not elements of themselves; e.g., the "set of all numbers" is not itself a number. But some sets are elements of themselves; e.g., the "set of all abstract ideas" is itself an abstract idea and the "set of all sets" is itself a set. Let N be the "set of all those sets which are not elements of themselves." Now discover the paradox by trying to determine whether or not N is an element of itself.

TOPICS

- A. Notation and some definitions.
- B. Set operations and Venn Diagrams
- C. Cardinal Number of sets. Problems 1 and 2.
- D. Some history: The trials and tribulations of Georg Cantor (1845-1918), the creator of modern set theory. Problem 3.