

A general introduction

1 unit is (at least) 45 hours of work per semester

“Traditional accounting” for one unit:

- 1 hour of lectures per week
- 2 hours of discussion sections per week
- 3 hours of lab work per week

Ramifications for USC's 15-week semester:

- 1 unit is 3 hours of work per week
- 16 units = 48 hours of work per week
- a 4-unit math class = 7 hours of *independent* work per week

And this is the bare minimum!

Good news: one week is 168 hours; $168=48+60+60$.

An absolute grading scheme

A	100–95
A-	94–90
B+	89–87
B	86–83
B-	82–80
C+	79–77
C	76–73
C-	72–70
D+	69–67
D	66–63
D-	62–60
F	59 and below

Think!

Quotation number 1, A variation on *Bertrand Russell* (1872-1970):

Most people would rather die than think; in fact, many do so.

A follow-up by Yu. I. Manin (1937–2023), from an interview in 2015:

Think! Otherwise no Google will help you.

Quotation number 2, at the entrance to main auditorium at Uppsala University:

Tänka fritt är stort men tänka rätt är store.

A follow-up by Georg Cantor (1845–1918), as presented by Yu. I. Manin at ICM Berlin in 1998:

The essence of mathematics lies in its Freedom.

A quotation:

Education is what you get when you read the fine print.

Experience is what you get when you do not.

Unknown, on investing.

A generalization:

Education is what you get when you `< DO >`.

Experience is what you get when you `< DO NOT >`.

Three other suggestions:

1. Ask questions [try two serious ones per week].
 - At the lecture (right on the spot, before/after).
 - During office hours.
 - By e-mail
2. Keep your notes.
3. Have fun while learning the material.

The 7%-38%-55% rule

COMMUNICATION:

- **Verbal** (words): 7%
- **Vocal** (tone of voice): 38%
- **Visual** (body language): 55%

Source: Albert Mehrabian (Professor of Psychology at UCLA, b. 1939) studies on communication in 1960's.

The fine print: This only applies to messages pertaining to feelings and attitudes.

Conclusion: For a (math) lecture, make it 100% verbal (lecture words) and visual (blackboard and/or video).

Probability and Statistics

Subject	Word	Motivation
Probability	Probus (Latin) = honest	GAMBLING
	Probabilis (Latin) = provable	
Statistics	Stare (Latin) = stand	AGRICULTURE
	Statistik (German) = political arithmetic	

First department of statistics in the USA: 1933, Iowa State University
World: 1911, University College London

In the background is a model with uncertain outcomes.

Probability is mathematical study of uncertainty: Given a model, describe the outcomes — a *forward* problem.

Statistics is collecting, organizing, analyzing, interpreting, and presenting data.

Applied Statistics: understanding whether the observed difference is due to chance or is caused by something else — all about facts (data). Theorem-free.

Mathematical Statistics: Given the outcomes (data), determine the underlying model — an *inverse* problem. Provides the tools to interpret the facts (process the data) and safeguards against wrong interpretations and conclusions. Proves theorems.

Numbers

X_1, X_2, \dots, X_n

Sample mean

$$\bar{X}_n = \frac{X_1 + X_2 + \dots + X_n}{n} = \frac{1}{n} \sum_{k=1}^n X_k$$

Sample median M_n

$$11, 25, \mathbf{38}, 478, 5000 \mapsto M_5 = 38;$$

$$16, 27, \mathbf{324}, \mathbf{450}, 598, 61111 \mapsto M_6 = \frac{324 + 450}{2} = 387.$$

Sample standard deviation

$$s_n = \sqrt{\frac{1}{n-1} \sum_{k=1}^n (X_k - \bar{X}_n)^2}$$

Tossing a coin, with outcomes H(EADS), T(AILS)

Rolling a Die, with outcomes $\{1, 2, 3, 4, 5, 6\}$

Drawing Cards

- 52 cards;
- 2 *colors*: black, red;
- 4 *suits*: hearts (red), clubs (black), diamonds (red), spades (black);
- 13 *ranks* per suit: A(ce), 2,3,4,5,6,7,8,9,10, J(ack), Q(ueen), K(ing).

Go steady but not too slow

A worm at one end of a rubber band. Worm: moves at the speed of 1 centimeter per minute. Band: one meter to start, stretches by one meter every minute. When will the worm get to the other end, if ever?

The meaning of slow

It will, eventually, in about 10^{37} years.