Introduction

by Hiro Kasahara

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Course Information

- Course Website:
  - http://faculty.arts.ubc.ca/hkasahara/econ325.html

- Instructor: Hiro Kasahara (hkasahar@mail.ubc.ca)
- Office Hours: Tuesday 11-12 @ Iona 163 or by appointment
- TA: Juan Riano Rodriguez (jf.riano@alumini.ubc.ca)
- Lab Sessions: Monday 17:00-18:00 BUCH B215

Textbook and references

- Textbook: Newbold, Carloson, and Thorne, Statistics for Business and Economics (older editions are fine)
- Other References:
  1. *Introductory Statistics* by OpenStax
  2. Hogg, Tanis, and Zimmerman, *Probability and Statistical Inference*

Grading

- **Grading**
  - Midterm exam (30%)
  - Final exam (45%)
  - Clicker Questions (5%)
  - Assignments (20%)
- **Midterm exam (30%)**
  - **The midterm exam will be held in class from 12:30-14:00 on Tuesday, October 17.**
  - No make-up exam for the midterm exam. If you miss it, your midterm weight will be shifted to your final exam.
- **Final exam (45%)**
  - Covers all course materials including the materials covered in the midterm exam.

Clicker Questions (5%)

- Review questions using clicker will be asked in class.
- Grading is based on your participation regardless of your answers.
- Do not cheat with clicker. I will occasionally count the number of students in class and compare it with the number of answers from clicker.
- **Please register your clicker in Econ 325 Canvas page by midnight, 11:59PM, Tuesday September 17th, 2019.**

Assignments (20%)

- **Eight assignments.** The worst assignment grade will be dropped for grading.
- No work will be accepted after the lecture on the due date unless a proof of the emergency situation is provided.
- You may submit as a group of two or three (but not four) or by yourself s an individual.
- Write the names and student IDs of all members of your group when you submit your assignemnt.
- Don't be a free rider.
- **Do not copy and paste the answer you find over internet. You may fail the course if we find out.**

No Laptop Use and In-term Concession

- **No Laptop Use in Classrooms**
  - "The use of laptop computers has negative externality to nearby peers" (Sana, Weston, and Cepeda, 2013) because your fellow students will be destructed when you are searching over internet.
  - The exception is the use of tablet: you may use tablet on flat surface for note-taking by writing directly with stylus.
- **In-term Concession**
  - Arts Students must contact Arts Advising as soon as you are aware you may need an in-term concession.

    https://students.arts.ubc.ca/advising/academic-performance/help-academic-concession/
  - Students in other Faculties should contact their Faculty advising office for direction.

UBC-wide Policy Statement

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here (https://senate.ubc.ca/policies-resources-support-student-success)

Introduction with Examples

Introduction

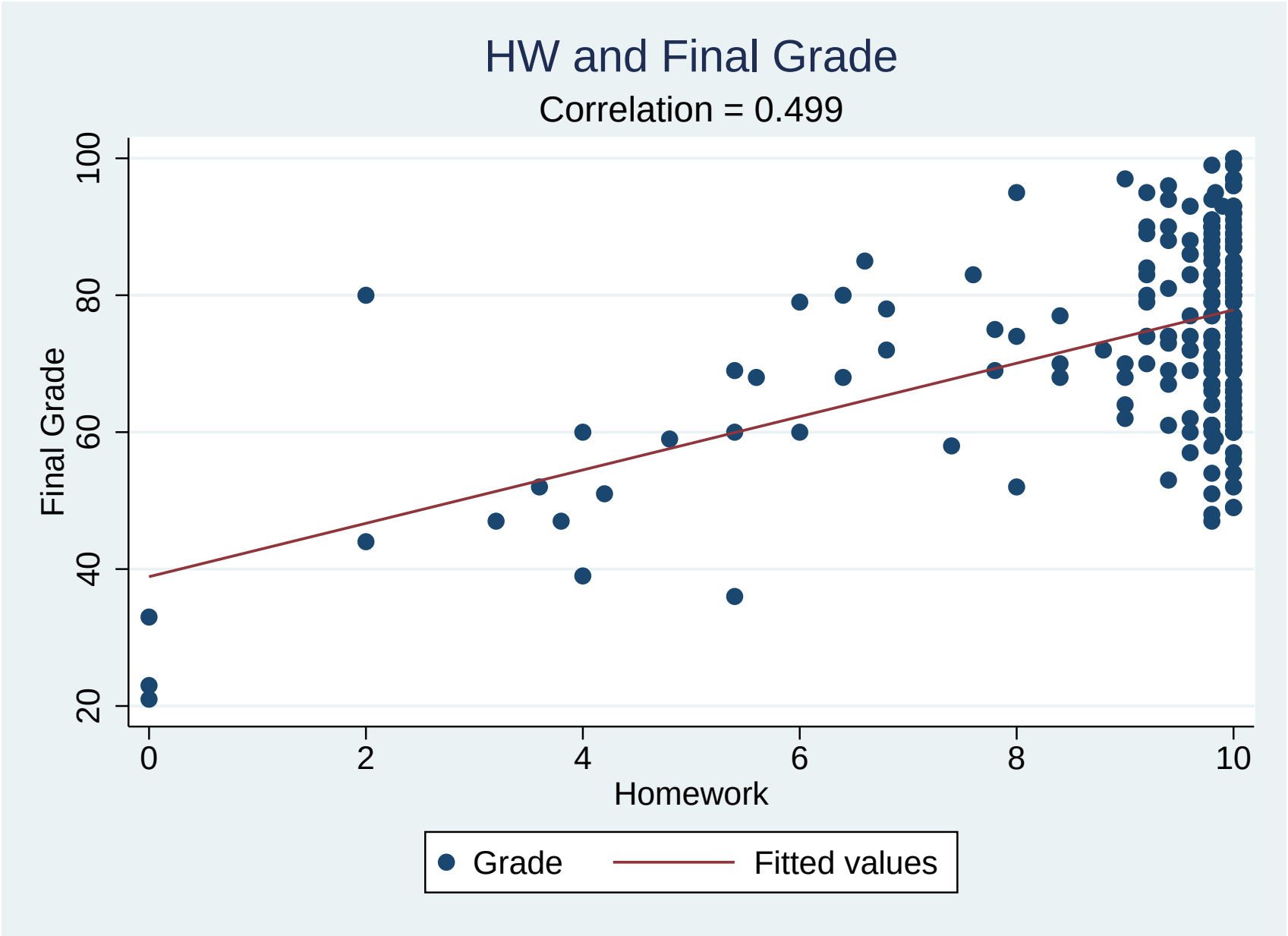
- Numbers and data are used to assist decision making
- Statistics is a tool to help process, summarize, analyze, and interpret data

Five Examples

- Assignments and Final Grades
- A/B testing
- A Study of Lung Cancer
- Can blue LED lumps prevent suicide at train stations?
- Screening Test of Mammograms
- The 2011 Stanley Cup Finals

Completing homework assignments is important for this course!!

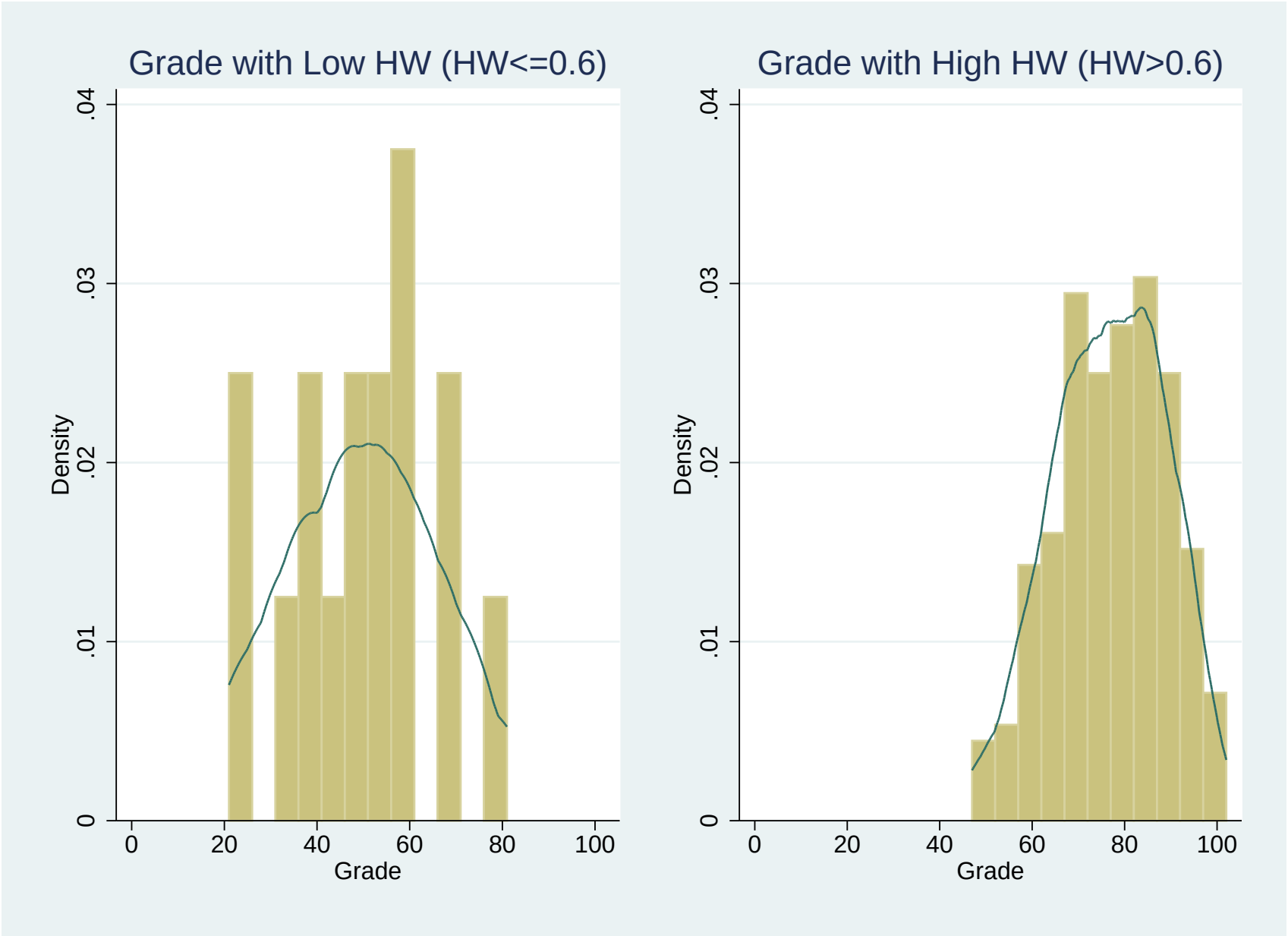
Scatter Plot of HW Grade and Final Grade



Summary Statistics by Stata

Define Low HW group as students with HW grade less than 6 out of 10.

Histogram of Final Grade: Low HW vs. High HW



More than half of students in Low HW group failed Econ 325!!

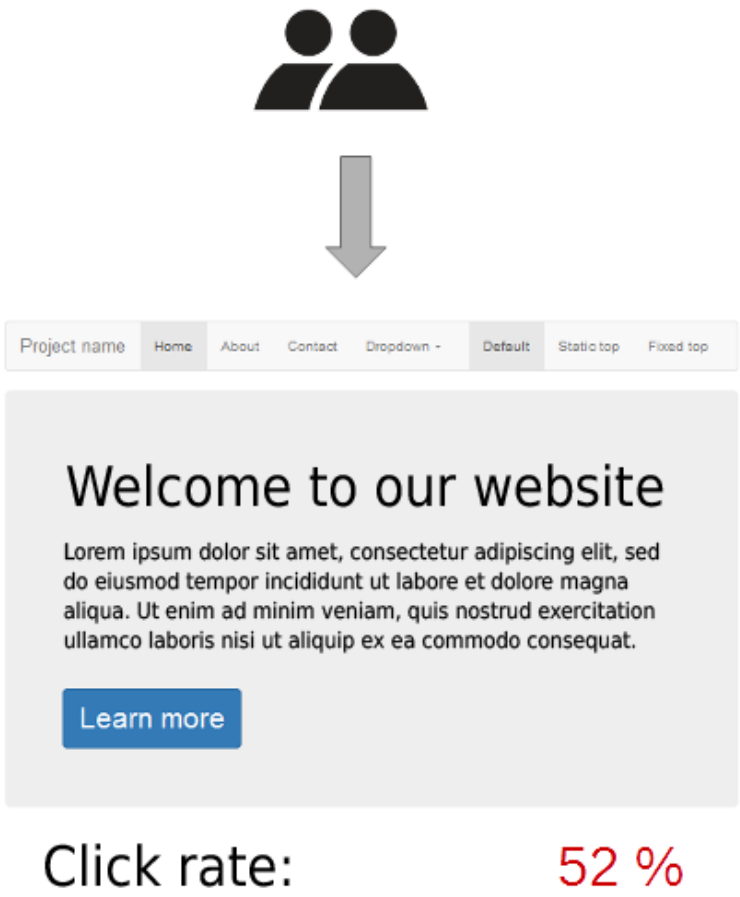
We may test the following Hypothesis:

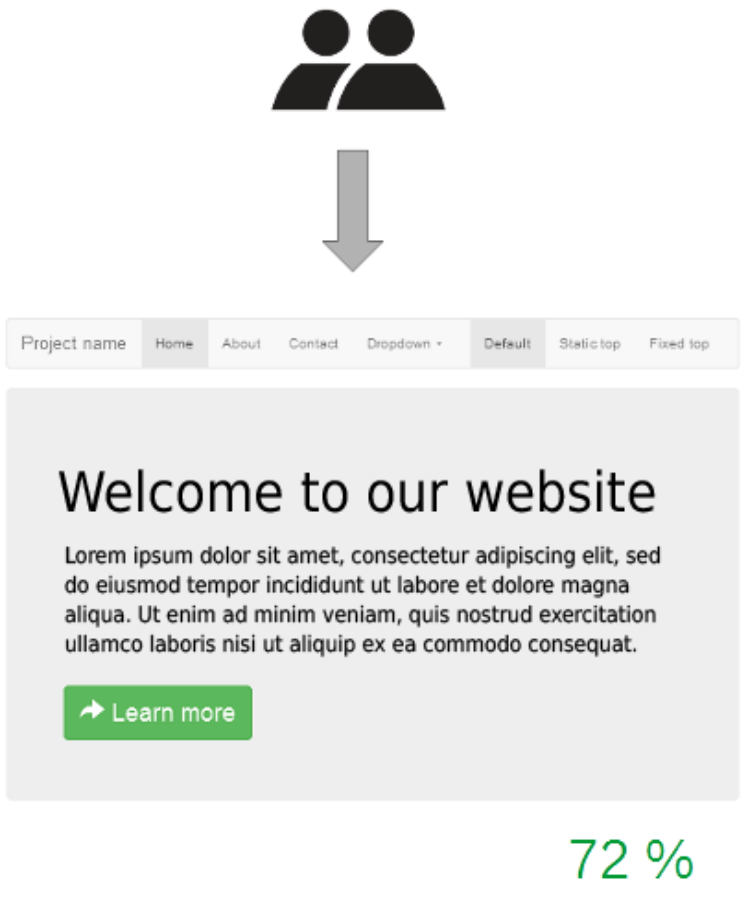
"the average grade of High HW group is the same as that of Low HW group"

$\rightarrow$ This hypothesis is rejected by a statistical test called two-sample t test.

A/B testing

A/B testing





By Maxime Lorant - https://commons.wikimedia.org/wiki/File:A-B_testing_simple_example.png

Clicker Question

Which of the following is true?

A). With certainty, design B has higher click rates than design A.

B). It is likely that design B has higher click rates than design A.

C). There is not enough information to tell how likely design B has higher click rates than A.

A/B testing

- No information on how the data is generated!
- Is it randomly assigned?
- How large is the sample size?

A/B testing

Randomly assign 200 visitors into two versions of web designs.

	Click	No Click	Total visits
Design A	52	48	100
Design B	72	28	100

- 52 out of 100 visitors clicked for design A.
- 72 out of 100 visitors clicked for design B.

A/B testing

Randomly assign 200 visitors into two versions of web designs.

	Click	No Click	Total visits
Design A	52	48	100
Design B	72	28	100

- We may test the following hypothesis.

  "The click rate of design B is the same as that of design A."

- This hypothesis is rejected using statistical procedure which we learn in this class.

  $\Rightarrow$ Statistical evidence that B is better than A.

A/B testing

Randomly assign 200 billion visitors into two versions of web designs.

	Click	No Click	Total visits
Design A	52 bil.	48 bil.	100 bil.
Design B	72 bil.	28 bil.	100 bil.

In this case, almost with certainty, the click rate of design B is higher than that of design A.

Study of Lung Cancer

A Study of Lung Cancer

- Doll and Hill (1952) interviewed 1357 men with lung cancer in hospitals.
- Doll and Hill also interviewed another set of 1357 men without lung cancer but with other diseases including other types of cancer ("control group").
- In the interview, each individual was asked about smoking frequency per day.

Testing Hypothesis

Disease Group	No. of Non-Smokers	No. of Smokers
1357 lung-cancer patients	7 (1%)	1350 (99%)
1357 patients with other diseases	61 (5%)	1296 (95%)

- Doll and Hill tested the following hypothesis:

  "The likelihood of being a smoker is the same between lung-cancer patients and patients with other diseases."

- This hypothesis is rejected using statistical procedure which we learn in this class.

Can blue lights at train stations prevent suicides?

Figure: Does installing blue lights at train stations prevent suicides?

Blue lights and suicides at train stations

- Railway and metro suicides constitute a major problem in Japan.
- *Matsubayashi et al. (2014)* examines the effect of blue lights on the number of suicides by using panel data from 71 train stations between 2000 and 2013.
- Compare the number of suicides before and after the intervention of blue lights at 14 stations, using other stations without the intervention as a control group.
- **The effect of installing blue LED lamps on a decrease in the number of suicides is estimated at 74% (with 95% Confidence Interval given by 48–87%).**

Blue lights and suicides at train stations

Table 1
The average number of suicides before and after the installation of blue lights.

	(1) Station with blue lights Installed	(2) One station away	(3) Two stations away	(4) Three stations away	(5) Four stations away	(6) Five stations away	(7) Six and more stations away
Before	0.435 (115)	0.269 (182)	0.234 (201)	0.275 (189)	0.245 (200)	0.259 (220)	0.090 (546)
After	0.189 (53)	0.274 (84)	0.269 (93)	0.275 (91)	0.266 (94)	0.245 (102)	

Note: Table entries are the average number of suicides per year before and after the installation of blue lights with the number of station-year in parentheses. Data represent the number of suicides at 71 stations between 2000 and 2013. The total number of observations is 994.

Hypothesis Testing

We may test the following Hypothesis:

"The average number of suicides is the same before and after installing blue LED lamps."

Screening Test for Cancer

Screening Test for Cancer

Table: Two-way table of results of tests on 10,000 patients with Tumors

	Cancer	No Cancer	Total
Test Positive	85	1485	1570
Test Negative	15	8415	8430
Total	100	9900	10000

Notes: From Table 10.19 of Bennett, Briggs, and Triola (2000).

Question: Suppose your test is positive. How likely do you have, in fact, cancer?

Answer: The probability of having cancer if the test is positive is

$$\frac{85}{1570} \approx 5.4 \text{ percent}.$$

Clicker Question

	Cancer	No Cancer	Total
Test Positive	85	1485	1570
Test Negative	15	8415	8430
Total	100	9900	10000

Question: Suppose your test is negative. How likely do you have, in fact, cancer?

A). 1.8 percent

B). 0.18 percent

C). 0 percent

2011 Stanley Cup Finals

Vancouver Canucks and the 2011 Stanley Cup Finals

- Vancouver Canucks vs. Boston Bruins in the 2011 Stanley Cup Finals
- Stanley Cup: 7 games, a team who wins 4 games first will win the Stanley Cup
- The Canucks won the first 2 games!
- After the first 2 games, the Canucks needed to win 2 games out of 5 games left.

Clicker Question

Suppose that the probability of winning each game was 0.5. What is the probability that the Canucks could have won at least 2 games out of 5 games?

A). 61 percent

B). 71 percent

C). 81 percent

Table: Probability of how many games will be won out of 5 games

	Probability
Winning 0 games	1/32
Winning 1 games	5/32
Winning 2 games	10/32
Winning 3 games	10/32
Winning 4 games	5/32
Winning 5 games	1/32

Answer: C). Probability of winning at least 2 games out of 5 games

$$= \frac{10+10+5+1}{32} = \frac{13}{16} \approx 0.81!$$