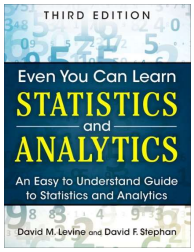
IMGD 2905

Fundamentals of Statistics

Chapter 1



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Why Do We Need Statistics?

445 446 397 226
388 3445 188 1002
47762 432 54 12
98 345 2245 8839
77492 472 565 999
1 34 882 545 4022
827 572 597 364

Aggregate data into meaningful information.

$\bar{x} = \ldots$

Ok, but what *are* statistics?
→ First, some key words

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Key Words

- Population – all members of group pertaining to study
  - e.g., every person in IMGD 2905 in D-term
  - e.g., every *Heroes of the Storm* player in the world
- In many cases, *impossible* to survey a population!
  - Typical for game analytics → want to understand/improve game for all

So … what to do?

http://www.mycariboonow.com/wp-content/uploads/2016/02/Population.jpg

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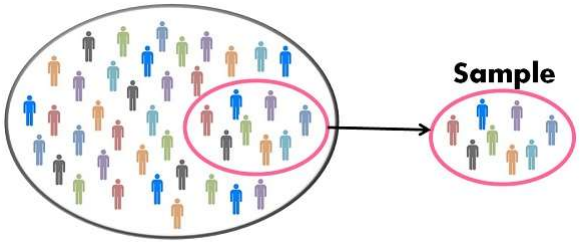
Key Words

- Sample – part of population selected for analysis
  - e.g., all *League of Legends* players at WPI
  - e.g., students in first row in IMGD 2905



http://keydifferences.com/wp-content/uploads/2016/04/census-vs-sample.jpg

- Often hope *sample* is representative of *population.* …
  - (e.g., poll: "did you finish chart for Project 1, Part 3?")
- But Is it? → method to obtain sample is important! (We won't talk much about this right now, however.)

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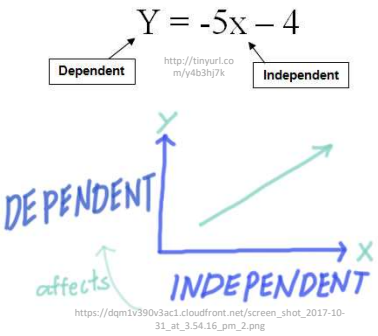
Key Words

- Variable – characteristic of individuals in population analyzing
  - e.g., time spent in competitive mode in *Starcraft 2*
  - e.g., vehicle choice in *Grand Theft Auto* (GTA)
- Independent variable is inherent in population, versus dependent variable that want to assess

https://www.coursepics.com/wp-content/uploads/2016/11/Independent-and-Dependent-Variable.jpg



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Key Words

- Observation – all variable values for sample
  - e.g., *League of Legends* competitive hours/week and Champion most played could be (2 observations)
    - "Player A: Leona, 2 hours"
    - "Player B: Teemo, 7.5 hours"
  - Can be continuous (time) or discrete (Champions)
- Often, data in grid
  - Observation in rows
  - Variables in columns
  - Consider our project 1 → *HOTS* data!

Player	Hours	Champ
A	2	Leona
B	7.5	Teemo

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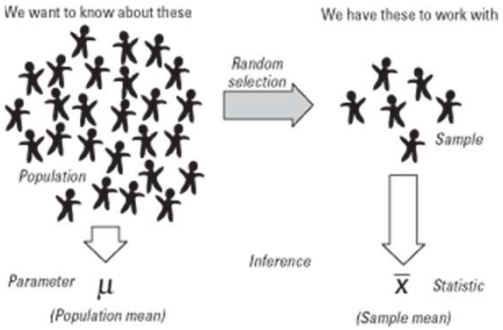
Key Words

- Parameter – measure of dependent variable for population
  - e.g., average crashes in *Mario Cart* level for everyone
  - Usually what we want to know, but can't get easily
- Statistic – measure of dependent variable in sample
  - e.g., average crashes in Mario Cart level for IMGD 2905 class
- Statistics – set of numerical methods for getting information about population based on data from sample, usually to get information about population parameters



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"Statistics - a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data."
-- Merriam-Webster dictionary

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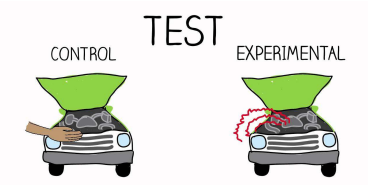
Sources of Data

- Published – generally made available from those that collected it
  - e.g., Riot's *League of Legends* data
  - e.g., Metacritic's reviews and ratings
  - e.g., HOTS Logs dataset on *Heroes of the Storm*
- Experiments – multiple trials to collect data from sample
  - Can be in laboratory or "real world" setting
  - e.g., play shooter, add lag and play again
- Survey – ask people to answer questions
  - e.g., self-rating as gamer, difficulty with level, …
  - Ethical issues with stress and use of data

  → Institute Review Board (IRB) for approval with human subjects



https://i.ytimg.com/vi/qtLnBz6IbRQ/maxresdefault.jpg

http://www.mayersmemorial.com/pictures/content/122253.jpg

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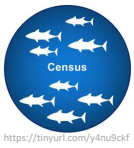

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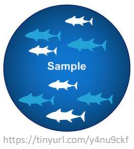
Sampling Concepts



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- Sampling – process by which members of population are selected for sample
  - e.g., choose ½ class based on seat, or choose ½ class based on alphabet
- Probability sampling – sampling considering likelihood of selection
  - e.g., survey for intended Champ, ask ½ class, but when tournament starts, result different. Why? → sample didn't consider League players! (e.g., often similar analogy for voter polls)
  - e.g., voluntary polls/surveys
  - Use probability sampling whenever possible, but sometimes it is not (cost) or not known
- Sampling with replacement – once sample, put back in pool
  - e.g., die roll to see which attack boss makes
- Sampling without replacement – once sample, won't sample again
  - e.g., user survey – don't allow to submit twice
  - e.g., deck of 52 cards for blackjack


https://tinyurl.com/y3ndyrom

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Using Sample Data

- Word "sample" comes from same root word as "example"
  - Similarly, one sample does not prove a theory, but rather is an example
- Basically, in general, definite statement *cannot* be made about characteristics of all systems
- Instead, make **probabilistic statement** about range of most systems

→ That's where statistics come in!

Statistics – set of numerical methods for getting information about population based on data from sample, usually to get information about population parameters

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