Statistics
Summer 2023
Lecture 1

Feb 19-8:47 AM

Basic Math Review

SG 1

1) Reduce $\frac{36}{45} = \frac{3 \cdot 12}{3 \cdot 15} = \frac{4 \cdot 3}{5 \cdot 3} = \boxed{\frac{4}{5}}$

1) $\frac{4}{5}$ Designated area

36 ÷ 45 enter .8

MATH 1: ▶Frac Enter $\frac{4}{5}$

2) Convert .1% to

a) Reduced fraction

.1% = .1 ÷ 100 .001

MATH 1: ▶Frac Enter

a) $\frac{1}{1000}$

b) Decimal

.1% = .1 × .01 .001

b) .001

Jun 12-7:39 AM

3) 18% of 432 students had a part-time job.

How many of them had part-time job?

If decimal, Round-up to a whole #.

what is 18% of 432?

$x = .18(432)$

$= 77.76$ $\boxed{x \approx 78}$ 3) 78

4) 36 of 800 students were smokers.

What percent of them were smokers?

36 is what percent of 800?

4.5%

$\frac{P}{100} = \frac{\text{Part}}{\text{whole}}$ $\frac{P}{100} = \frac{36}{800}$

whole comes after of. Cross-Multiply

$800P = 100(36)$ $\boxed{P = 4.5}$

$P = \frac{100(36)}{800}$

4) 4.5%

Jun 12-7:46 AM

Scientific Notation

$N \times 10^{n}$ ← Any integer

$1 \le N < 10$

2.5×10^{-6}

1.75×10^{8}

It is used for large or small numbers

$2.5 \times 10^{-6} = 0.0000025$ = 0.0000025

↳ 6 times

optional

$1.75 \times 10^{8} = 1.75000000$

↳ 8 times

$= 175000000.00$

$= 175,000,000$

Jun 12-7:54 AM

Use your calc to Simplify

$$\frac{8(125) - 10^3}{8(8-2)} = \frac{1000 - 1000}{8(6)}$$

$$= \frac{0}{48} = \boxed{0}$$

Do not use Ø for Zero.

$$\frac{83 - 70}{\frac{8}{\sqrt{25}}} = \frac{13}{\frac{8}{5}} = \frac{13}{1.6} = \boxed{8.125}$$

Round to		Round up to a whole #
whole	8	
1-decimal	8.1	$\boxed{9}$
2-decimal	8.13	

Jun 12-7:59 AM

Factorial !

$n! = n(n-1)(n-2)\cdots 3\cdot 2\cdot 1$

$0! = 1$

$1! = 1$

$2! = 2\cdot 1 = 2$

$3! = 3\cdot 2\cdot 1 = 6$

$5! = 5\cdot 4\cdot 3\cdot 2\cdot 1 = 120$

$8! = 8\cdot 7\cdot 6\cdot 5\cdot 4\cdot 3\cdot 2\cdot 1$

$= \boxed{40\,320}$

8 MATH ⟶ ⟶ PRB 4:! Enter

Simplify $\frac{10!}{4! \cdot 6!} = \frac{10\cdot 9\cdot 8\cdot 7\cdot 6\cdot 5\cdot 4\cdot 3\cdot 2\cdot 1}{4\cdot 3\cdot 2\cdot 1 \cdot 6\cdot 5\cdot 4\cdot 3\cdot 2\cdot 1}$

$= \frac{10\cdot 3\cdot 7}{1} = \boxed{210}$

Jun 12-8:07 AM

Simplify

$\sqrt{\frac{(.2)(.8)}{25}} = \sqrt{\frac{.16}{25}} = \sqrt{.0064} = .08$

2nd x^2

To convert to reduced fraction

MATH | 1: ▶Frac | Enter $\frac{2}{25}$

To convert to %

$.08 * 100\ \% \rightarrow 8\%$

Jun 12-8:14 AM

Given $y = -2.5x + 10$

Find y when x is

a) 4 $y = -2.5(4) + 10$

$= -10 + 10 = 0$

Do not use Ø for 0.

b) −4 $y = -2.5(-4) + 10$

$= 10 + 10 = 20$

Find x when y is −10.

Subtraction (−)

$y = -2.5x + 10$

$-10 = -2.5x + 10$

$-10 \quad -10 = -2.5x$

$-20 = -2.5x$

Enter

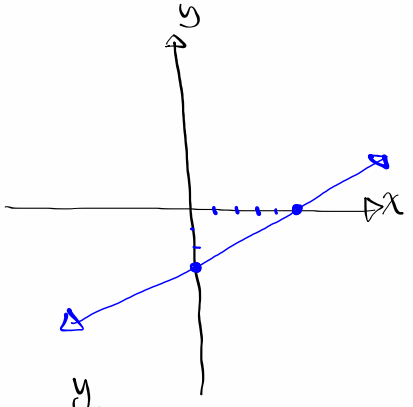
(−) Negative Sign

Jun 12-8:21 AM

Graph

$3x - 5y = 15$

x	y
0	-3
5	0



Intercept Method

$y = \frac{-2}{3}x + 5$

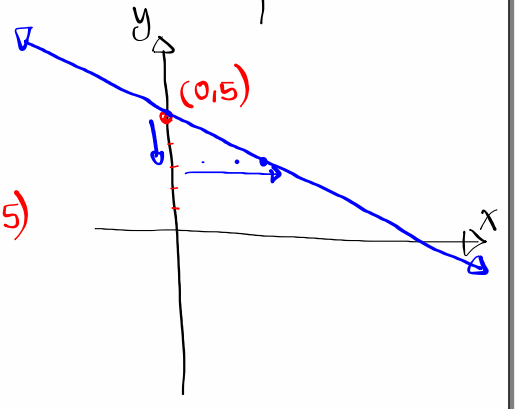
Slope-Int. Form

$y = mx + b$

$m = \frac{-2}{3}$, Y-Int (0,5)

Down 2 → Rise

Right 3 → Run



Jun 12-8:28 AM

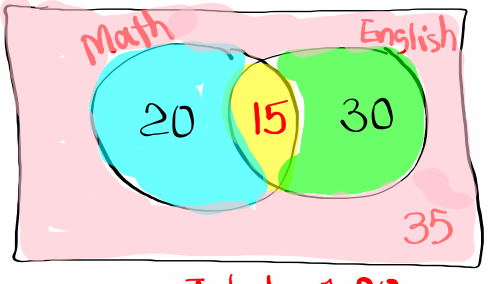
I Surveyed 100 Students.

20 were taking Math only.

30 " " English only.

15 " " both Math and English.

Organize this problem in a Venn Diagram.



Total = 100

Total = 100

$100 - (20 + 15 + 30) =$

$100 - 65 = 35$

SG 1

Jun 12-8:34 AM

Terminologies in Statistics

SG 2

What is Statistic?

It is about collecting information (data), organize them, draw graphs, do certain calculations, and draw conclusion and make predictions

Two Branches:

1) Descriptive Statistics

2) Inferential Statistics

Jun 12-8:56 AM

Descriptive Statistics:

Collecting data, organize and graph, do certain computations.

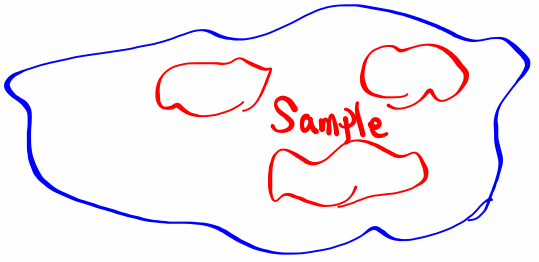
Inferential Statistics:

We learn from descriptive Statistics to draw conclusion, and make predictions with some level of confidence.

Jun 12-9:01 AM

Entire field of interest → Population

Randomly Selected data from Population → Sample



Sample ⟷ Statistic

Population ⟷ Parameter

Jun 12-9:04 AM

Information (data)

1) Qualitative (Non-Numerical)

2) Quantitative (Numerical)
   - 1) Discrete (Countable)
   - 2) Continuous (Measureable)

1 cup of coffee → Discrete

16 oz of coffee → Continuous

7 days in a week → Discrete

Room temp → Continuous

Jun 12-9:08 AM

Level of measurements:

1) Nominal — Names, Colors, Races, Name of countries, ...

2) Ordinal — order is meaningfull
Small, Med., Large

3) Ratio — Ratio must be meaningfull
Small → 10oz
Large → 20oz → Ratio of 2 to 1.

4) Interval — Range of values
90% – 100% → A
Slight time from LA to SF
50 mins to 60 mins.
Distance between two cities,

Jun 12-9:14 AM

Methods on Collecting Data:

1) Systematic — when every Kth item Selected
Record every 10th Call.
Select every 25th item for inspection.

2) Stratified — Divide into groups,
Select few from each group
32 Students
- 12 Males → Select 3 Males
- 20 Females → Select 5 Females

Jun 12-9:20 AM

3) Cluster — Divide into groups
Select few groups
Collect data from all members of selected groups

I randomly Selected 100 freshmen, 200 Sophmores, 150 Jrs, 75 Srs, and 50 graduate students from UCLA to do a Survey. Stratified

College offered 500 Sections of classes. I randomly Selected 50 Sections and asked all students to do a Survey. cluster

4) Random / Convenience "Least Reliable Method"

Jun 12-9:25 AM

Experiment vs observation

Experiment — You observe changes after some action taken.

Observation — You observe changes without taking any actions.

Simple Random Sample
when every member of the Sample has the same chance of being Selected.

Jun 12-9:34 AM

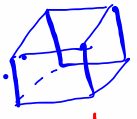
I flip a fair coin, Heads & Tails

Prob. that it lands tails 50/50 chance

Possible & likely

" " " " legs. Impossible.

Fair

Roll a die  1, 2, 3, 4, 5, 6

Can you get 10? No → Impossible

Can you get 6? Yes → unlikely

SG 2 ✓

Jun 12-9:41 AM

Collecting Data, organize and graph: SG 3 & 4

I randomly selected 20 exams, and here are the scores:

58 60 62 68 70

70 73 75 75 75

78 82 84 84 88

90 95 98 100 100

1) Sample Size

$n = 20$

2) Min. = 58, Max = 100

3) Range = Max − Min

= 100 − 58 = 42

4) Midrange = $\frac{\text{Max} + \text{Min}}{2}$

= $\frac{100+58}{2}$

= 79

5) Mode: 75

We wish to organize this Sample into a freq. table with 4 classes.

Class width = $\frac{\text{Range}}{\#\text{ of classes}}$

If decimal → Round-up

If whole → Add 1

CW = $\frac{\text{Range}}{4}$

= $\frac{42}{4}$ = 10.5

CW = 11

Jun 12-10:04 AM

class limits	class BNDRS	class MP	class F	Cum. F	Rel. F	% F
58 - 68	57.5 - 68.5	63	4	4	.20	20%
69 - 79	68.5 - 79.5	74	7	11	.35	35%
80 - 90	79.5 - 90.5	85	5	16	.25	25%
91 - 101	90.5 - 101.5	96	4	20	.20	20%

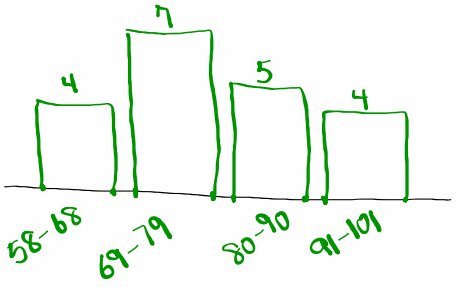
n = 20

68.5 (68 | 69)

, Class MP $= \frac{\text{+class limits}}{2} = \frac{58+68}{2} = 63$

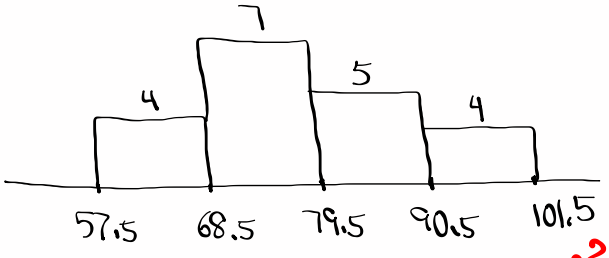
Rel. F $= \frac{f}{n} = \frac{f}{20}$

Bar chart
- class limits
- class F

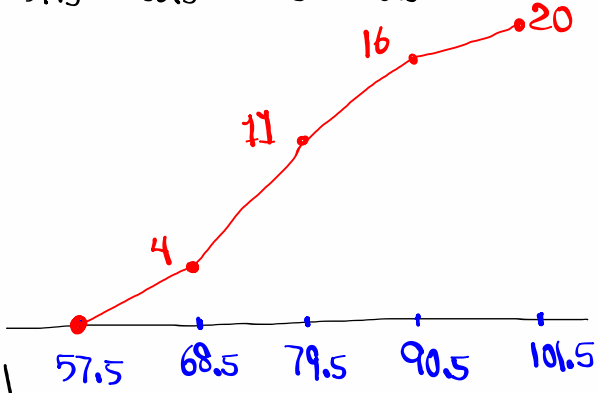


Jun 12-10:15 AM

Histogram
- class BNDRS
- class F



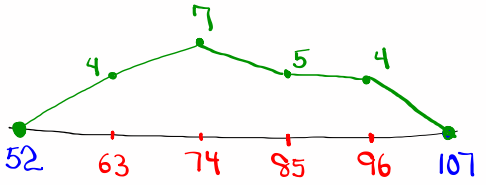
Ogive
- class BNDRS
- Cum. F
- Start at 0 level.



Jun 12-10:31 AM

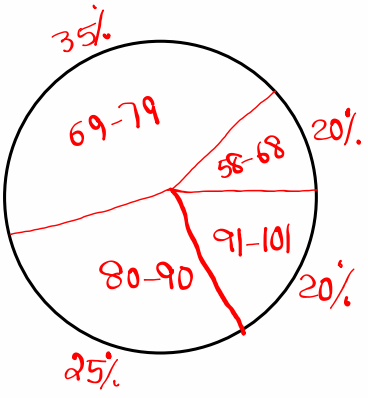
Freq. Polygon

- class MP
- one extra MP on each side
- class F
- starts & Ends at 0 level.



Pie Chart

- class limits
- % F
- Circle



Jun 12-10:35 AM

STEM Plot

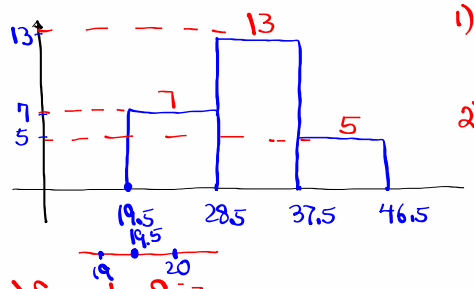
(Data must be Sorted)

58	60	62	68	70
70	73	75	75	75
78	82	84	84	88
90	95	98	100	100

5	8
6	0 2 8
7	0 0 3 5 5 8
8	2 4 8
9	0 5 8
10	0 0

Jun 12-10:41 AM

Consider the histogram below for ages of randomly selected students:



1) How many classes?

3

2) class width

28.5 − 19.5 = 9

37.5 − 28.5 = 9

46.5 − 37.5 = 9

3) Sample Size

n = 5 + 7 + 13 = 25 ✓

class mp = $\frac{\text{+ class BNDRS}}{2}$

class limits	class BNDRS	class MP	class F	Cum. F	Rel. F	% F
20 – 28	19.5 – 28.5	24	7	7	.28	28%
29 – 37	28.5 – 37.5	33	13	20	.52	52%
38 – 46	37.5 – 46.5	42	5	25	.20	20%

Rel. F = $\frac{f}{n} = \frac{f}{25}$

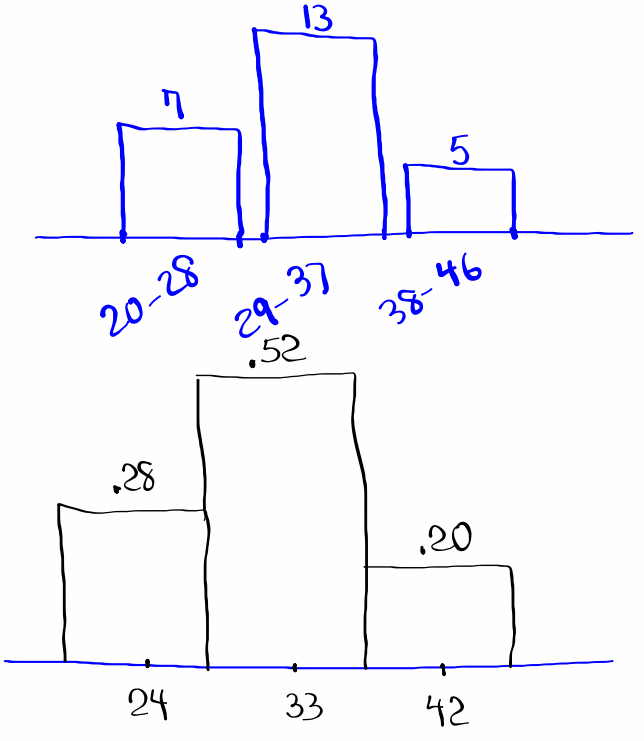
Jun 12-11:02 AM

Bar chart

- class limits
- class F

Histogram

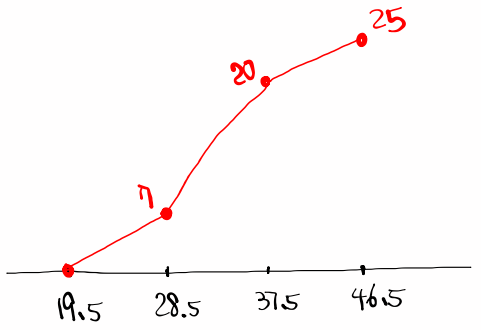
- class MP
- Rel. F.



Jun 12-11:13 AM

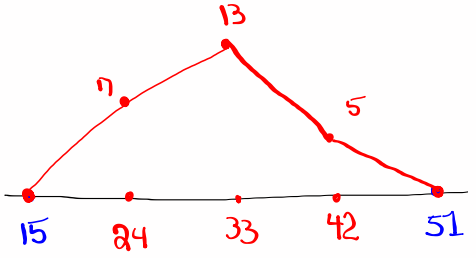
Ogive

- Class BNDRS
- Cum. F.
- Starts at 0.



Freq. Polygon

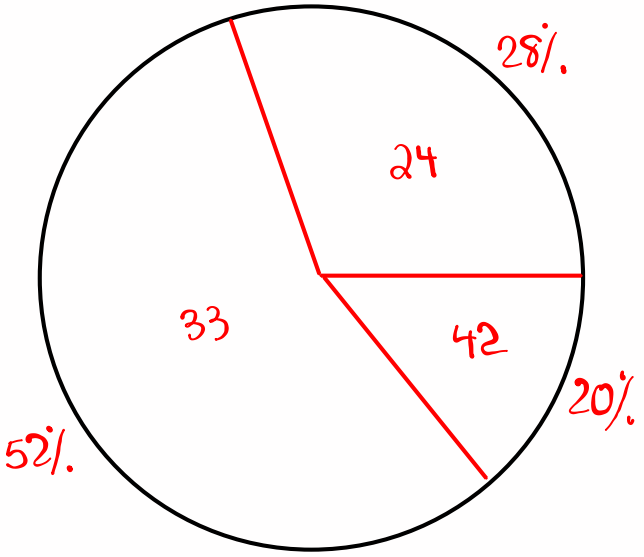
- Class MP
- Extra MP, one on each side,
- class F
- Start & End at 0 level.



Jun 12-11:17 AM

Pie chart

- Circle
- Class MP
- % F



Jun 12-11:22 AM

Consider the Sample below

1 2 2 4 8

Sample Size $n = 5$

$\sum x = 1 + 2 + 2 + 4 + 8 = \boxed{17}$

Summation of data elements x

$\frac{\sum x}{n} = \frac{17}{5} = \boxed{3.4}$

$\sum x^2 = 1^2 + 2^2 + 2^2 + 4^2 + 8^2 =$

$1 + 4 + 4 + 16 + 64 = \boxed{89}$

Simplify $\frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 89 - 17^2}{5(5-1)}$

$= \frac{5 \cdot 89 - 289}{5 \cdot 4}$

$= \frac{445 - 289}{20}$

3-decimal places $= \frac{156}{20} = \boxed{7.8}$

Find $\sqrt{7.8} \approx \boxed{2.793}$

Jun 12-11:27 AM

Consider the Sample below

2 4 4 4 6

1) $\boxed{n = 5}$ 2) $\boxed{\text{Min.} = 2}$ $\boxed{\text{Max.} = 6}$

3) Range = Max − Min = $\boxed{4}$ 4) Midrange = $\frac{\text{Max} + \text{Min}}{2}$

$= \boxed{4}$

5) Mode = $\boxed{4}$ 6) $\sum x = 2 + 4 + 4 + 4 + 6 = \boxed{20}$

7) $\sum x^2 = 2^2 + 4^2 + 4^2 + 4^2 + 6^2 = \boxed{88}$

8) $\frac{\sum x}{n} = \frac{20}{5} = \boxed{4}$

9) $\frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 88 - 20^2}{5(5-1)} = \frac{40}{20} = 2$

10) $\sqrt{2} \approx$ 3-decimal $\boxed{1.414}$ TI-83 or TI-84

Jun 12-11:35 AM