Week 1

Rafael Garcia

Outline

- About the topic
  - What are Statistics
  - Why do we do them
- Review of ‘basic math’
  - Orders of operation

About the topic

What are Statistics

- Tools for making sense out of the nonsense we gather using scientific methods
- Two major types:
  - **Descriptive-** summarize, organize, and simplify (SOS)
  - **Inferential-** generalize findings from smaller groups (samples) to larger groups (populations)
- Statistics is NOT just some horrible class we shove on undergrads that will never be used
  - **Whether we know it or not, we are all consuming statistics constantly

Why do we do them

- Describe- summarize, organize, and simplify (SOS)
- Identify- critical variables/conditions/situations
- Model- the way our measurements behave
- Predict- infer what will happen in new situations
- Learn- about how the universe works
- Evaluate- what works and what does not
- Synthesize- new interesting questions for research

DIMPLES ☺

Review of ‘basic math’

Order of operations

- **P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally
  - Or whatever you used in grade school

1. Parentheses- do anything in them
2. Exponents- squaring, cubing, square rooting, etc.
3. Multiplication and/or Division- do left → right
4. Addition and/or Subtraction- do left → right
   1. Summations using Σ first (implied parentheses!)
   2. Then the rest of it

Frequency distributions

What are they

- Listing of possible values for a variable, together with the number of observations at each value
  - i.e., category labels with the number of occurrences (frequency) in each category
- The distribution itself can be shown
  - Graphically
    - Tables, Histograms, Stem-and-Leaf plots, and Boxplots (typically)
  - Statistically
    - Measures of central tendency and spread

78.41007	97.46329	93.94233	100.8617	84.04854	97.56548
94.8594	96.78311	120.1307	93.93054	81.1404	95.25304
116.2395	77.28616	119.5105	106.7899	118.3557	108.107
104.6798	103.1343	107.3367	96.39819	89.99162	93.22944
98.59336	113.1344	93.21332	102.8965	98.06298	84.85477
113.9224	119.5482	90.43924	83.27477	103.4965	110.5043
92.32983	96.61805	82.35515	97.55055	97.20157	107.2146
103.3935	94.21196	85.73752	117.6113	96.0238	112.6415
108.1431	99.00023	104.5972	119.7462	96.38129	96.77553
96.67677	99.406	106.4173	96.56493	103.8133	89.62429
91.10055	106.9746	102.0897	97.10971	91.23302	107.8133
101.9511	112.0304	88.84668	90.1707	112.973	88.93628
104.0345	100.3541	88.86743	89.46928	117.6127	93.06964
97.66504	97.90227	103.9001	84.80487	90.53584	112.045
89.39691	110.7899	104.5614	92.41307	106.9121	80.5312
92.98936	105.2603	94.04338	111.6796	86.8331	109.1603
111.7798	98.72292	95.02044	92.49184	160	

X
150-160
140-150
130-140
120-130
110-120
100-110
90-100
80-90
70-80

78.41007	97.46329	93.94233	100.8617	84.04854	97.56548
94.8594	96.78311	120.1307	93.93054	81.1404	95.25304
116.2395	77.28616	119.5105	106.7899	118.3557	108.107
104.6798	103.1343	107.3367	96.39819	89.99162	93.22944
98.59336	113.1344	93.21332	102.8965	98.06298	84.85477
113.9224	119.5482	90.43924	83.27477	103.4965	110.5043
92.32983	96.61805	82.35515	97.55055	97.20157	107.2146
103.3935	94.21196	85.73752	117.6113	96.0238	112.6415
108.1431	99.00023	104.5972	119.7462	96.38129	96.77553
96.67677	99.406	106.4173	96.56493	103.8133	89.62429
91.10055	106.9746	102.0897	97.10971	91.23302	107.8133
101.9511	112.0304	88.84668	90.1707	112.973	88.93628
104.0345	100.3541	88.86743	89.46928	117.6127	93.06964
97.66504	97.90227	103.9001	84.80487	90.53584	112.045
89.39691	110.7899	104.5614	92.41307	106.9121	80.5312
92.98936	105.2603	94.04338	111.6796	86.8331	109.1603
111.7798	98.72292	95.02044	92.49184	160	

X	f
150-160	1
140-150	0
130-140	0
120-130	1
110-120	17
100-110	25
90-100	39
80-90	16
70-80	2

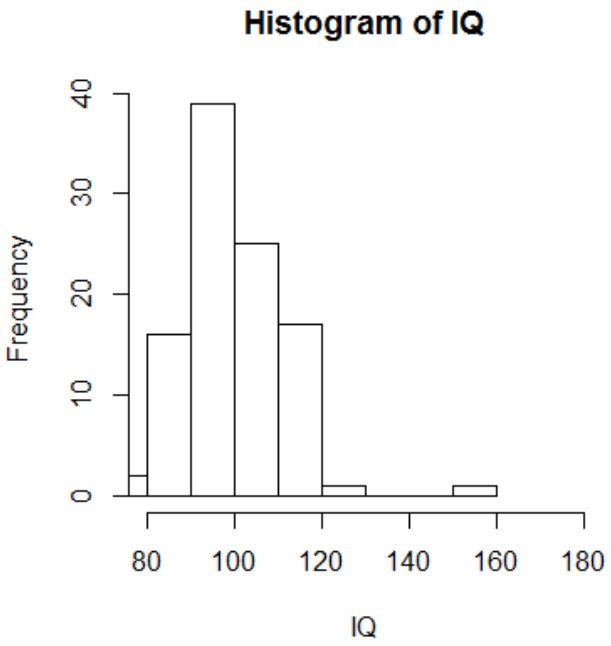
X	f	cf
150-160	1	101
140-150	0	100
130-140	0	100
120-130	1	100
110-120	17	99
100-110	25	82
90-100	39	57
80-90	16	18
70-80	2	2

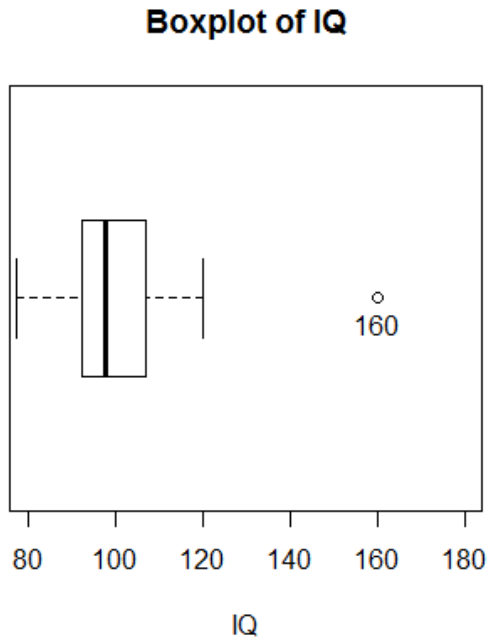
X	f	cf	p
150-160	1	101	0.01
140-150	0	100	0.00
130-140	0	100	0.00
120-130	1	100	0.01
110-120	17	99	0.17
100-110	25	82	0.25
90-100	39	57	0.39
80-90	16	18	0.16
70-80	2	2	0.02

X	f	cf	p	cp
150-160	1	101	0.01	1.00
140-150	0	100	0.00	0.99
130-140	0	100	0.00	0.99
120-130	1	100	0.01	0.99
110-120	17	99	0.17	0.98
100-110	25	82	0.25	0.81
90-100	39	57	0.39	0.56
80-90	16	18	0.16	0.18
70-80	2	2	0.02	0.02

X	f	cf	p	cp	C%
150-160	1	101	0.01	1.00	100
140-150	0	100	0.00	0.99	99
130-140	0	100	0.00	0.99	99
120-130	1	100	0.01	0.99	99
110-120	17	99	0.17	0.98	98
100-110	25	82	0.25	0.81	81
90-100	39	57	0.39	0.56	56
80-90	16	18	0.16	0.18	18
70-80	2	2	0.02	0.02	2

```
Stem-and-Leaf Plot
      IQ scores
 7 | 78
 8 | 11234
 8 | 556799999
 9 | 000011122233334444
 9 | 55566777777777888889999
10 | 01223333444
10 | 5555677777888 9
11 | 1122223334
11 | 6888
12 | 0000
12 |
13 |
13 |
14 |
14 |
15 |
15 |
16 | 0
```





Variables and Scales of Measurement

Variable Types

- Qualitative
  - Categorical- Names a category
- Quantitative
  - Discrete- Comes in nice little packages (can’t have half units)
    - Ex: People (can’t have half a person)
  - Continuous- Varies infinitely between two values (fractionally)
    - Ex: Height (can be 6’ 10.234817485712354351235436”

Scales of measurement

- **Nominal-** (Naming scales) Categorical
  - Ex: Group A, Blues, Person C, #1023
- **Ordinal-** (Ordering scales) Ranks individuals in sequences; distances between scores not same size
  - Ex: 1st place, 2nd place, 3rd place,…
- **Interval-** Intervals between scores of the same size and comparable
  - Ex: 20°C change is always the same; 10-pt increase in IQ is always the same
- **Ratio-** Same as interval scales, but with an absolute zero (a gold standard)
  - Ex: 20°K (0°K = no heat)