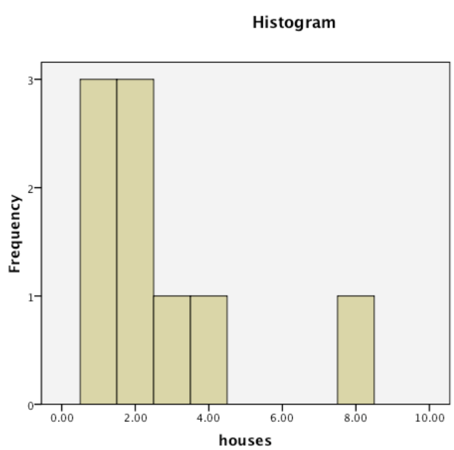
1. O. J. Simpson has been in the courtroom a few times. In one notable case, he was acquitted. More recently, he was found guilty (of a different crime). Think of the courtroom setting as similar to a research setting. That is, one collects evidence and makes a decision, but the truth is ultimately unknown. Thus, you should be able to describe the potential outcomes of the recent O. J. Simpson trial in terms of Null Hypothesis Significance Testing. First, state H_0. Then, describe the four possible results that might emerge (two correct decisions and two erroneous decisions), being sure to use Type I and Type II Error appropriately. [5 pts]

<table>
<tr><td colspan="2" rowspan="2">H_0: OJ is not guilty
H_1: OJ is guilty</td><td colspan="2">True State of the World</td></tr>
<tr><td>OJ is innocent</td><td>OJ is guilty</td></tr>
<tr><td rowspan="2">Courtroom Decision</td><td>OJ is innocent (acquit)
Retain H_0</td><td>Correctly Retain H_0</td><td>Type II Error</td></tr>
<tr><td>OJ is guilty (convict)
Reject H_0</td><td>Type I Error</td><td>Correctly Reject H_0</td></tr>
</table>

2. In this political season, one “issue” that arose is the number of houses owned by the presidential candidates. (They’ve also turned to counting the number of cars.) Below is a graph of the number of houses owned by a sample of nine prominent politicians. From the graph below, compute the sample statistics for central tendency and variability. [15 pts]



$\Sigma X = 24$

$\Sigma X^2 = 104$

$$SS = \sum X^2 - \frac{\left(\sum X\right)^2}{n} = 104 - \frac{24^2}{9} = 40$$

$$s^2 = \frac{SS}{n-1} = \frac{40}{8} = 5$$

$$s = \sqrt{s^2} = \sqrt{5} = 2.24$$

$$\overline{X} = M = \frac{\sum X}{n} = \frac{24}{9} = 2.67$$

Mdn = 2 (And, because this distribution is skewed, the median would be a good measure of central tendency.)

3. Bardwell, Ensign, and Mills (2005) assessed the moods of U.S. Marines following a month-long exercise conducted at cold temperatures and high altitudes. One component of assessment was a measure of anger, which we know to be 8.9 for male college students on this particular anger test. (FYI…the mean is 13.5 for male psychiatric outpatients.) For a sample of $n = 6$ Marines, the mean anger score was 13.3 ($M = 13.3$) and the standard deviation was 1.2 ($s = 1.2$). Test the null hypothesis that these Marines were sampled from the same population as the male college students (i.e., H_0: $\mu = 8.9$). [10 pts] {N&H}

H_0: $\mu = 8.9$ H_1: $\mu \neq 8.9$ $t_{Crit}(5) = 2.571$	$s_{\overline{X}} = \frac{s}{\sqrt{n}} = \frac{1.2}{\sqrt{6}} = .49$ $t = \frac{13.3 - 8.9}{.49} = 8.98$

Decision: Reject H0, because $|t_{Obt}| \geq t_{Crit}$.

Conclusion: Marines likely came from a population with $\mu > .89$.

4. If you think of SAT-M (Math) scores as normally distributed with μ = 500 and σ = 100, you should be able to answer the following questions: [3 pts each]

a. What proportion of SAT-M scores would fall between 550 and 650?

$z = \frac{550-500}{100} = .5$ $z = \frac{650-500}{100} = 1.5$	.4332 - .1915 = .2417 So, .24 (or 24%) of SAT-M scores fall between 550 and 650.

b. What proportion of SAT-M scores would fall below 400?

$z = \frac{400-500}{100} = -1.0$	.1587 So, .16 (or 16%) of SAT-M scores fall below 400.

c. If you wanted to do better than 95% of people taking the exam, what SAT-M score would you need to earn?

The z that cuts off the upper 5% is 1.645.	$1.645 = \frac{X-500}{100}$ $X = 664.5$

d. If you administered the SAT-M to a random sample of n = 9 people, what is the probability that their mean SAT-M would be between 500 and 600?

$z = \frac{500-500}{100/\sqrt{9}} = 0$ $z = \frac{600-500}{100/\sqrt{9}} = 3.0$	.4987 – 0 = .4987 So, .50 (50%) of mean SAT-M scores for a sample of n = 9 fall between 500 and 500.

e. If you were about to take a random sample of n = 9 people and you wanted to estimate the mean SAT-M of the sample, you might expect that it should fall in the middle 95% of the distribution. Thus, their mean would likely fall between what two scores?

$1.96 = \frac{\overline{X}-500}{100/\sqrt{9}}$ $-1.96 = \frac{\overline{X}-500}{100/\sqrt{9}}$	So, 95% of the means of samples of n = 9 would fall between 434.7 and 565.3.

5. Miscellaneous Questions [10 pts]:

a. Signal Detection Theory is actually quite similar to Null Hypothesis Significance Testing. What would be the Signal Detection analog of effect size?

d', which is a measure of sensitivity

b. What is the definition of power? (in words…1-β isn't acceptable as an answer)

The probability of correctly rejecting H_0.

c. What is the definition of the range?

Either Max – Min or (Max – Min) +1

d. As Seth pointed out, what would be true of the range for a population and the range for the sampling distribution of the mean (with *n* = 16) from that population?

They would be identical.

e. What is generally true of the variability of the sampling distribution of the mean relative to the population from which the sample means were obtained? Why?

The standard error (the standard deviation of the sampling distribution of the mean) will be smaller than the population standard deviation. In fact, the formula is $\sigma_{\bar{X}} = \sigma / \sqrt{n}$. The reason is that most sample means will fall closer to μ, due to the averaging together of scores that are more extreme with scores that are less extreme, or extreme in the other direction.

f. Interpret the SPSS output below as completely as you can. (In other words, what is the statistic, what is H_0, how would you interpret the results, etc.)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
houses	9	2.6667	2.23607	.74536

One-Sample Test

	Test Value = 4					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
houses	-1.789	8	.111	-1.33333	-3.0521	.3855

H_0: μ = 4 H_1: μ ≠ 4
t_{Obt} = -1.789, with p = .111. Thus, because $p > .05$, I would retain H_0 and conclude that the sample, with M = 2.6667 may have come from a population with μ = 4.