(1) a) Type I error is rejecting H_0 when in fact it is true (i.e. no effect of treatment).
Happens because of sampling error

b.) Type II error is failing to reject a false H_0. This can happen because the treatment effect is small (or weak).

(4) a) D.V. is S.A.T. score
I.V. is whether you take the special course or not.

b) $\boxed{\text{Step 1}}$: $H_0: \mu_{\text{SAT after course}} = 500$ (No effect of special course on average SATs)

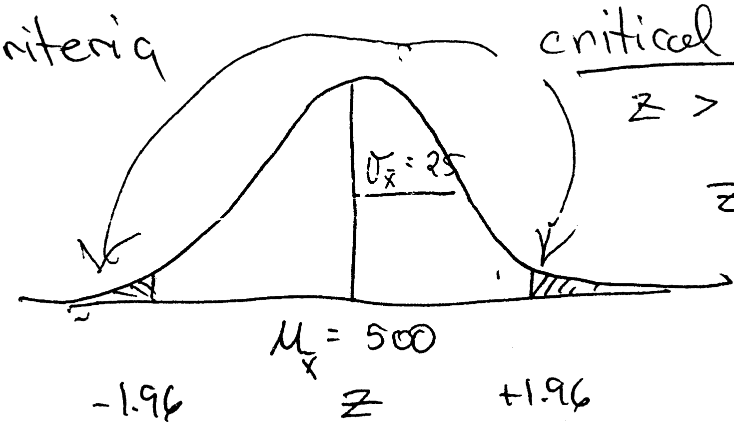
$H_1: \mu_{\text{SAT after course}} \neq 500$ (There is an effect of the special course on SATs)

$\alpha = .05$

$\boxed{\text{Step 2}}$ Set criteria

critical region
$z > +1.96$
or
$z < -1.96$

$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$
$= \frac{100}{\sqrt{16}}$
$= \frac{100}{4}$
$= 25$



Step 3 Collect sample data $\bar{X} = 554$

$\sigma_{\bar{x}} = 25$

$$\therefore \quad z_{obt.} = \frac{\bar{X} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{554 - 500}{25} = \frac{54}{25} = 2.16$$

Step 4: Reject H_0 because $z_{obt.}$ of 2.16 is in the critical region.

Step 5: Conclusion. The course significantly changed SATs, $z = 2.16$, $p < .05$.

c) If $\alpha = .01$ the critical region is:
$z > 2.58$ or $z < -2.58$

d) With $\alpha = .01$, decision would be to retain H_0 (fail to reject H_0). In part 'b' rejected H_0; here we did not. Reason: we've set the criteria higher (more extreme) to reject H_0.

5. a) $\bar{X} - \mu$ measures the difference between the sample mean (data) and the hypothesized pop. mean

b) A sample mean is not expected to be identical to the pop. mean. The standard error indicates the ~~how~~ expected difference between the pop. mean and the sample mean: in other words it indicates the amount of sampling error expected.

(6.) $\mu = 100$ $\sigma = 15$ IQs for general population

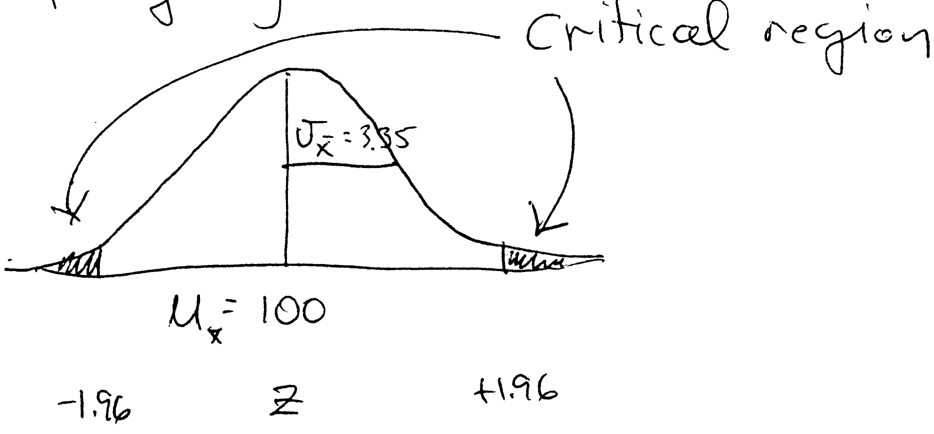
1) $H_0: \mu_{\text{IQ after measles}} = 100$ (No effect of German Measles on avg. IQ)

$H_1: \mu_{\text{IQ after measles}} \neq 100$ (There is an effect of German Measles on avg. IQ)

$\alpha = .05$

2) Set criteria for rejecting H_0

$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{20}} = 3.35$



3) Collect sample data: $\bar{X} = 97.3$

$$z_{obt.} = \frac{\bar{X} - \mu_{\bar{X}}}{\sigma_{\bar{X}}} = \frac{97.3 - 100}{3.35} = \boxed{-.81}$$

4) Retain H_0 because sample mean (z_{obt} of $-.81$) not in critical region.

5) Conclusion: There is no significant effect of German Measles on average SATs, $z = -.81$, $p > .05$.

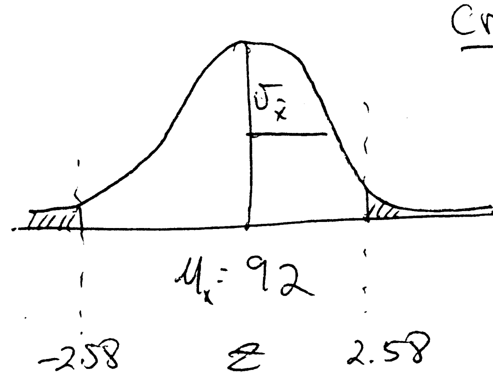
(8) $\mu = 92$ $\sigma = 11$ sample size $n = 5$

1) $H_0: \mu_{\text{Time for brain-damaged People}} = 92$ (No effect of frontal lobe damage on sort time)

$H_1: \mu_{\text{Time for brain-damaged People}} \neq 92$ (There is an effect of frontal lobe damage ...)

$\alpha = .01$

2) Set criteria:



critical region

$z > 2.58$

or

$z < -2.58$

3) Collect sample data: $\bar{X}_{\text{brain-damaged sample}} = 115$ seconds

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{11}{\sqrt{5}} = 4.91$$

$$z_{obt.} = \frac{\bar{X} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{115 - 92}{4.91} = \frac{23}{4.91} = \boxed{4.68}$$

4) Decision. Reject H_0 because z_{obt} of 4.68 is in the critical region

5) Conclusion: Frontal lobe damage significantly affected average time to complete task, $z = 4.68$, $p < .05$

9. $\mu = 185$ cans sold per week $\sigma = 23$

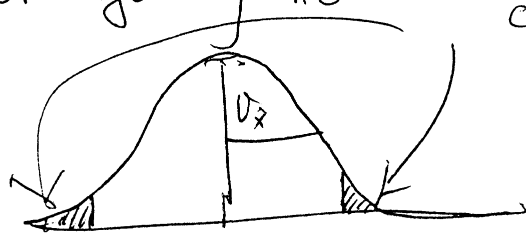
1) $H_0: \mu_{\text{number sold after price increase}} = 185$ (No effect of price change on number of cans sold)

$H_1: \mu_{\text{number sold after price increase}} \neq 185$ (There is an effect of the price change on # of cans sold)

$\alpha = .05$

2) Set criteria for rejecting H_0

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{23}{\sqrt{8}} = 8.13$$



$\mu_{\bar{x}} = 185$

-1.96 z +1.96

critical region

$z > +1.96$ or $z < -1.96$

3) Collect sample data: $\bar{X} = 161.75$

148
135
142
181
164
159
192
173

$\sum X = 161.75 / 8$ (n) $= 161.75$

$$z_{obt.} = \frac{\bar{X} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{161.75 - 185}{8.13} = \frac{-23.15}{8.13} = \boxed{-2.85}$$

4) Decision. Reject H_0 because sample mean ($z_{obt.}$ of -2.85) is in critical region.

5) Conclus: The price increase significantly changed sales, $z = -2.85$, $p < .05$.

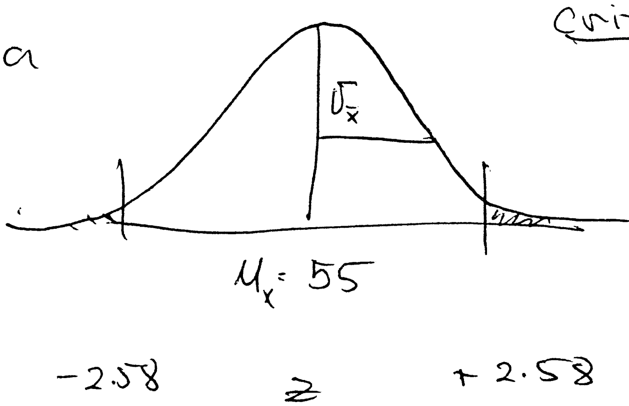
(13) $\mu_{normals} = 55$ $\sigma = 12$

1) H_0: $\mu_{\text{score for 'depressed' indivs}} = 55$ (Test is not sensitive in detecting depressed indivs.)

H_1: $\mu_{\text{scores for 'depressed' individuals}} \neq 55$ (The new test <u>is</u> sensitive in detecting depressed individuals)

$\alpha = .01$

2) Set criteria



<u>crit region</u>
$z > 2.58$
or
$z < -2.58$

$\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

$= \dfrac{12}{\sqrt{21}}$

$= 2.62$

3) Collect sample data: 59, 60, 60, 67, 65, 90, 89, 73, 74, 81, 71, 71, 83, 83, 88, 83, 84, 86, 85, 78, 79

$n = 21$

$z_{obt.} = \dfrac{\bar{X} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

$\bar{X} = \dfrac{\Sigma X}{n} = \dfrac{1609}{21} = 76.62$

$= \dfrac{76.62 - 55}{2.62} = \boxed{8.25}$

4) Reject H_0 because z_{obt} of 8.25 is in crit region.

5) <u>Conclusion</u>: The test is able to detect depressed individuals, $z = 8.25$, $p < .01$.

(24) Scores on standardized mem. test (normal): $\mu = 50$, $\sigma = 6$

1) State hypotheses

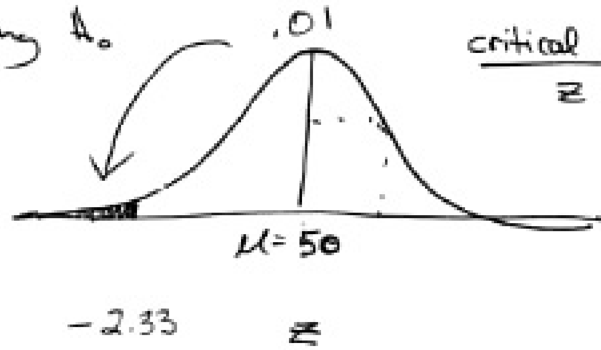
$H_0: \mu_{\text{score for abusers}} \geq 50$ (Alcohol does not impair performance on the memory test)

$H_1: \mu_{\text{score for abusers}} < 50$ (Alcohol impairs avg performance on the memory test)

$\alpha = .01$

2) Set criteria for rejecting H_0

$n = 22$



critical region

$z < -2.33$

3) Compute sample statistic

$\bar{X} = 47 \qquad n = 22$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6}{\sqrt{22}} = \frac{6}{4.6904} = 1.279$$

$$z_{obt.} = \frac{\bar{X} - \mu}{\sigma_{\bar{x}}} = \frac{47 - 50}{1.279} = \frac{-3}{1.279} = -2.35$$

4) Reject H_0 b/c z_{obt} of -2.35 is in c.r.

5) Conclusion. Alcohol significantly decreases avg. performance on the memory test ($M = 47$), $z = -2.35$, $p < .01$.