Panel 1

Confidence Int.

μ is between $\bar{x} - k \cdot s/\sqrt{n}$ and $\bar{x} + k \cdot s/\sqrt{n}$.

k is:

	$n \geq 30$	$n < 30$
90%	1.645	t-table with $df = n-1$
95%	1.96	
99%	2.58	

$\bar{X} = 2.06$

$s = 0.227$

$N = 10$

$k = 3.250$

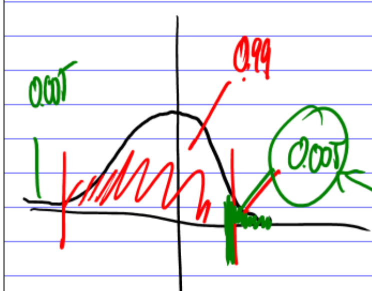
$df = 9$

$s/\sqrt{n} = 0.071$. (1.83) to (2.29)

From $2.06 - 3.250 \cdot 0.071$ to $2.06 + 3.250 \cdot 0.071$,

1

Panel 2



99%

z-table corresponds to

$z = 2.575$, or $\underline{2.58}$

2

Panel 3

Hypothesis Testing

H_0: (null hypothesis) default assumption, status quo

H_a (alternative hyp): the opposite of H_0

Test statistics: # you compute based on a sample

Decision Rule: specifies when to reject H_0 and accept H_a, (you never accept H_0) or test is inconclusive

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Panel 4

Does money make you happy? (Chi-Square Test)

H_0: There is no relationship between finances and happiness

H_a: There is a relation

Chi-Square: $\chi^2 = \sum \frac{(f - f_e)^2}{f}$ (f: frequency, f_e: expected value)

≈ 225.3

Cell format
Count Expected count

	1 - very happy	2 - pretty happy	3 - not too happy	Total
1 - satisfied	267 169.5	273 311.9	31 89.57	571
2 - more or less	236 241.6	476 444.7	102 127.7	814
3 - not at all satisfied	93 184.9	348 340.4	182 97.73	623
Total	596	1097	315	2008

Chi-Square test:

Statistic	DF	Value	P-value
Chi-square	4	225.30081	<0.0001

Decision: Reject H_0 if $p < 0.05$

Answer: Reject H_0, so there is a relation

4

Panel 5

Test about a Mean μ. ($n \geq 30$)

H_0: $\mu = \#$

H_a: $\mu \neq \#$

stats: $z_0 = \frac{\bar{x} - \mu}{(s/\sqrt{n})}$

decision: Compute $p = 2P(z > |z_0|)$. Reject H_0 if $p < 0.05$, else inconclusive

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Panel 6

A large supermarket chain sells longhorn cheese in one-pound (= *16* ounces) packages. As city inspector you weigh *100* randomly selected packages of cheese and note that the sample mean is *15.6* ounces, with a standard deviation of *2.0* ounces. You therefore suspect that the chain is miss-labeling the cheese and that the actual weight of a package is different from the stated *16* ounces. Use your data to test your suspicion against the null hypothesis that the average weight of a package is *16* ounces. Use $\alpha = 0.05$.

H_0: $\mu = 16$

H_a: $\mu \neq 16$

$z_0 = \frac{\bar{x} - \mu}{(s/\sqrt{n})} = \frac{15.6 - 16}{2/\sqrt{100}} = \frac{0.4}{2/10} = \frac{4}{2} = 2.$

$2 \cdot P(z > 2) = 2 \cdot 0.0228 = 0.0456$

Conclusion: Reject H_0 (and accept H_a), i.e. packages are mislabeled

6

Panel 7

A test was conducted to determine the length of time required for a student to read a specified amount of material while a low-level music was playing to see if students were distracted by the noise. All students were instructed to read at the maximum speed at which they could still comprehend the material. Fourteen students took the test, with the following results (in minutes):

25, 18, 27, 29, 20, 19, 25, 24, 32, 21, 24, 20, 24, 28

The average reading time for students in a quiet environment is 22 minutes. Use an appropriate statistical test to determine whether noise is indeed distracting students.

should use small sample test!

$H_0: \mu = 22$

$H_a: \mu \neq 22 \quad (\mu < 22)$

Test is inconclusive at the $\alpha = 0.05$ level

$t_0 = \frac{\bar{x} - 22}{s/\sqrt{14}} = \frac{24 - 22}{4.09/3.74} = (24-22) \cdot \frac{3.74}{4.09} = +2 \cdot \frac{3.74}{4.09} = +1.87$

$p = 2 \cdot P(t > |t_0|) = 2P(t > 1.87) = 2 \cdot 0.0307 = 0.0614$

7

Panel 8

Test for pop. mean μ. $(n < 30)$ - Small sample.

$t_{0.025} = 2.260$

$H_0: \mu = \#$ $\qquad \mu = 22$

$H_a: \mu \neq \#$ $\qquad \mu \neq 22$

$t = +1.87$

Stat: $t_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

in t-table

decision: look up t-value for $df = n-1$ and desired level of significance $\left(\frac{0.05}{2}\right)$. Reject H_0 if $t_0 > t$ or $-t_0 < t$, else inconclusive!

8

Panel 9

The manufacturer of car batteries claims that the average lifetime of its batteries (in months) is 20 months. You want to produce batteries with an average lifetime higher than that, but first you want to make sure that the manufactures claim is accurate. You randomly select a sample of six automobile batteries of that brand and find their lifetimes (in months) to be:

22 17 20 21 17 23

Setup a statistical test for checking whether the population mean indeed is 20 months or not.

Small sample Means test

$H_0: \mu = 20$

$H_a: \mu \neq 20$

$\bar{x} = 20$

$s = 2.53$

$t_0 = \frac{\bar{x} - 20}{s/\sqrt{6}} = \frac{20-20}{2.53/\sqrt{6}} = 0$

$t_{0.025} = 2.571$

df = 5

Decision: is $t_0 > t_{0.025,5}$

$0 > 2.571$

$\Rightarrow$ inconclusive

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