THE UNIVERSITY OF QUEENSLAND AUSTRALIA | CREATE CHANGE

ECON1310
Introductory Statistics for Social Sciences

Tutorial 8: CONFIDENCE INTERVALS II

Tutor: Francisco Tavares Garcia

CML 03 (2nd) and CML 04 (1st) are open.

CML 3 and 4 Reminder

Posted on: Wednesday, 11 January 2023 09:00:00 o'clock AEST

Dear Students,

A reminder that:

1. **CML 3 (2nd Attempt)** is now open and will **close at 4pm this Friday** (13 January)
2. **CML 4 (1st Attempt)** is now open and will **close at 4pm on Monday 16 January** (Week 7)
3. Please note that you **MUST check, save and submit** your CMLs, are they do not auto-submit.

Feel free to email me if you have any questions.

Best of luck!

Dominic

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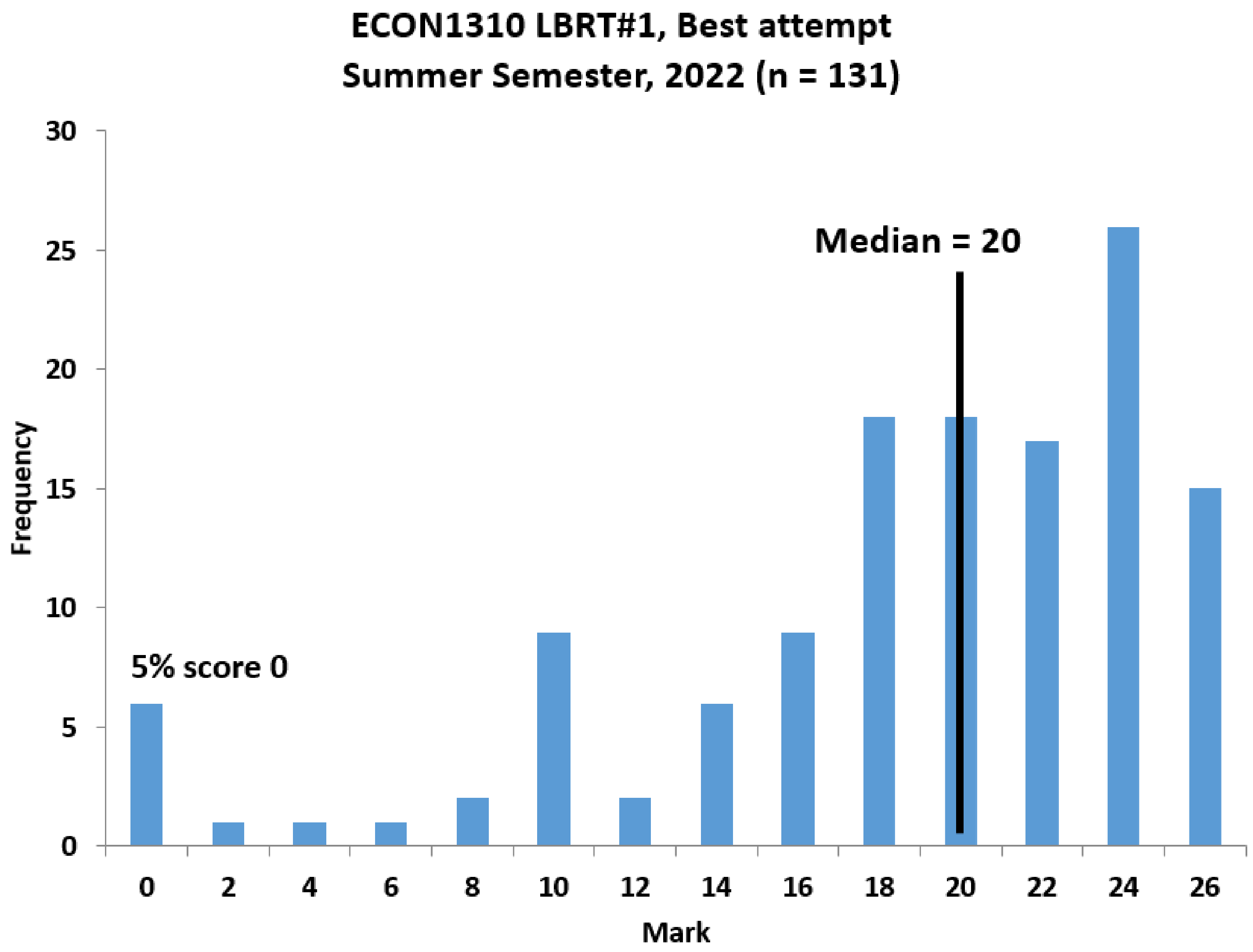
LBRT #1 Best attempt

LBRT#1 Best Attempt, Summer Sem 2022		
Mean	**19.0**	73%
Standard Error	0.49	
Median	**20**	77%
Mode	**24**	
Standard Deviation	5.5	
Sample Variance	30.5	
Kurtosis	0.3	
Skewness	-0.9	
Range	24	
Minimum	2	
Maximum	26	
Sum	2369.7	
Count	**125**	

Excludes scores of 0



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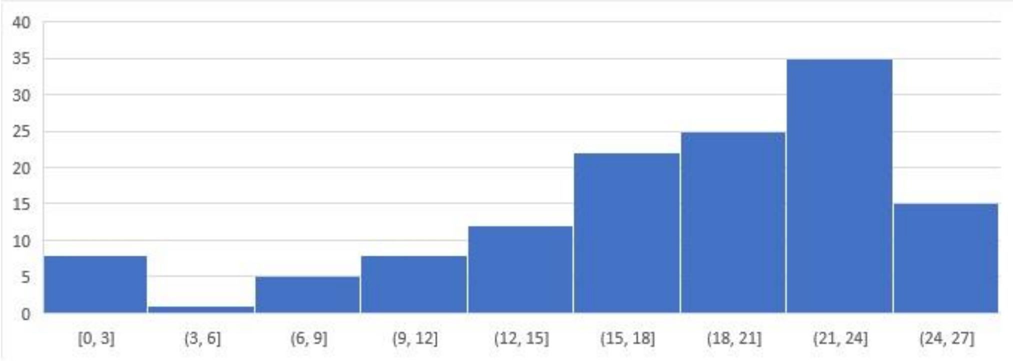
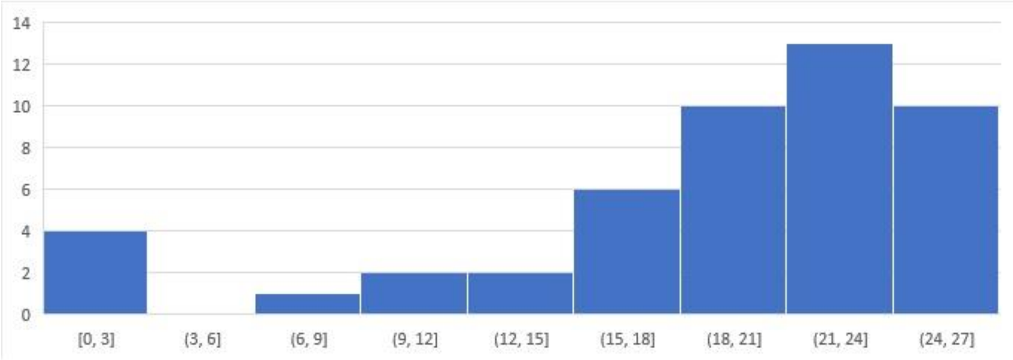
All students (n = 131)



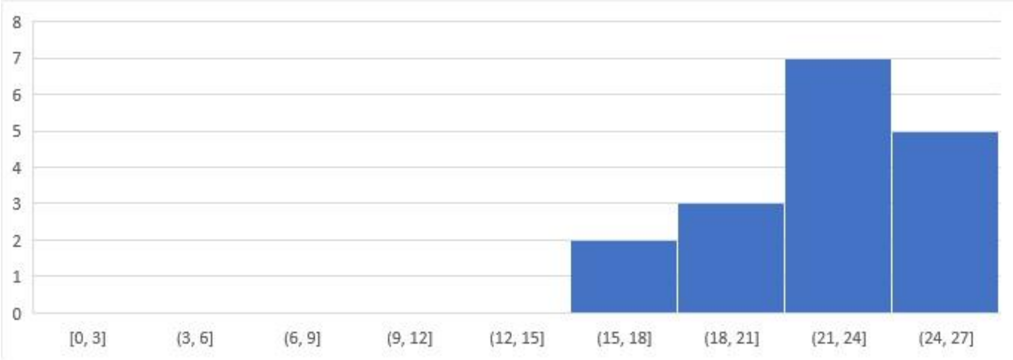
Mean = 18.07
Median = 19.33

Our tutorial (n = 48)



Mean = 19.31
Median = 21

Students who attended at least 5 tutorials by then (n = 17)



Mean = 22.94
Median = 24

Oral Interview (IVA)

ECON1310 Oral interview for Identity Verified Assessment (IVA)

Posted on: Thursday, 12 January 2023 06:00:00 o'clock AEST

Dear Students

Over the next few days, tutors will identify and email students required to have a **mandatory oral interview** for IVA purposes. Students must respond by email to this tutor request for a **mandatory oral interview** within **72 hours**.

NOTE: It is your responsibility to check your UQ student email AND Blackboard announcements regularly. Claiming 'I didn't know I had an email' will not be accepted.

The oral interviews, organised by the student's tutor, will generally be held during Week 8.

All oral interviews will be conducted and recorded on Zoom. **NOTE:** The School of Economics has decided to make such recordings mandatory unless a student has a legitimate reason (e.g. because of a medical reason and has valid supporting documentation). At the start of the interview, students must show their student card as proof of identity.

For more information, please refer to Section 5.4 Other Assessment Information of the course profile.

Kind regards,

Dominic

ECON1310

Tutorial 8 – Week 9

CONFIDENCE INTERVALS II

At the end of this tutorial you should be able to

- Determine the sample mean or level of confidence for a specified confidence interval,
- Determine the sample size required to provide a specified level of confidence for a confidence interval,
- Calculate confidence intervals for the difference between two population means.

Q1. It costs more to produce defective items (since they must be scrapped or reworked) than it does to produce non-defective items. This implies that manufacturers should ensure the quality of their products by perfecting their production processes rather than through inspection of finished products. In order to better understand a particular metal-stamping process, a manufacturer wishes to estimate the mean length of items produced by the process during the past 24 hours.

a) How many parts should be sampled to estimate the population mean length within 0.1 mm with 90% confidence? Previous studies have indicated the standard deviation is 2mm.

b) Time permits the use of a sample size no larger than 100. If a 90% confidence interval for μ is constructed using n=100 will it be wider or narrower than would have been obtained using the sample size in a)? Explain.

c) If management requires that μ be estimated to within 0.1mm and that a sample size of no more than 100 be used, what is the maximum confidence level that could be attained for a confidence interval that meets management's specifications? Note that previous studies have indicated the standard deviation is 2mm.

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Q1. It costs more to produce defective items (since they must be scrapped or reworked) than it does to produce non-defective items. This implies that manufacturers should ensure the quality of their products by perfecting their production processes rather than through inspection of finished products. In order to better understand a particular metal-stamping process, a manufacturer wishes to estimate the mean length of items produced by the process during the past 24 hours.

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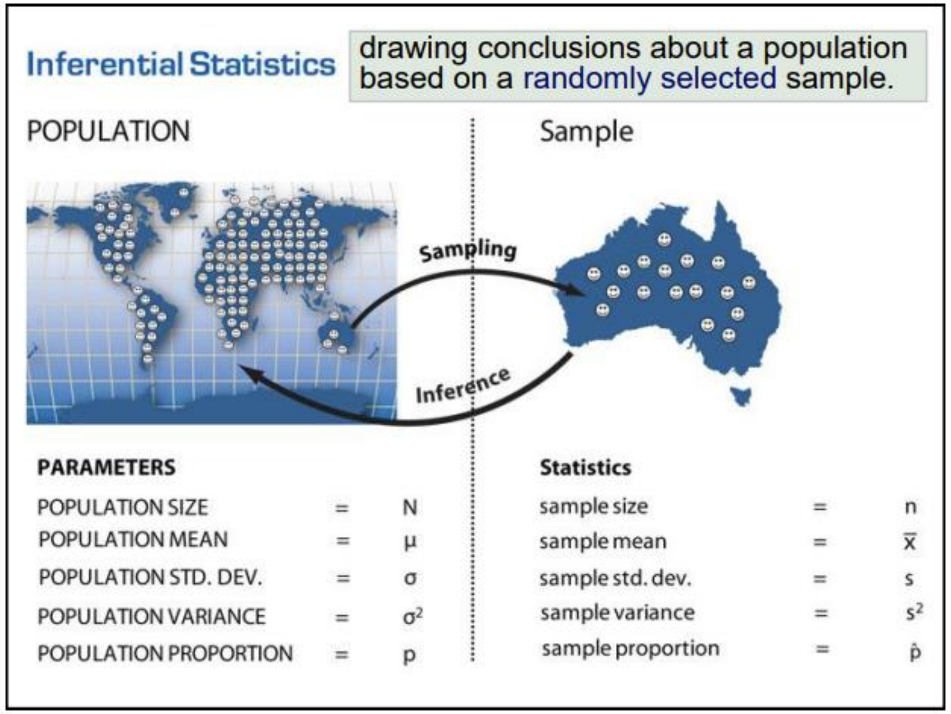

1. What symbol would you give to the value 90% confidence? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- E

2. What symbol would you give to the value 2mm? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- E

(Poll)

3. What symbol would you give to the value 0.1mm? (Single Choice) *

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- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- E

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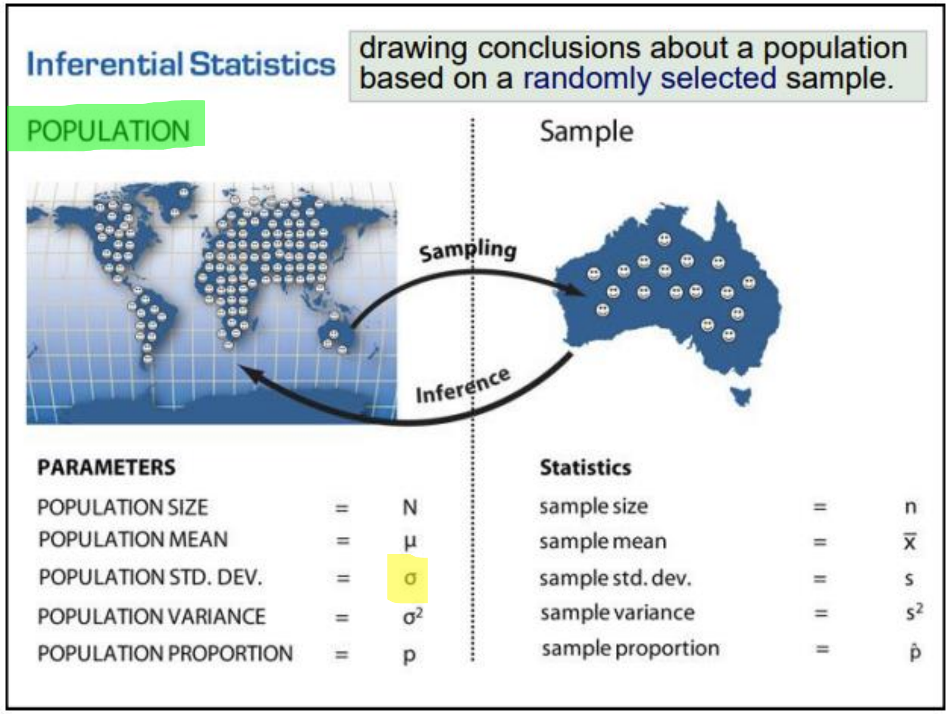

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1. What type of problem is it? (Single Choice) *

(Poll)

- Population Mean (Seagull) (no sample)
- Population Mean (Pelican) (σ is known)
- Population Mean (Shag) (σ is unknown but s is known)
- Population Proportion (Freaky fish) (proportion)

2. What table will we use? (Single Choice) *

- Z table (standard normal distribution)
- t table (Student's t-distribution)

3. What is the value of α (alpha)? (Single Choice) *

- 0.01
- 0.05
- 0.1
- 0.9
- 0.95
- 0.99

adm T08 Q1 Q2 Q3 Q4

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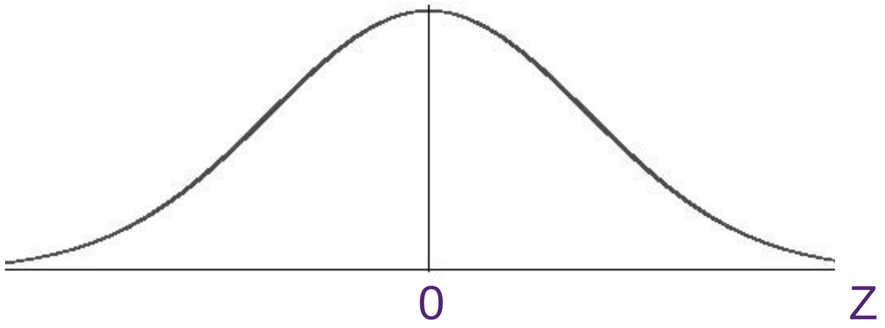

σ = 2mm

LOC = 90%

α = 1 - 0.99 = 0.01

E = 0.1mm

n = ?

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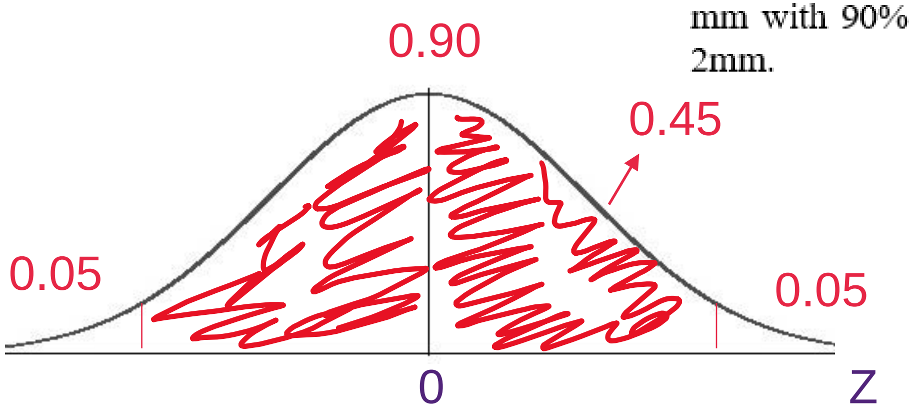

σ = 2mm
LOC = 90%
α = 1 - 0.99 = 0.01
E = 0.1mm
n = ?
Z_{crit} = ?

1. Determining Sample Size, σ known
(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

$$\boxed{n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2}$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign ≥ .

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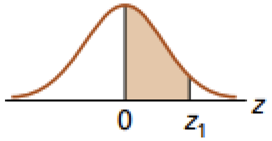
TABLE A.5 Areas of the standard normal distribution $\mu = 0, \sigma = 1$

The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).

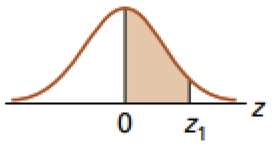


0.45

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767

TABLE A.5 Areas of the standard normal distribution $\mu = 0, \sigma = 1$

The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



1.645

0.45

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
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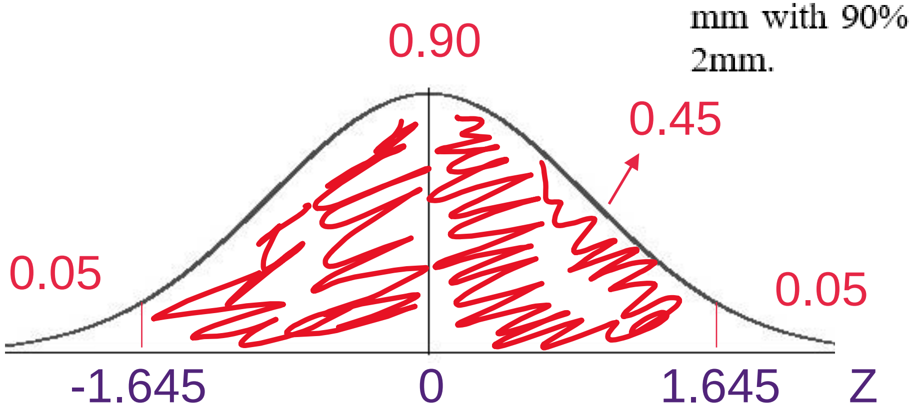

σ = 2mm

LOC = 90%

α = 1 - 0.9 = 0.1

E = 0.1mm

n = ?

Z_{crit} = 1.645

1. Determining Sample Size, σ known

(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

$$\boxed{n \geq \left(\frac{Z_{crit}\,\sigma}{E} \right)^2}$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign $\geq$.

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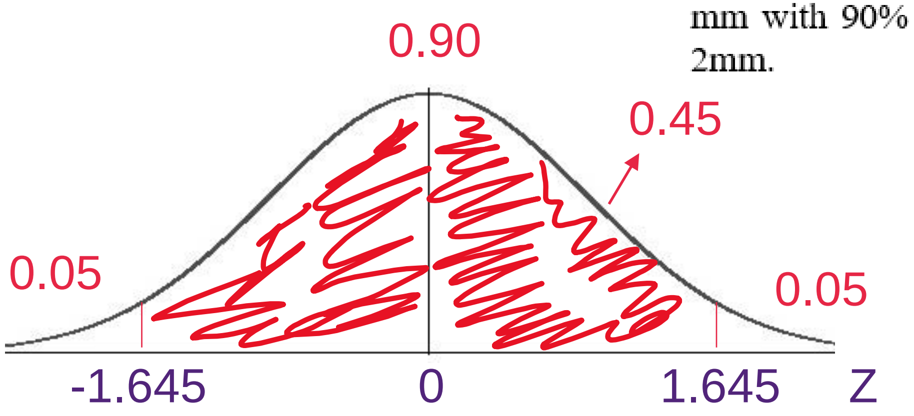

σ = 2mm
LOC = 90%
α = 1 - 0.9 = 0.1
E = 0.1mm
n = ?
Z_{crit} = 1.645

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = ?$$

1. Determining Sample Size, σ known
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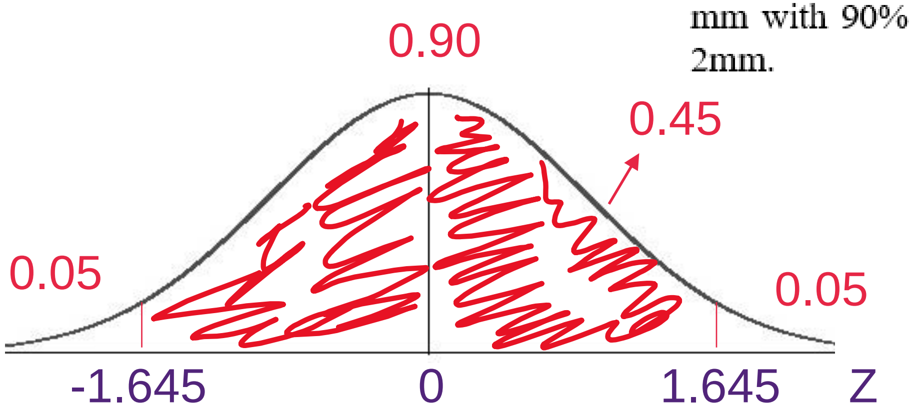
1083 parts.



σ = 2mm
LOC = 90%
α = 1 - 0.9 = 0.1
E = 0.1mm
n = ?
Z_{crit} = 1.645

$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = \left(\frac{1.645*2}{0.1}\right)^2 = 1082.41 \sim$ 1083 parts ↑ Round up

1. Determining Sample Size, σ known
(for estimating the population mean)

$\mu: \quad \bar{X} \pm Z_{crit}\frac{\sigma}{\sqrt{n}}$

$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$

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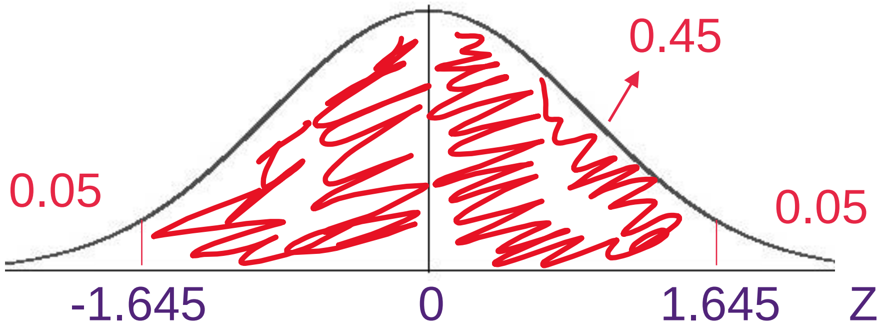

σ = 2mm
LOC = 90%
α = 1 - 0.9 = 0.1
E = 0.1mm
n = ?
Z_{crit} = 1.645

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = \left(\frac{1.645*2}{0.1}\right)^2 = 1082.41 \sim 1083$$

Therefore, at least 1083 parts should be sampled.

1. Determining Sample Size, σ known

(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit}\frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

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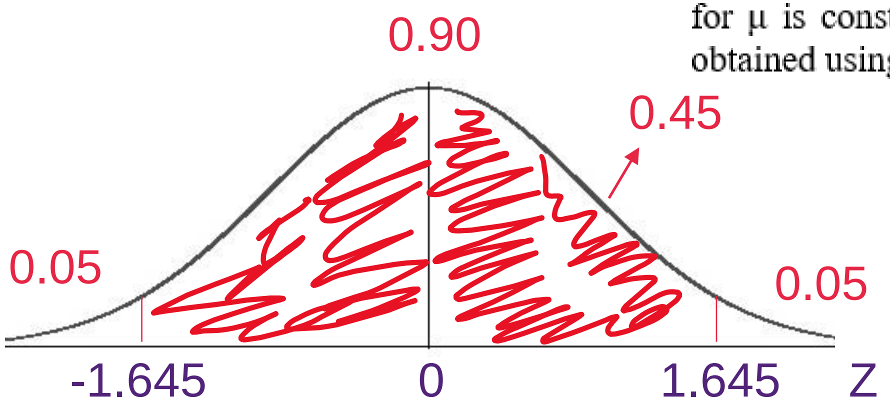

σ = 2mm
LOC = 90%
α = 1 - 0.9 = 0.1
n = 100
Z_{crit} = 1.645
E = ?

1. Determining Sample Size, σ known
(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit}\frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign ≥ .

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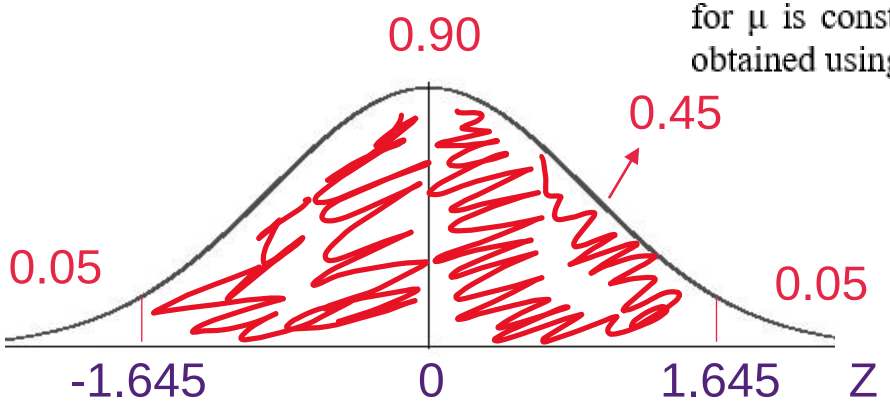
Australia

Q1. It costs more to produce defective items (since they must be scrapped or reworked) than it does to produce non-defective items. This implies that manufacturers should ensure the quality of their products by perfecting their production processes rather than through inspection of finished products. In order to better understand a particular metal-stamping process, a manufacturer wishes to estimate the mean length of items produced by the process during the past 24 hours.

a) How many parts should be sampled to estimate the population mean length within 0.1 mm with 90% confidence? Previous studies have indicated the standard deviation is 2mm.

1083 parts.

b) Time permits the use of a sample size no larger than 100. If a 90% confidence interval for μ is constructed using n=100 will it be wider or narrower than would have been obtained using the sample size in a)? Explain.



$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} = ?$

$\sigma = 2$mm
LOC = 90%
$\alpha = 1 - 0.9 = 0.1$
$n = 100$
$Z_{crit} = 1.645$
$E = ?$

1. Determining Sample Size, σ known
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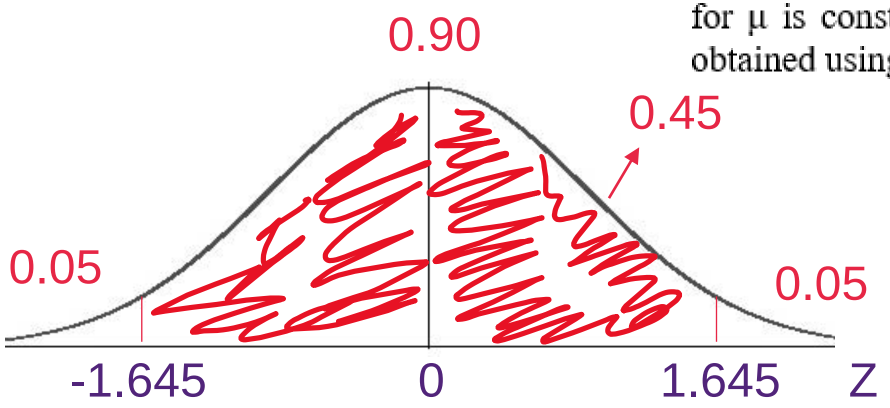
Wider, 0.329 mm



σ = 2mm
LOC = 90%
α = 1 - 0.9 = 0.1
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Z_{crit} = 1.645
E = ?

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} = 1.645 * \frac{2}{\sqrt{100}} = 0.329 \text{ mm}$$

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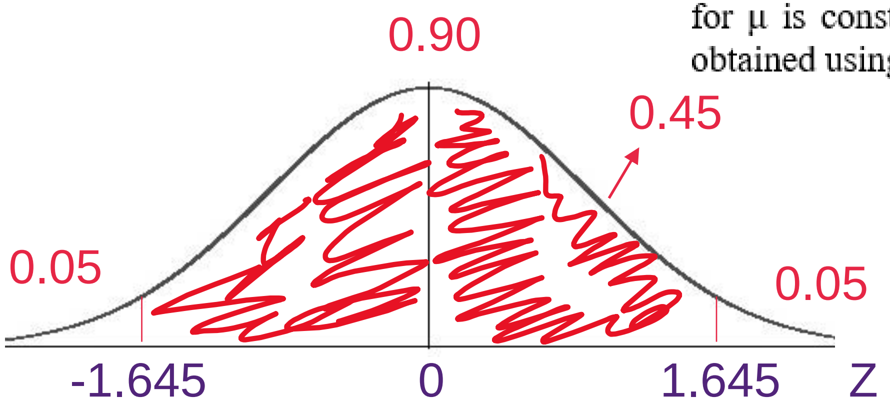

σ = 2mm
LOC = 90%
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Z_{crit} = 1.645
E = ?

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} = 1.645 * \frac{2}{\sqrt{100}} = 0.329 \text{ mm}$$

The CI will be wider since allowance for sampling error on either side of the mean will be bigger.

1. Determining Sample Size, σ known
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$$\mu: \quad \bar{X} \pm Z_{crit}\frac{\sigma}{\sqrt{n}}$$

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Wider, 0.329 mm

c) If management requires that μ be estimated to within 0.1mm and that a sample size of no more than 100 be used, what is the maximum confidence level that could be attained for a confidence interval that meets management's specifications? Note that previous studies have indicated the standard deviation is 2mm.

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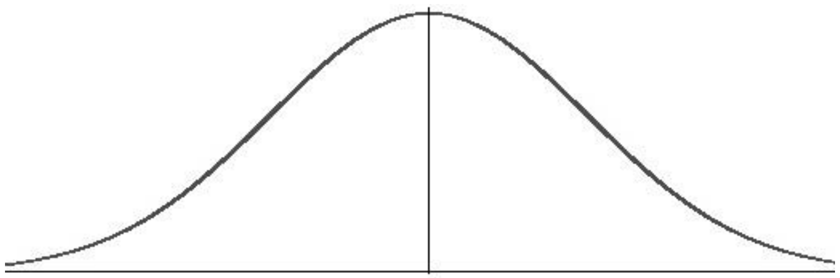

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σ = 2 mm
n = 100
E = 0.1
LOC = ?
α = 1 - LOC = ?
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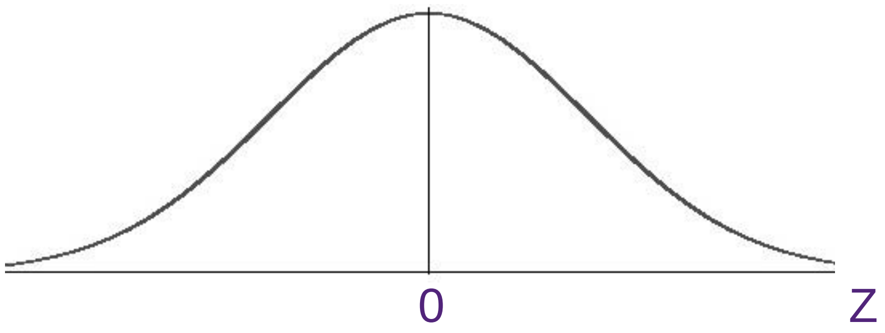

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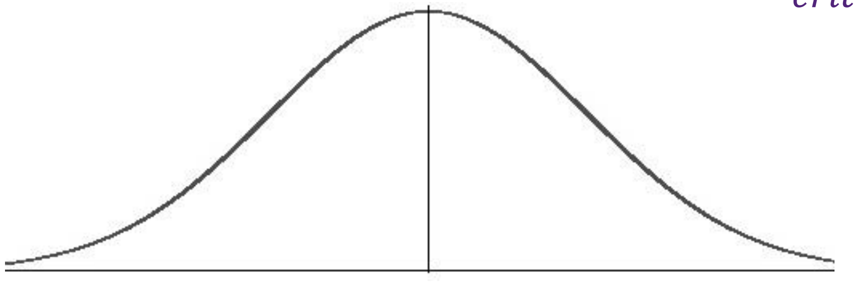

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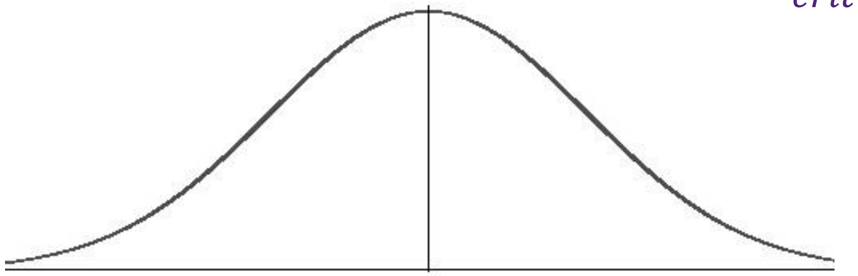

adm T08 Q1 Q2 Q3 Q4

σ = 2 mm
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E = 0.1
LOC = ?
α = 1 - LOC = ?
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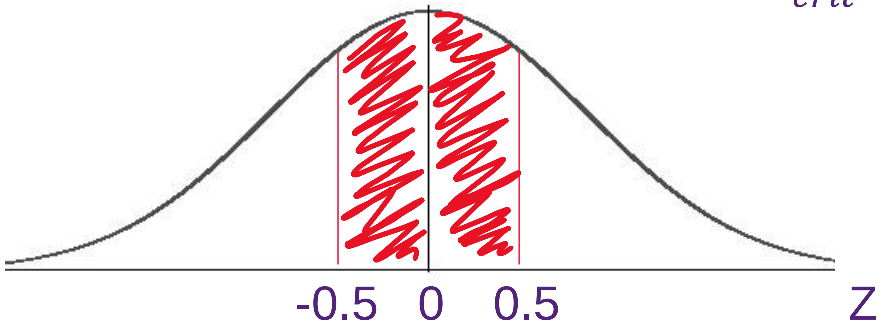

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$$μ: \quad \bar{X} \pm Z_{crit} \frac{σ}{\sqrt{n}}$$

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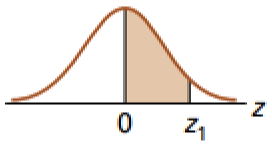
TABLE A.5 Areas of the standard normal distribution $\mu = 0, \sigma = 1$

The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



0.5

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767

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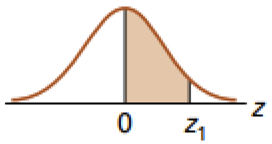

0.5

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
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0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
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σ = 2 mm
n = 100
E = 0.1
LOC = ?
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1083 parts

b) Time permits the use of a sample size no larger than 100. If a 90% confidence interval for μ is constructed using n=100 will it be wider or narrower than would have been obtained using the sample size in a)? Explain.

Wider, 0.329 mm

c) If management requires that μ be estimated to within 0.1mm and that a sample size of no more than 100 be used, what is the maximum confidence level that could be attained for a confidence interval that meets management's specifications? Note that previous studies have indicated the standard deviation is 2mm.

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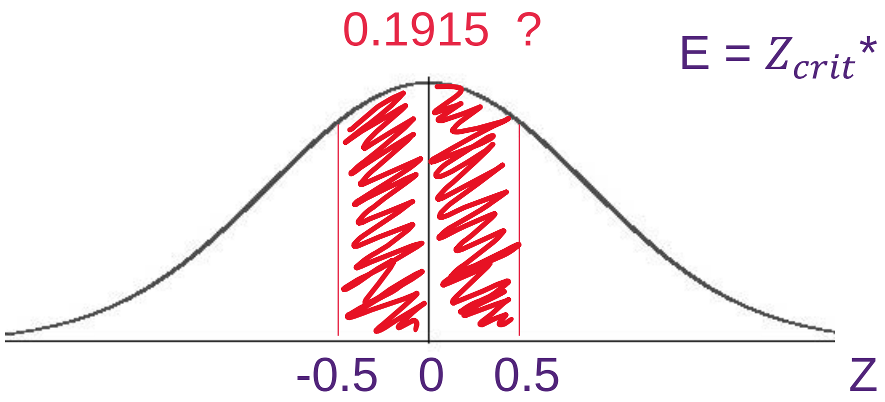

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} \rightarrow Z_{crit} = \frac{E*\sqrt{n}}{\sigma} = \frac{0.1*\sqrt{100}}{2} = 0.5$$

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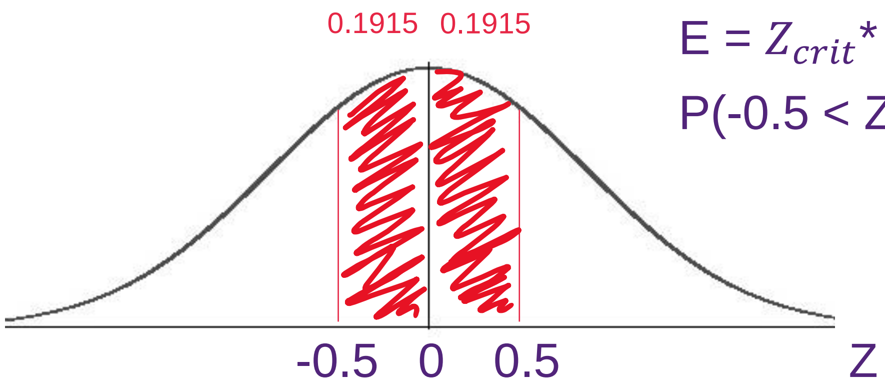

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} \rightarrow Z_{crit} = \frac{E * \sqrt{n}}{\sigma} = \frac{0.1 * \sqrt{100}}{2} = 0.5$$

P(-0.5 < Z < 0.5) = 0.1915 + 0.1915 = ?

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α = 1 - LOC = ?
Z_{crit} = ?

Q1. It costs more to produce defective items (since they must be scrapped or reworked) than it does to produce non-defective items. This implies that manufacturers should ensure the quality of their products by perfecting their production processes rather than through inspection of finished products. In order to better understand a particular metal-stamping process, a manufacturer wishes to estimate the mean length of items produced by the process during the past 24 hours.

a) How many parts should be sampled to estimate the population mean length within 0.1 mm with 90% confidence? Previous studies have indicated the standard deviation is 2mm.

1083 parts

b) Time permits the use of a sample size no larger than 100. If a 90% confidence interval for μ is constructed using n=100 will it be wider or narrower than would have been obtained using the sample size in a)? Explain.

Wider, 0.329 mm

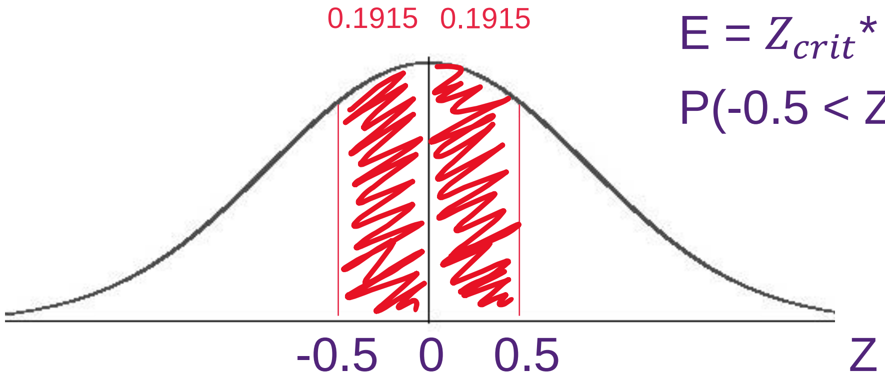
c) If management requires that μ be estimated to within 0.1mm and that a sample size of no more than 100 be used, what is the maximum confidence level that could be attained for a confidence interval that meets management's specifications? Note that previous studies have indicated the standard deviation is 2mm.

38.3% LOC

Therefore, the maximum confidence level is only 38.3% when n = 100 and error is within 0.1 mm.

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}} \rightarrow Z_{crit} = \frac{E*\sqrt{n}}{\sigma} = \frac{0.1*\sqrt{100}}{2} = 0.5$$

P(-0.5 < Z < 0.5) = 0.1915 + 0.1915 = 0.383 = 38.3% LOC



1. Determining Sample Size, σ known

(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

$$\boxed{n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2}$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign ≥ .

Q2. You wish to estimate the mean of a particular population and, at the 95% level of confidence, you want your sampling error to be no more than 50g. You take a sample of 100 from the population and this gives a sample mean of 5000g and a standard deviation of 800g.

a) On the basis of this sample, construct an interval estimate of the population mean.

b) Does this estimate satisfy the requirements regarding the sampling error?

c) If the answer in b) was no, what sample size would be required to satisfy the conditions of 95% level of confidence with a sampling error of no more that 50g? (Assume 800g is a good estimate of σ).

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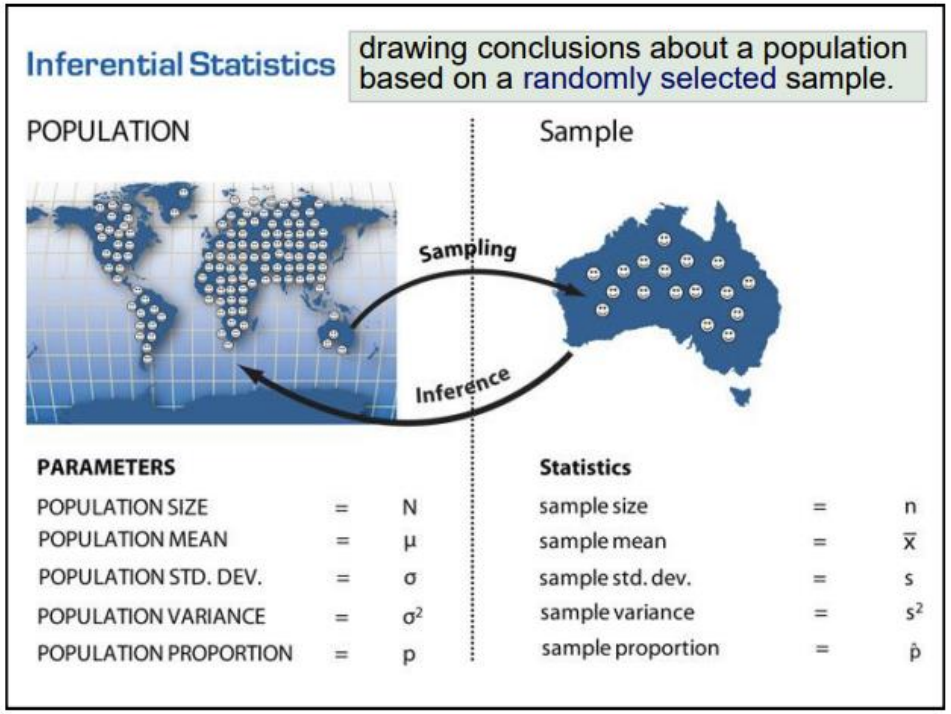
b) Does this estimate satisfy the requirements regarding the sampling error?

c) If the answer in b) was no, what sample size would be required to satisfy the condi of 95% level of confidence with a sampling error of no more that 50g? (Assume 80 a good estimate of σ).

(Poll)



1. What symbol would you give to the value 95% level of confidence? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

2. What symbol would you give to the value 50g? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

3. What symbol would you give to the sample of 100? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

4. What symbol would you give to the value 5000g? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

5. What symbol would you give to the value 800g? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

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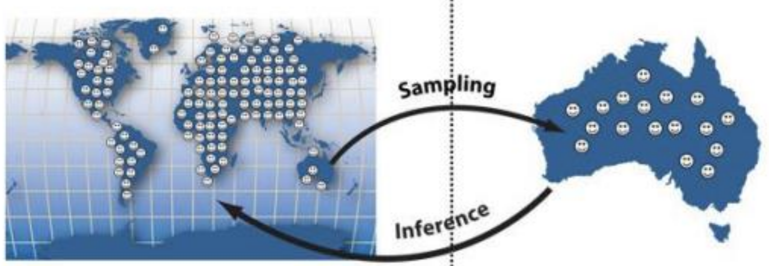
(Poll)

Inferential Statistics drawing conclusions about a population based on a randomly selected sample.

POPULATION | Sample



PARAMETERS			Statistics		
POPULATION SIZE	=	N	sample size	=	n
POPULATION MEAN	=	μ	sample mean	=	$\bar{x}$
POPULATION STD. DEV.	=	σ	sample std. dev.	=	s
POPULATION VARIANCE	=	σ^2	sample variance	=	s^2
POPULATION PROPORTION	=	p	sample proportion	=	$\hat{p}$

1. What symbol would you give to the value 95% level of confidence? (Single Choice) *

- n
- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
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- σ (sigma)
- s
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- Level of Confidence (LOC)
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5. What symbol would you give to the value 800g? (Single Choice) *

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- σ (sigma)
- s
- x̄ (x bar)
- Level of Confidence (LOC)
- E

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1. What type of problem is it? (Single Choice) *

- Population Mean (Seagull) (no sample)
- Population Mean (Pelican) (σ is known)
- Population Mean (Shag) (σ is unknown but s is known)
- Population Proportion (Freaky fish) (proportion)

(Poll)

2. What table will we use? (Single Choice) *

- Z table (standard normal distribution)
- t table (Student's t-distribution)

3. What is the value of α (alpha)? (Single Choice) *

- 0.01
- 0.05
- 0.1
- 0.9
- 0.95
- 0.99

Q2. You wish to estimate the mean of a particular population and, at the 95% level of confidence, you want your sampling error to be no more than 50g. You take a sample of 100 from the population and this gives a sample mean of 5000g and a standard deviation of 800g.

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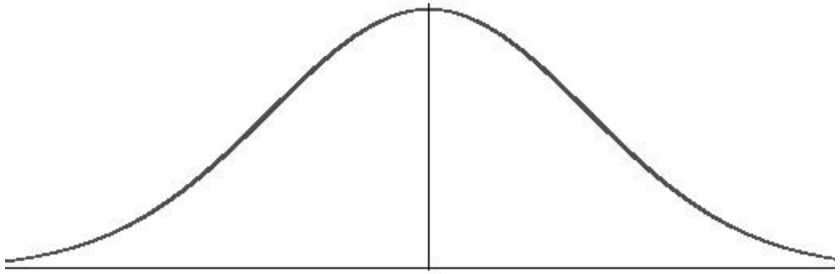
$E = 50$ g
$n = 100$
$\bar{X} = 5000$ g
$s = 800$ g
LOC = 95%



Confidence Intervals for the parameters **μ** and **p** so far are

$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$

$\mu: \quad \bar{X} \pm t_{\alpha/2,\, n-1} \frac{s}{\sqrt{n}}$

$p: \quad \hat{p} \pm Z_{crit} \sqrt{\frac{\hat{p} * (1-\hat{p})}{n}}$

5

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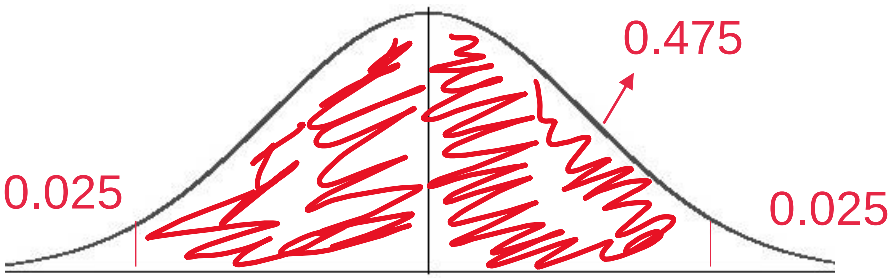
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
df = n – 1 = 99
$t_{crit} = t_{\alpha/2,\, df} = t_{0.025,\, 99}$



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5

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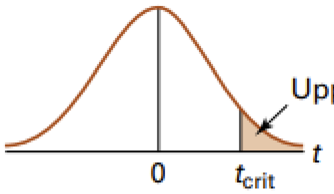

$t_{0.025,\,99}$

	Upper tail areas					
df	$t_{.10}$	$t_{.05}$	$t_{.025}$	$t_{.01}$	$t_{.005}$	$t_{.001}$
76	1.293	1.665	1.992	2.376	2.642	3.201
77	1.293	1.665	1.991	2.376	2.641	3.199
78	1.292	1.665	1.991	2.375	2.640	3.198
79	1.292	1.664	1.990	2.374	2.640	3.197
80	1.292	1.664	1.990	2.374	2.639	3.195
81	1.292	1.664	1.990	2.373	2.638	3.194
82	1.292	1.664	1.989	2.373	2.637	3.193
83	1.292	1.663	1.989	2.372	2.636	3.191
84	1.292	1.663	1.989	2.372	2.636	3.190
85	1.292	1.663	1.988	2.371	2.635	3.189
86	1.291	1.663	1.988	2.370	2.634	3.188
87	1.291	1.663	1.988	2.370	2.634	3.187
88	1.291	1.662	1.987	2.369	2.633	3.185
89	1.291	1.662	1.987	2.369	2.632	3.184
90	1.291	1.662	1.987	2.368	2.632	3.183
91	1.291	1.662	1.986	2.368	2.631	3.182
92	1.291	1.662	1.986	2.368	2.630	3.181
93	1.291	1.661	1.986	2.367	2.630	3.180
94	1.291	1.661	1.986	2.367	2.629	3.179
95	1.291	1.661	1.985	2.366	2.629	3.178
96	1.290	1.661	1.985	2.366	2.628	3.177
97	1.290	1.661	1.985	2.365	2.627	3.176
98	1.290	1.661	1.984	2.365	2.627	3.175
99	1.290	1.660	1.984	2.365	2.626	3.175
100	1.290	1.660	1.984	2.364	2.626	3.174
150	1.287	1.655	1.976	2.351	2.609	3.145
200	1.286	1.653	1.972	2.345	2.601	3.131
∞	1.282	1.645	1.960	2.326	2.576	3.090

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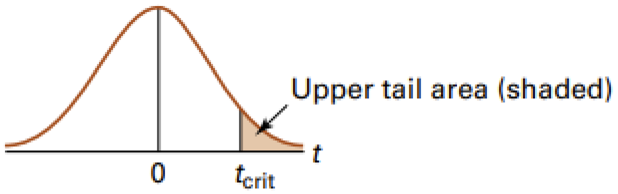

$t_{0.025,\,99}$

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α = 1 – 0.95 = 0.05
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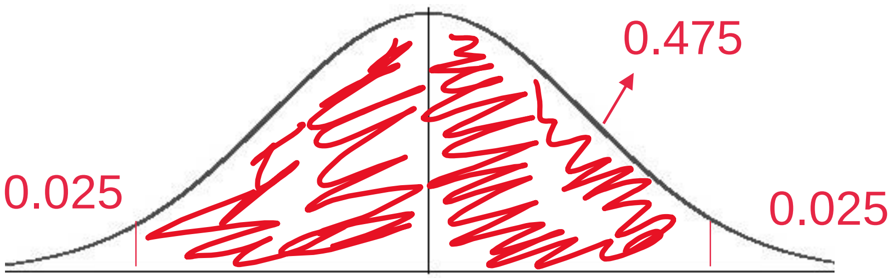
$t_{crit} = t_{\alpha/2,\,df} = t_{0.025,\,99} = 1.984$



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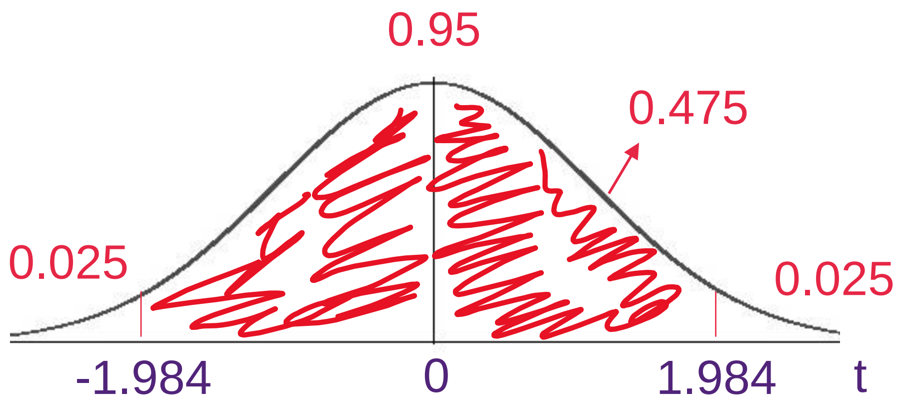
$$\bar{X} \pm t_{\alpha/2,\,df} * s_{\bar{X}} = \bar{X} \pm t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} = ?$$



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5

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a) On the basis of this sample, construct an interval estimate of the population mean.

4841.28 < μ < 5158.72

b) Does this estimate satisfy the requirements regarding the sampling error?

c) If the answer in b) was no, what sample size would be required to satisfy the conditions of 95% level of confidence with a sampling error of no more that 50g? (Assume 800g is a good estimate of σ).

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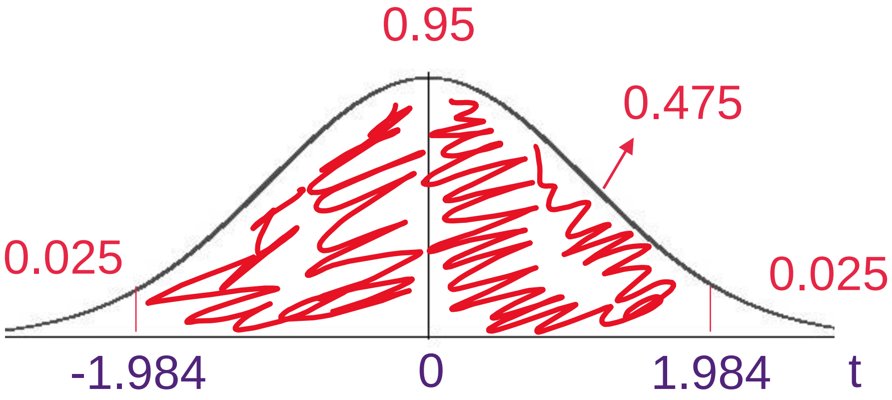
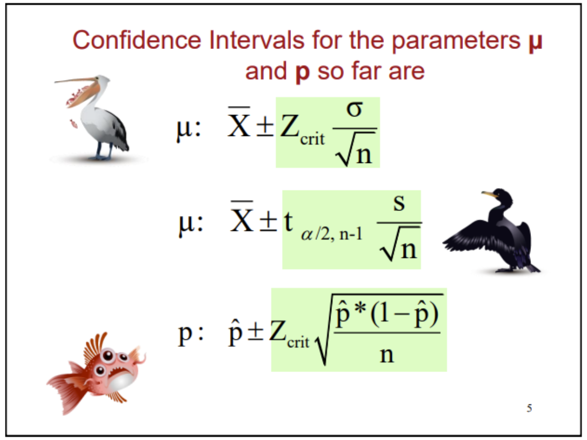
df = n – 1 = 99
$t_{crit} = t_{\alpha/2,\,df} = t_{0.025,\,99} = 1.984$

$$\bar{X} \pm t_{\alpha/2,\,df} * s_{\bar{X}} = \bar{X} \pm t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} =$$

$$5000 \pm 1.984 * \frac{800}{\sqrt{100}} = 4841.28 < \mu < 5158.72$$





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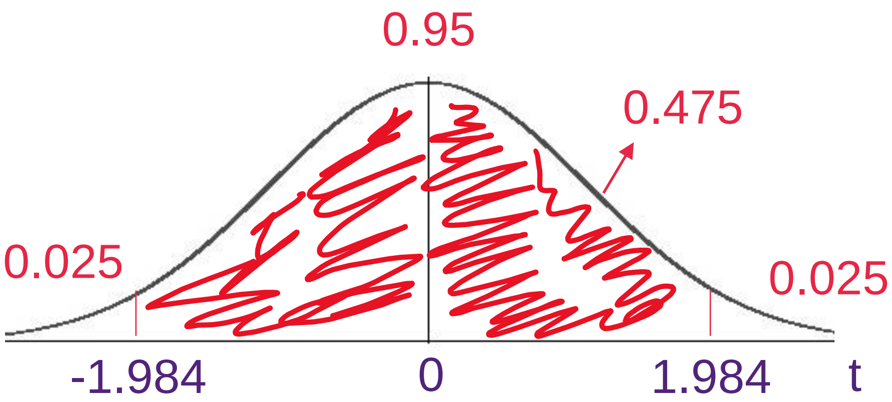
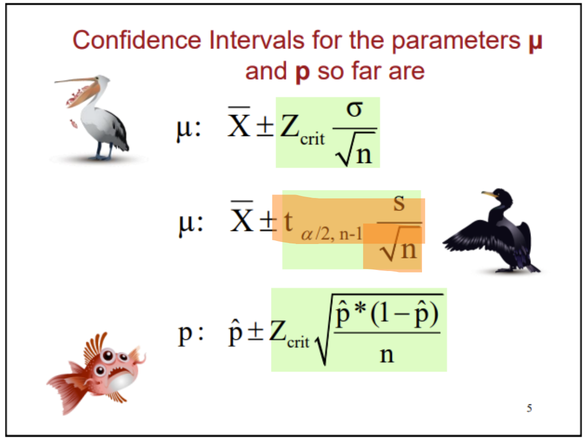
$t_{crit} = t_{\alpha/2,\,df} = t_{0.025,\,99} = 1.984$

$$E = t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} = ?$$





adm T08 Q1 Q2 Q3 Q4

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$4841.28 < \mu < 5158.72$

b) Does this estimate satisfy the requirements regarding the sampling error?

No, $158.72 > 50$

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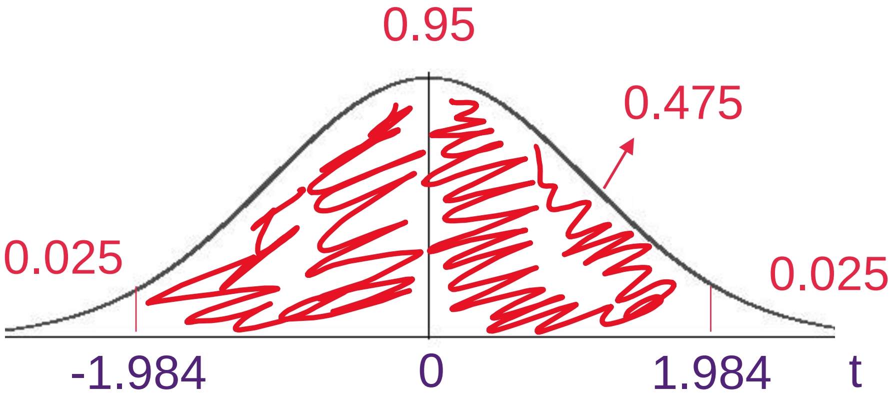
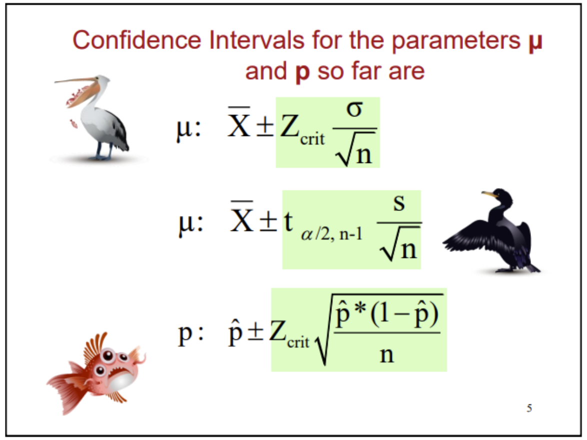
$\alpha = 1 - 0.95 = 0.05$
$df = n - 1 = 99$
$t_{crit} = t_{\alpha/2,\,df} = t_{0.025,\,99} = 1.984$

$$E = t_{\alpha/2,\,df} * \frac{s}{\sqrt{n}} = 1.984 * \frac{800}{\sqrt{100}} = 158.72 > 50$$

So it does not meet the requirements regarding sampling error.





Q2. You wish to estimate the mean of a particular population and, at the 95% level of confidence, you want your sampling error to be no more than 50g. You take a sample of 100 from the population and this gives a sample mean of 5000g and a standard deviation of 800g.

a) On the basis of this sample, construct an interval estimate of the population mean.

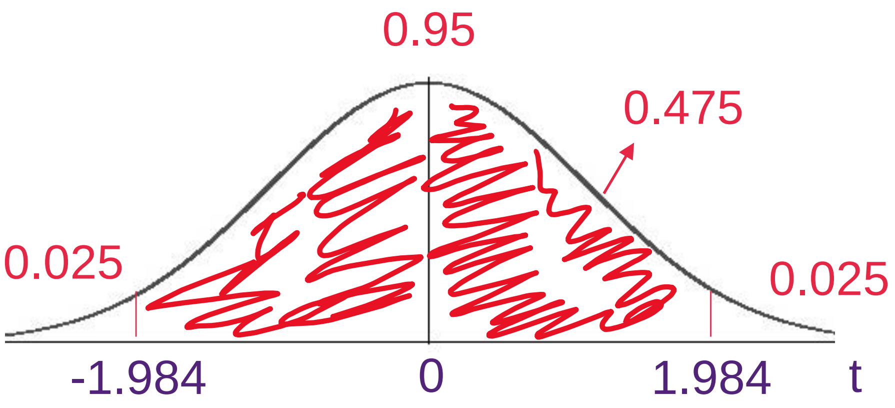
$4841.28 < \mu < 5158.72$

b) Does this estimate satisfy the requirements regarding the sampling error?

No, $158.72 > 50$

c) If the answer in b) was no, what sample size would be required to satisfy the conditions of 95% level of confidence with a sampling error of no more that 50g? (Assume 800g is a good estimate of σ).

$E = 50$ g
$n = 100$
$\bar{X} = 5000$ g
$s = 800$ g
LOC = 95% = 0.95
$\alpha = 1 - 0.95 = 0.05$
$df = n - 1 = 99$
$t_{crit} = t_{\alpha/2,\, df} = t_{0.025,\, 99} = 1.984$



Confidence Intervals for the parameters **μ** and **p** so far are

$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$

$\mu: \quad \bar{X} \pm t_{\alpha/2,\, n-1} \frac{s}{\sqrt{n}}$

$p: \quad \hat{p} \pm Z_{crit} \sqrt{\frac{\hat{p} * (1-\hat{p})}{n}}$

5

Q2. You wish to estimate the mean of a particular population and, at the 95% level of confidence, you want your sampling error to be no more than 50g. You take a sample of 100 from the population and this gives a sample mean of 5000g and a standard deviation of 800g.

a) On the basis of this sample, construct an interval estimate of the population mean.

$4841.28 < \mu < 5158.72$

b) Does this estimate satisfy the requirements regarding the sampling error?

No, $158.72 > 50$

c) If the answer in b) was no, what sample size would be required to satisfy the conditions of 95% level of confidence with a sampling error of no more that 50g? (Assume 800g is a good estimate of σ).

$E = 50$ g

$n = ?$

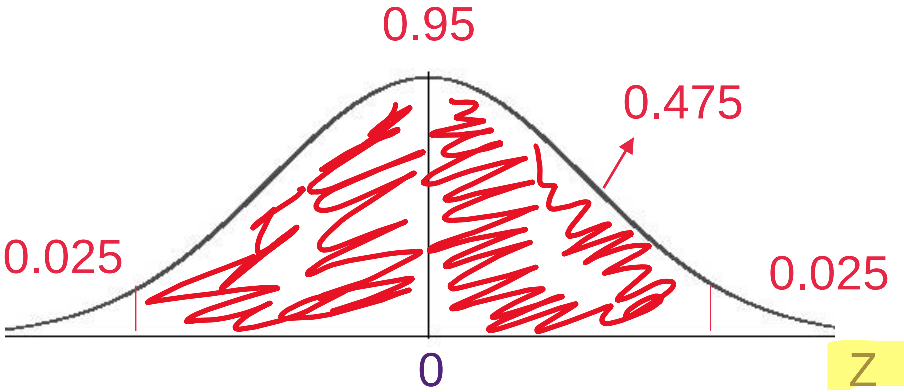
$\bar{X} = 5000$ g

$\sigma = 800$ g

LOC = 95% = 0.95

$\alpha = 1 - 0.95 = 0.05$

$Z_{crit} = ?$



1. Determining Sample Size, σ known

(for estimating the population mean)

$$\mu: \quad \bar{X} \pm Z_{crit} \frac{\sigma}{\sqrt{n}}$$

$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

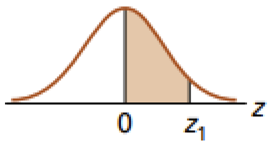
$$\boxed{n \geq \left(\frac{Z_{crit}\,\sigma}{E}\right)^2}$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign $\geq$.

adm T08 Q1 Q2 Q3 Q4

TABLE A.5 Areas of the standard normal distribution $\mu = 0, \sigma = 1$

The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



0.475

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767

adm T08 Q1 Q2 Q3 Q4

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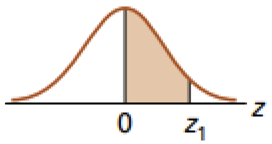
The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



0.475

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
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Q2. You wish to estimate the mean of a particular population and, at the 95% level of confidence, you want your sampling error to be no more than 50g. You take a sample of 100 from the population and this gives a sample mean of 5000g and a standard deviation of 800g.

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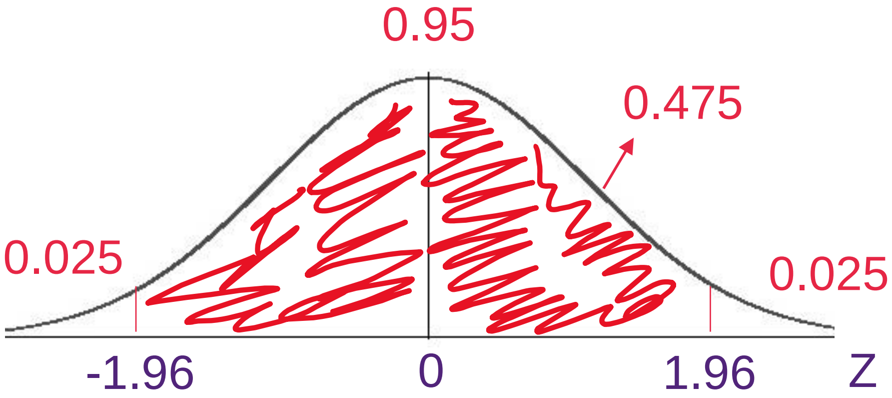
$E = 50$ g
$n = ?$
$\bar{X} = 5000$ g
$\sigma = 800$ g
LOC = 95% = 0.95
$\alpha = 1 - 0.95 = 0.05$
$Z_{crit} = 1.96$



1. Determining Sample Size, σ known
(for estimating the population mean)

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$$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$$

Note: Textbooks can use ME rather than E

rearranging to find n gives:

$$\boxed{n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2}$$

Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign ≥ .

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$n = ?$

$\bar{X} = 5000$ g

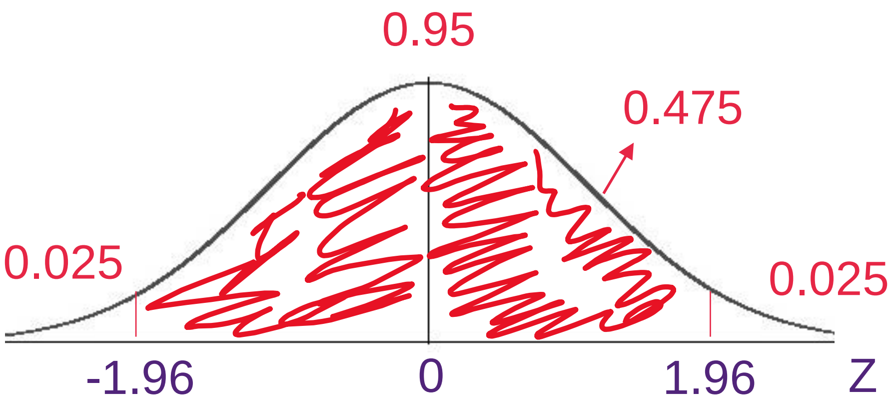
$\sigma = 800$ g

LOC = 95% = 0.95

$\alpha = 1 - 0.95 = 0.05$

$Z_{crit} = 1.96$

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = ?$$



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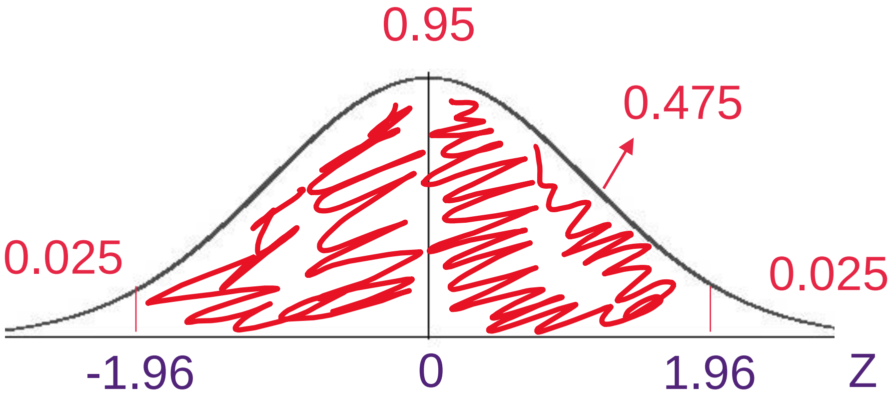
$n = ?$
$\bar{X} = 5000$ g
$\sigma = 800$ g
LOC = 95% = 0.95
$\alpha = 1 - 0.95 = 0.05$
$Z_{crit} = 1.96$

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = \left(\frac{1.96 * 800}{50}\right)^2 = 983.45$$



1. Determining Sample Size, σ known
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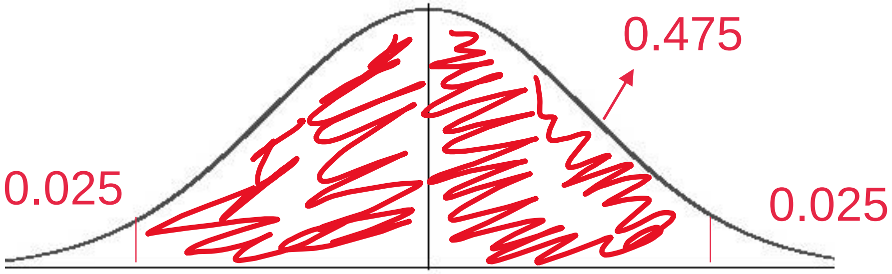
At least 984

$E = 50$ g
$n = ?$
$\bar{X} = 5000$ g
$\sigma = 800$ g
LOC = 95% = 0.95
$\alpha = 1 – 0.95 = 0.05$
$Z_{crit} = 1.96$

$$n \geq \left(\frac{Z_{crit}\sigma}{E}\right)^2 = \left(\frac{1.96 * 800}{50}\right)^2 = 983.45 \sim 984 \uparrow$$ Round up

A sample of at least 984 is required to satisfy the conditions.



1. Determining Sample Size, σ known
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$E = Z_{crit} * \frac{\sigma}{\sqrt{n}}$

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rearranging to find n gives:

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Note: textbook uses $Z_{\alpha/2}$ which is the same as Z_{crit} and does NOT use the sign ≥ .

adm T08 Q1 Q2 Q3 Q4

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken?

b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

1. What symbol would you give to the value 95% confidence? (Single Choice) *

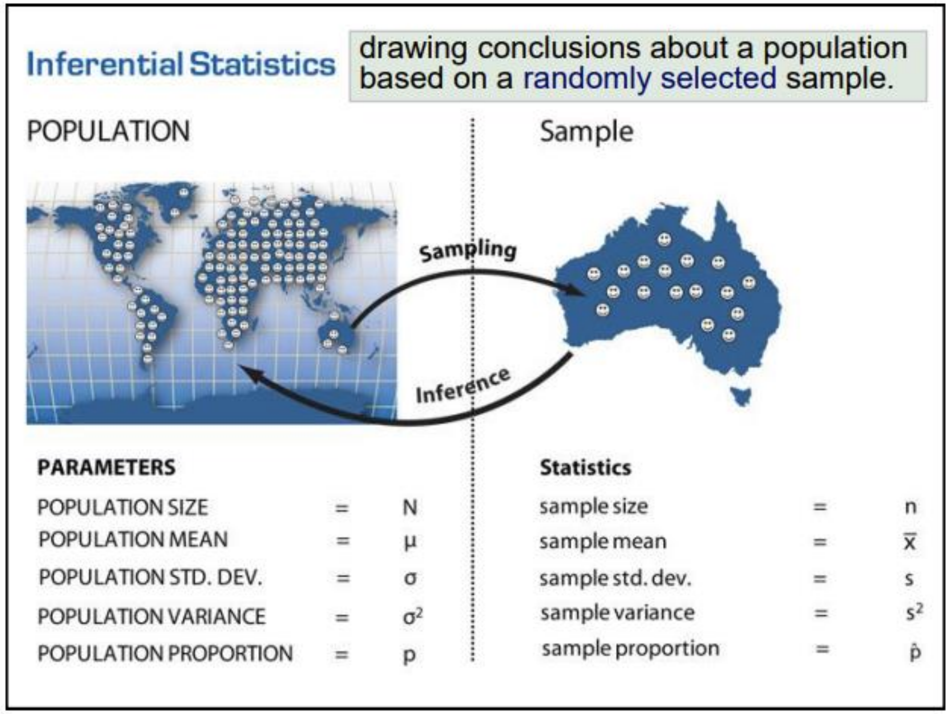
- n
- σ (sigma)
- s
- p̂ (p hat)
- Level of Confidence (LOC)
- E

2. What symbol would you give to the value 0.1? (Single Choice) *

- n
- σ (sigma)
- s
- p̂ (p hat)
- Level of Confidence (LOC)
- E

3. What is our variable of interest? (What are we trying to find?) (Single Choice) *

- n
- σ (sigma)
- s
- p̂ (p hat)
- Level of Confidence (LOC)
- E



(Poll)

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken?

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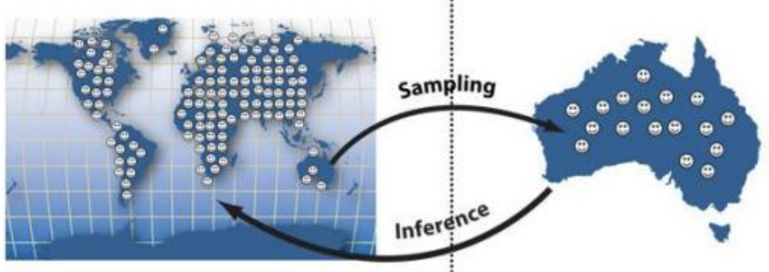
Inferential Statistics drawing conclusions about a population based on a randomly selected sample.

POPULATION | Sample



PARAMETERS			Statistics		
POPULATION SIZE	=	N	sample size	=	n
POPULATION MEAN	=	μ	sample mean	=	$\bar{x}$
POPULATION STD. DEV.	=	σ	sample std. dev.	=	s
POPULATION VARIANCE	=	σ^2	sample variance	=	s^2
POPULATION PROPORTION	=	p	sample proportion	=	$\hat{p}$

1. What symbol would you give to the value 95% confidence? (Single Choice) *

- n
- σ (sigma)
- s
- p̂ (p hat)
- Level of Confidence (LOC)
- E

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(Poll)

1. What type of problem is it? (Single Choice) *

- Population Mean (Seagull) (no sample)
- Population Mean (Pelican) (σ is known)
- Population Mean (Shag) (σ is unknown but s is known)
- Population Proportion (Freaky fish) (proportion)

2. What table will we use? (Single Choice) *

- Z table (standard normal distribution)
- t table (Student's t-distribution)

3. What is the value of α (alpha)? (Single Choice) *

- 0.01
- 0.05
- 0.1
- 0.9
- 0.95
- 0.99

adm T08 Q1 Q2 Q3 Q4

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken?

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- ○ Population Mean (Seagull) (no sample)
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- ○ 0.01
- ○ 0.05
- ○ 0.1
- ○ 0.9
- ○ 0.95
- ○ 0.99

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Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

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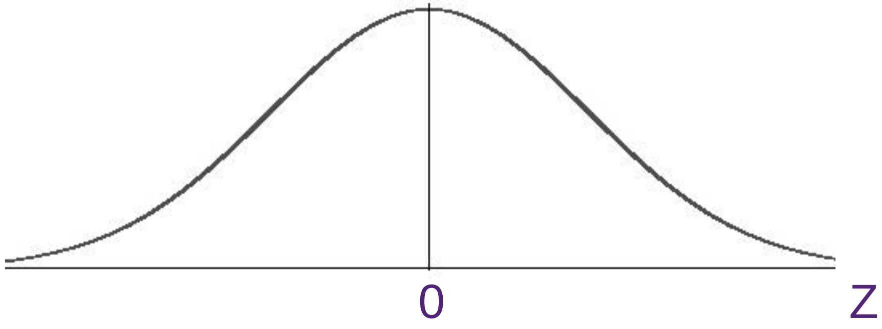
b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

E = 0.1g
LOC = 95% = 0.95
$\alpha = 1 - 0.95 = 0.05$
Z_{crit} = ?
n = ?



2. Determining Sample Size to estimate the true proportion.

$$p: \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

$$\Rightarrow E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

Solving for "n" gives:

$$\Rightarrow n \geq \frac{Z_{crit}^{2} * \hat{p}*(1-\hat{p})}{E^{2}}$$

13

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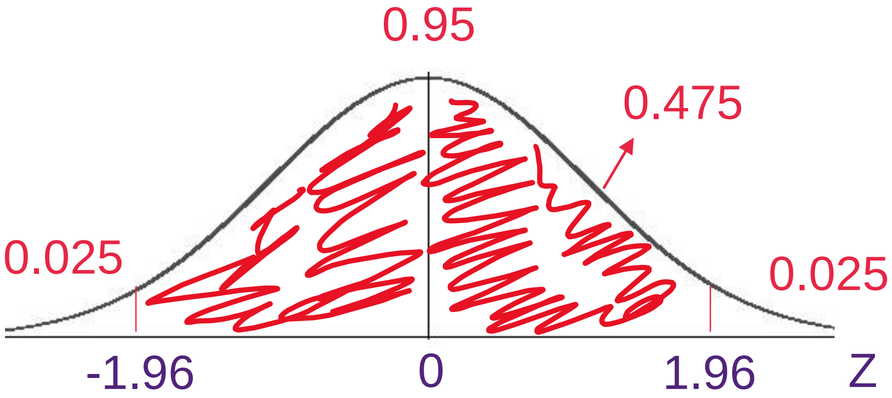
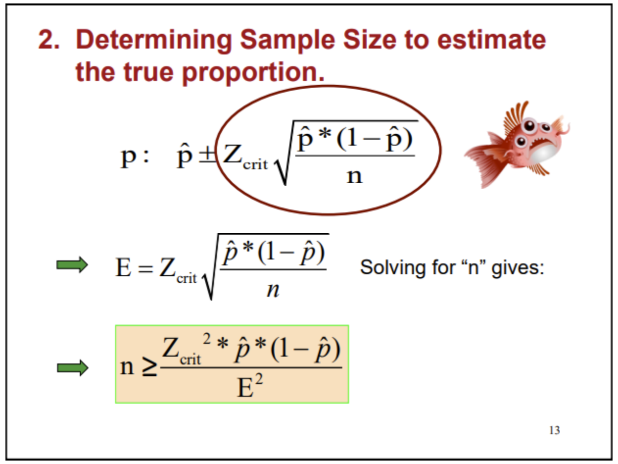
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
$\hat{p}$ = ?
n = ?

$\hat{p}$???





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$$\Rightarrow E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$ Solving for "n" gives:

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13

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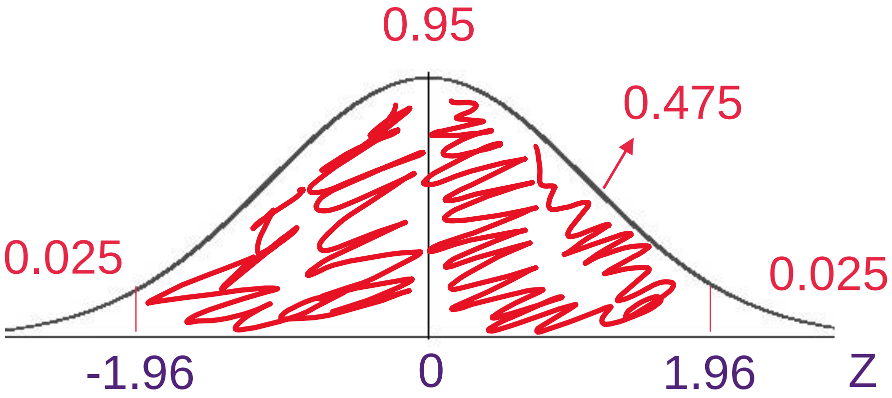
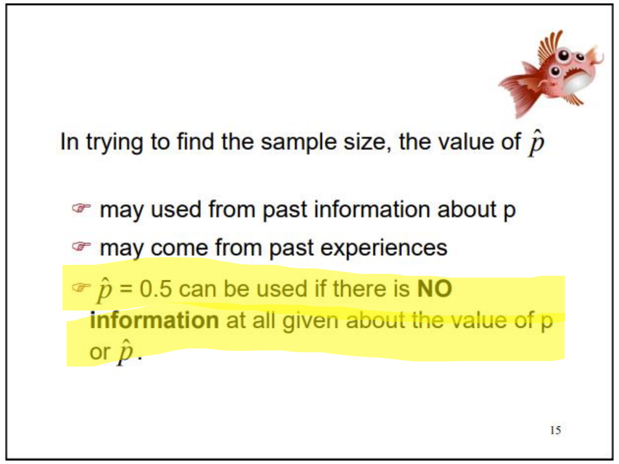
E = 0.1g
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
$\hat{p}$ = 0.5
n = ?

Since we don't know $\hat{p}$, we use $\hat{p}$ = 0.5, because it gives the highest value for $\hat{p}(1- \hat{p})$ possible. This allows us to have the safest (largest) sample size (n) for our specification.

Try it yourself!

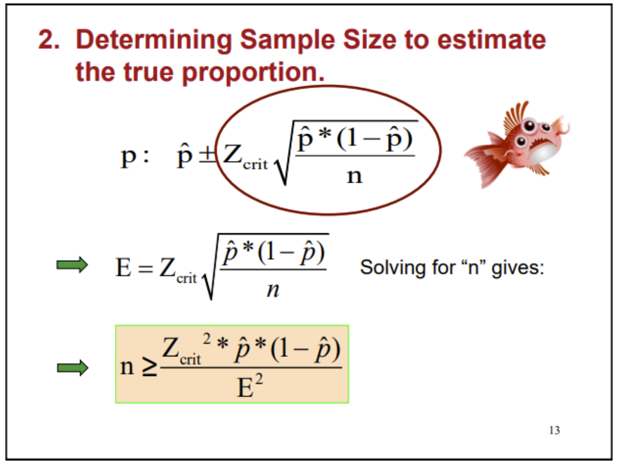




In trying to find the sample size, the value of $\hat{p}$

- may used from past information about p
- may come from past experiences
- $\hat{p}$ = 0.5 can be used if there is **NO information** at all given about the value of p or $\hat{p}$.

15



2. Determining Sample Size to estimate the true proportion.

$$p:\ \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

$$E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$ Solving for "n" gives:

$$n \geq \frac{Z_{crit}^{2} * \hat{p}*(1-\hat{p})}{E^2}$$

13

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

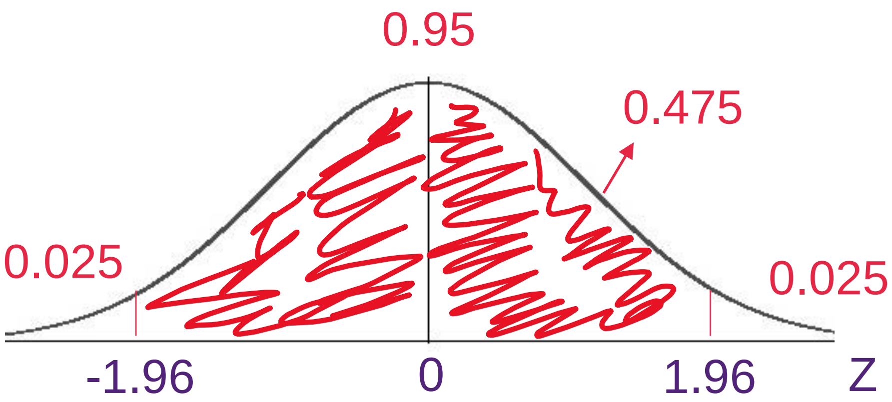
a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken?

b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

E = 0.1g
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
$\hat{p}$ = 0.5
n = ?

$$E = Z_{crit} * \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \rightarrow n = \left(\frac{Z_{crit} * \sqrt{\hat{p}(1-\hat{p})}}{E}\right)^2$$

$$n \geq \frac{Z_{crit}{}^2 * \hat{p}(1-\hat{p})}{E^2} = ?$$



2. Determining Sample Size to estimate the true proportion.

$$p: \ \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

➡ $E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$ Solving for "n" gives:

➡ $n \geq \frac{Z_{crit}{}^2 * \hat{p}*(1-\hat{p})}{E^2}$

13

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken?

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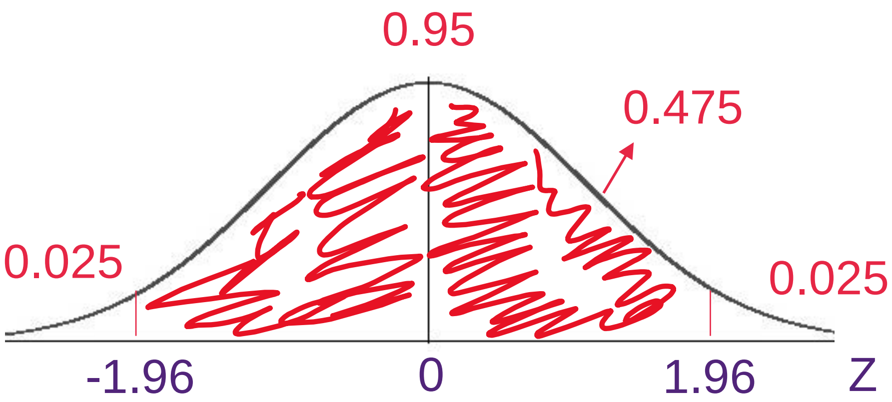
E = 0.1g
LOC = 95% = 0.95
$\alpha = 1 - 0.95 = 0.05$
$Z_{crit} = 1.96$
$\hat{p} = 0.5$
n = ?

$$E = Z_{crit} * \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \rightarrow n = \left(\frac{Z_{crit} * \sqrt{\hat{p}(1-\hat{p})}}{E}\right)^2$$

$$n \geq \frac{Z_{crit}^2 * \hat{p}(1-\hat{p})}{E^2} = \left(\frac{1.96^2 * 0.5(1-0.5)}{0.1^2}\right)^2 = 96.04$$



2. Determining Sample Size to estimate the true proportion.

$$p: \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

$$E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$ Solving for "n" gives:

$$\boxed{n \geq \frac{Z_{crit}^2 * \hat{p}*(1-\hat{p})}{E^2}}$$

13

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken? 97

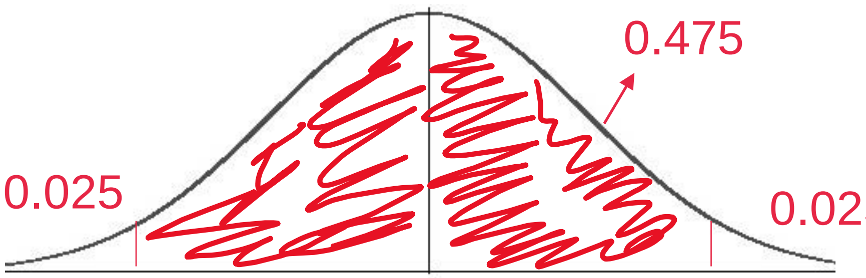
b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

E = 0.1g
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
$\hat{p}$ = 0.5
n = ?

$$E = Z_{crit} * \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \rightarrow n = \left(\frac{Z_{crit} * \sqrt{\hat{p}(1-\hat{p})}}{E}\right)^2$$

$$n \geq \frac{Z_{crit}^2 * \hat{p}(1-\hat{p})}{E^2} = \left(\frac{1.96^2 * 0.5(1-0.5)}{0.1^2}\right)^2 = 96.04 \sim 97$$ ↑ Round up

Therefore, a sample of at least 97 should be taken.



2. Determining Sample Size to estimate the true proportion.

$$p: \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

$$\Rightarrow E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$ Solving for "n" gives:

$$\Rightarrow \boxed{n \geq \frac{Z_{crit}^2 * \hat{p}*(1-\hat{p})}{E^2}}$$

13

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Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken? 97

b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

E = 0.1g

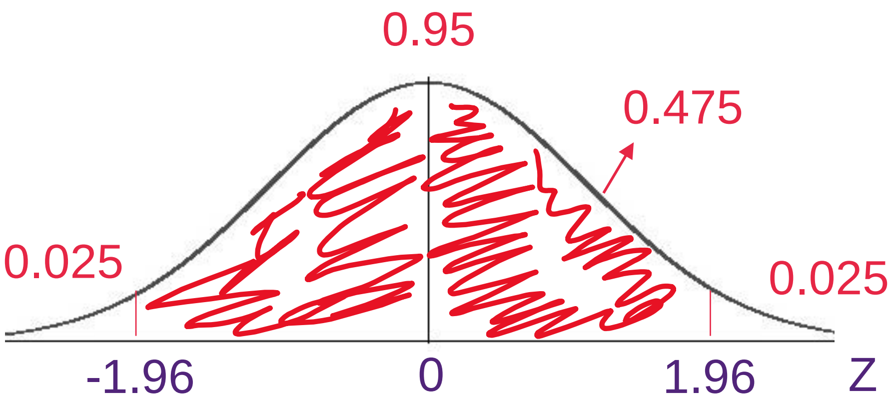
LOC = 95% = 0.95

α = 1 – 0.95 = 0.05

Z_{crit} = 1.96

p = 0.3

n = ?



2. Determining Sample Size to estimate the true proportion.

$$p: \ \hat{p} \pm Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$

$$\Rightarrow E = Z_{crit}\sqrt{\frac{\hat{p}*(1-\hat{p})}{n}}$$ Solving for "n" gives:

$$\Rightarrow n \geq \frac{Z_{crit}^{2} * \hat{p}*(1-\hat{p})}{E^2}$$

13

adm T08 Q1 Q2 Q3 Q4

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

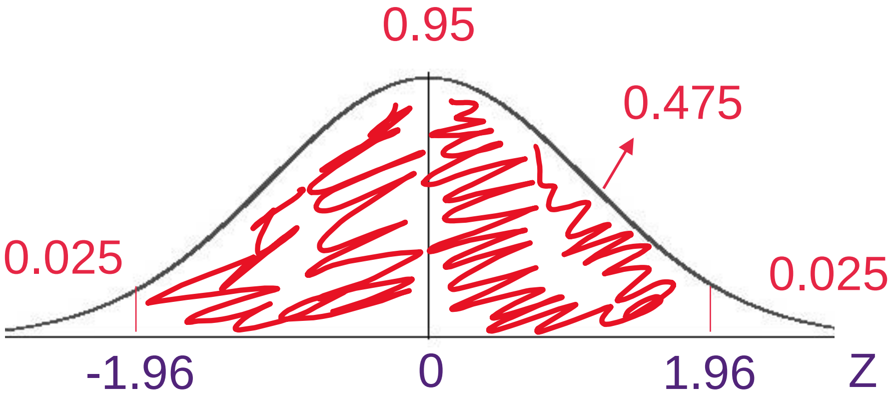
a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken? 97

b. If the population proportion is believed to be no more than 0.3, what sample size is necessary?

E = 0.1g
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
p = 0.3
n = ?

$$E = Z_{crit} * \sqrt{\frac{p(1-p)}{n}} \rightarrow n = \left(\frac{Z_{crit} * \sqrt{p(1-p)}}{E}\right)^2$$

$$n \geq \frac{Z_{crit}^{\,2} * p(1-p)}{E^2} = ?$$



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13

Q3. A market researcher wants to know what proportion of shoppers, at a large appliance store, make a "high-price" purchase.

a. To estimate this proportion within 0.10, and be 95% confident of the results, how large a sample should be taken? 97

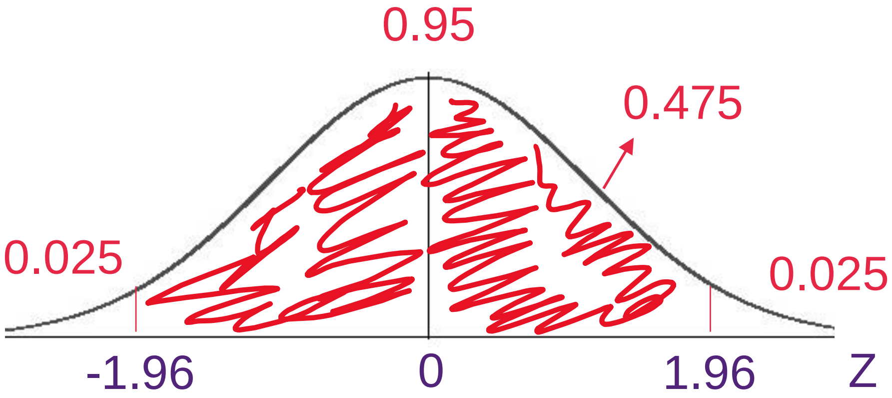
b. If the population proportion is believed to be no more than 0.3, what sample size is necessary? 81

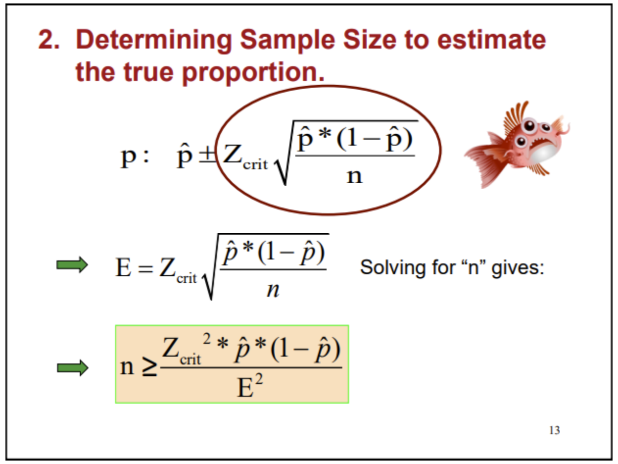
E = 0.1g
LOC = 95% = 0.95
α = 1 – 0.95 = 0.05
Z_{crit} = 1.96
p = 0.3
n = ?

$$E = Z_{crit} * \sqrt{\frac{p(1-p)}{n}} \rightarrow n = \left(\frac{Z_{crit} * \sqrt{p(1-p)}}{E}\right)^2$$

$$n \geq \frac{Z_{crit}^{2} * p(1-p)}{E^2} = \left(\frac{1.96^2 * 0.3(1-0.3)}{0.1^2}\right)^2 = 80.67 \sim 81$$ ↑ Round up

In this case, a sample of at least 81 should be taken.





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$$n \geq \frac{Z_{crit}^{2} * \hat{p}*(1-\hat{p})}{E^2}$$

13

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
Sample size	55	44
mean	$191.33 thous	$172.34 thous
standard deviation	$32.60 thous	$16.92 thous

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

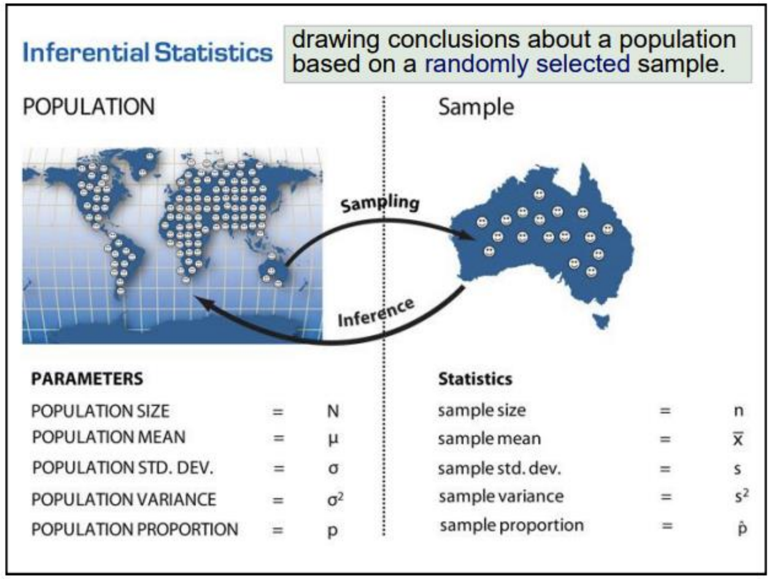
adm T08 Q1 Q2 Q3 Q4

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
Sample size	55	44
mean	\$191.33 thous	\$172.34 thous
standard deviation	\$32.60 thous	\$16.92 thous

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

(Poll)



1. What symbol would you give to the value 95% confidence? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

2. What symbol would you give to the values 55 and 44? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

3. What symbol would you give to the values 191.33 and 172.34? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

4. What symbol would you give to the values 32.60 and 16.92? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

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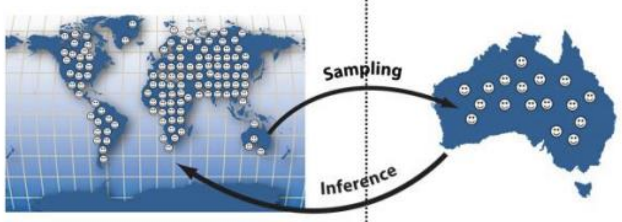
a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

(Poll)

Inferential Statistics drawing conclusions about a population based on a randomly selected sample.

POPULATION Sample



PARAMETERS			**Statistics**		
POPULATION SIZE	=	N	sample size	=	n
POPULATION MEAN	=	μ	sample mean	=	x̄
POPULATION STD. DEV.	=	σ	sample std. dev.	=	s
POPULATION VARIANCE	=	σ^2	sample variance	=	s^2
POPULATION PROPORTION	=	p	sample proportion	=	p̂

1. What symbol would you give to the value 95% confidence? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

2. What symbol would you give to the values 55 and 44? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

3. What symbol would you give to the values 191.33 and 172.34? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

4. What symbol would you give to the values 32.60 and 16.92? (Single Choice) *

- σ (sigma)
- s
- μ (mu)
- x̄ (x bar)
- Level of Confidence (LOC)
- n

adm T08 Q1 Q2 Q3 Q4

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	Taringa	West End
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mean	\$191.33 thous	\$172.34 thous
standard deviation	\$32.60 thous	\$16.92 thous

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).




1. What type of problem is it? (Single Choice) *

(Poll)

- ◯ Population Mean (Seagull) (no sample)
- ◯ Population Mean (Pelican) (σ is known)
- ◯ Population Mean (Shag) (σ is unknown but s is known)
- ◯ Population Proportion (Freaky fish) (proportion)

2. What table will we use? (Single Choice) *

- ◯ Z table (standard normal distribution)
- ◯ t table (Student's t-distribution)

3. What is the value of α (alpha)? (Single Choice) *

- ◯ 0.01
- ◯ 0.05
- ◯ 0.1
- ◯ 0.9
- ◯ 0.95
- ◯ 0.99

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Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
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a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

(Poll)

1. What type of problem is it? (Single Choice) *

- Population Mean (Seagull) (no sample)
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- Population Mean (Shag) (σ is unknown but s is known)
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2. What table will we use? (Single Choice) *

- Z table (standard normal distribution)
- t table (Student's t-distribution)

3. What is the value of α (alpha)? (Single Choice) *

- 0.01
- 0.05
- 0.1
- 0.9
- 0.95
- 0.99

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
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a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

The difference between two means has 3 steps:

Step 1: Find the pooled variance $s_p{}^2 = \frac{(n_1-1)s_1{}^2+(n_2-1)s_2{}^2}{n_1+n_2-2}$

Step 2: Find the standard deviation $s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p{}^2(\frac{1}{n_1}+\frac{1}{n_2})}$

Step 3: Calculate CI = $(\bar{X}_1 - \bar{X}_2) \pm\ t_{\alpha/2,\, n_1+n_2-2}\ {}^{*}\ s_{\bar{X}_1-\bar{X}_2}$

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

adm T08 Q1 Q2 Q3 Q4

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

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Step 1: Find the pooled variance $s_p{}^2 = \frac{(n_1-1)s_1{}^2+(n_2-1)s_2{}^2}{n_1+n_2-2}$

$s_p{}^2 = ?$

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

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adm T08 Q1 Q2 Q3 Q4

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b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

$s_p{}^2$ = 718.55

Step 1: Find the pooled variance $s_p{}^2 = \frac{(n_1-1)s_1{}^2+(n_2-1)s_2{}^2}{n_1+n_2-2}$

$$s_p{}^2 = \frac{(55-1)32.6^2+(44-1)16.92^2}{55+44-2} = 718.55$$

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
Sample size	55	44
mean	\$191.33 thous	\$172.34 thous
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$s_p{}^2 = 718.55$

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

Step 2: Find the standard deviation $s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p{}^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$

$s_{\bar{X}_1-\bar{X}_2}$ = ?

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
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standard deviation	\$32.60 thous	\$16.92 thous

$s_p{}^2 = 718.55$

$s_{\bar{X}_1 - \bar{X}_2} = 5.422$

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

Step 2: Find the standard deviation $s_{\bar{X}_1 - \bar{X}_2} = \sqrt{s_p{}^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

$$s_{\bar{X}_1 - \bar{X}_2} = \sqrt{718.55\left(\frac{1}{55} + \frac{1}{44}\right)} = 5.422$$

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1 + n_2 - 2} * s_{\bar{X}_1 - \bar{X}_2}}$$

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$$s_{\bar{X}_1 - \bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

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	Taringa	West End
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mean	$191.33 thous	$172.34 thous
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$s_p{}^2 = 718.55$

$s_{\bar{X}_1-\bar{X}_2} = 5.422$

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

Step 3: Calculate CI = $(\bar{X}_1 - \bar{X}_2) \pm\ t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}$

CI = ?

Confidence interval estimation for the difference between two different population means **μ_1 - μ_2** is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

Q4. A real estate agency wants to compare the appraised values of studio apartments in two regions. The following results were obtained from random samples:

	Taringa	West End
Sample size	55	44
mean	\$191.33 thous	\$172.34 thous
standard deviation	\$32.60 thous	\$16.92 thous

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

$s_p{}^2 = 718.55$

$s_{\bar{X}_1 - \bar{X}_2} = 5.422$

Step 3: Calculate CI = $(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1 - \bar{X}_2}$

CI = $(191.33 - 172.34) \pm t_{0.025,\, 97} * 5.422$ = ?

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1 - \bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1 - \bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

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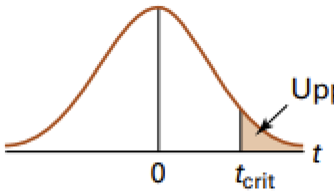
adm T08 Q1 Q2 Q3 Q4



$t_{0.025,\,97}$

	Upper tail areas					
df	$t_{.10}$	$t_{.05}$	$t_{.025}$	$t_{.01}$	$t_{.005}$	$t_{.001}$
76	1.293	1.665	1.992	2.376	2.642	3.201
77	1.293	1.665	1.991	2.376	2.641	3.199
78	1.292	1.665	1.991	2.375	2.640	3.198
79	1.292	1.664	1.990	2.374	2.640	3.197
80	1.292	1.664	1.990	2.374	2.639	3.195
81	1.292	1.664	1.990	2.373	2.638	3.194
82	1.292	1.664	1.989	2.373	2.637	3.193
83	1.292	1.663	1.989	2.372	2.636	3.191
84	1.292	1.663	1.989	2.372	2.636	3.190
85	1.292	1.663	1.988	2.371	2.635	3.189
86	1.291	1.663	1.988	2.370	2.634	3.188
87	1.291	1.663	1.988	2.370	2.634	3.187
88	1.291	1.662	1.987	2.369	2.633	3.185
89	1.291	1.662	1.987	2.369	2.632	3.184
90	1.291	1.662	1.987	2.368	2.632	3.183
91	1.291	1.662	1.986	2.368	2.631	3.182
92	1.291	1.662	1.986	2.368	2.630	3.181
93	1.291	1.661	1.986	2.367	2.630	3.180
94	1.291	1.661	1.986	2.367	2.629	3.179
95	1.291	1.661	1.985	2.366	2.629	3.178
96	1.290	1.661	1.985	2.366	2.628	3.177
97	1.290	1.661	1.985	2.365	2.627	3.176
98	1.290	1.661	1.984	2.365	2.627	3.175
99	1.290	1.660	1.984	2.365	2.626	3.175
100	1.290	1.660	1.984	2.364	2.626	3.174
150	1.287	1.655	1.976	2.351	2.609	3.145
200	1.286	1.653	1.972	2.345	2.601	3.131
∞	1.282	1.645	1.960	2.326	2.576	3.090

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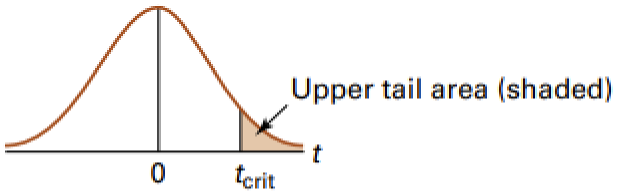

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84	1.292	1.663	1.989	2.372	2.636	3.190
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94	1.291	1.661	1.986	2.367	2.629	3.179
95	1.291	1.661	1.985	2.366	2.629	3.178
96	1.290	1.661	1.985	2.366	2.628	3.177
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$s_{\bar{X}_1-\bar{X}_2} = 5.422$

a. Set up a 95% confidence interval estimate of the difference between the population means (in thousands of dollars).

b. Is there evidence of a difference in the average appraised values?

c. List the assumptions needed for these calculations. Do you think any of the assumptions have been violated?

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CI = (191.33 – 172.34) ± 1.985 * 5.422 = ?

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

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adm T08 Q1 Q2 Q3 Q4

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Both sides are positive, so that is evidence that $\mu_1 > \mu_2$.

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The CI for the difference between the two regions' appraised values of studio apartments indicates that values in region 1 (Taringa) are estimated with 95% confidence to be between \$8,230 and \$29,750 higher than region 2 (West End).

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$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

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adm T08 Q1 Q2 Q3 Q4

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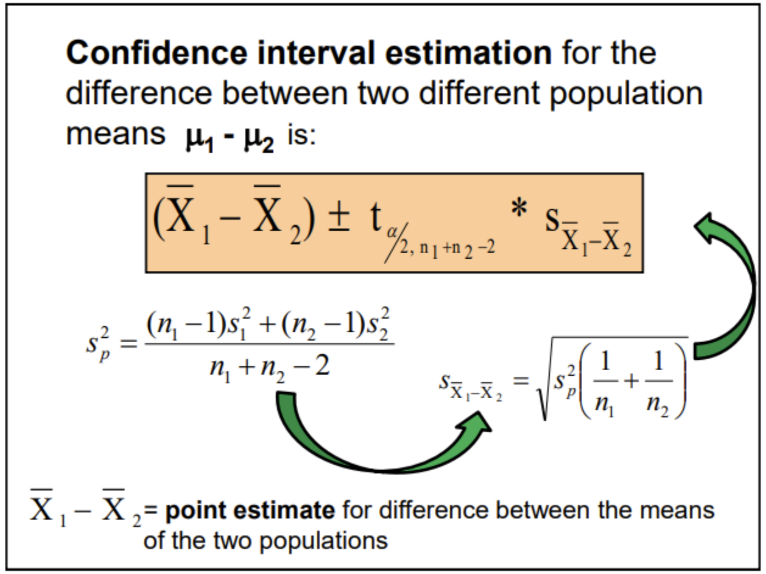

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- Population variances of appraised values in the two regions are the same.

Confidence interval estimation for the difference between two different population means $\mu_1 - \mu_2$ is:

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The University Of Queensland Australia

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- Population variances of appraised values in the two regions are the same.

→ not violated, required because the sample variances have been pooled (averaged), which only makes sense if they are estimating the same value.

Confidence interval estimation for the difference between two different population means **μ_1 - μ_2** is:

$$\boxed{(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2,\, n_1+n_2-2} * s_{\bar{X}_1-\bar{X}_2}}$$

$$s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{s_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$\bar{X}_1 - \bar{X}_2$ = **point estimate** for difference between the means of the two populations

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Tutorial 8 – Week 9

CONFIDENCE INTERVALS II

At the end of this tutorial you should be able to

- Determine the sample mean or level of confidence for a specified confidence interval,
- Determine the sample size required to provide a specified level of confidence for a confidence interval,
- Calculate confidence intervals for the difference between two population means.

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Thank you

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Reference

Black et al. (2016), Australasian Business Statistics, 4th Edition, Wiley Australia.