THE UNIVERSITY OF QUEENSLAND AUSTRALIA | CREATE CHANGE

ECON1310
Introductory Statistics for Social Sciences

Tutorial 6: SAMPLING DISTRIBUTIONS

Tutor: Francisco Tavares Garcia

LBRT 01 (2nd attempt) is available now

LBRT #1 (Second Attempt) now available

Posted on: Thursday, 5 January 2023 09:00:00 o'clock AEST

Dear Students,

A reminder that **LBRT #1 (Second Attempt)** is now available and will be open until **4pm Friday 6 January.** This LBRT can be accessed via Blackboard under Assessment > LBRTs (Lecture Block Review Tasks) > LBRT #1.

Please note that you will have **90 minutes (1.5 hrs)** to complete the quiz. The quiz will **automatically submit** once the 90 minutes have elapsed. It should also be noted that **no access will be available after 4pm Friday**. Therefore, please give yourself enough time to complete the quiz (i.e. start at 2:30pm Friday at the latest to give yourself a full 90 minutes).

You will be able to **view** both your **score and feedback** at **9am Monday 9 January**. Please note that if you completed the first attempt for the LBRT, your **best score** from the 2 attempts will contribute towards your final grade.

In preparation for LBRT #1, please familiarise yourself with the **Practice LBRT test**, (which shows you how the questions will appear) and the **General Information for Completing LBRTs** document. Details can be found under Assessment > LBRTs (Lecture Block Review Tasks).

Best of luck!

Dominic

CML03 LBRT 01 (1st attempt) is available now

CML 3 (1st Attempt) Now Open

Posted on: Wednesday, 4 January 2023 09:00:00 o'clock AEST

Dear Students,

A reminder that:

1. **CML 3 (1st Attempt)** is now open and will **close at 4pm on Monday 9 January** (Week 6)
2. 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

ECON1310

Tutorial 6 – Week 7

SAMPLING DISTRIBUTIONS

At the end of this tutorial you should be able to

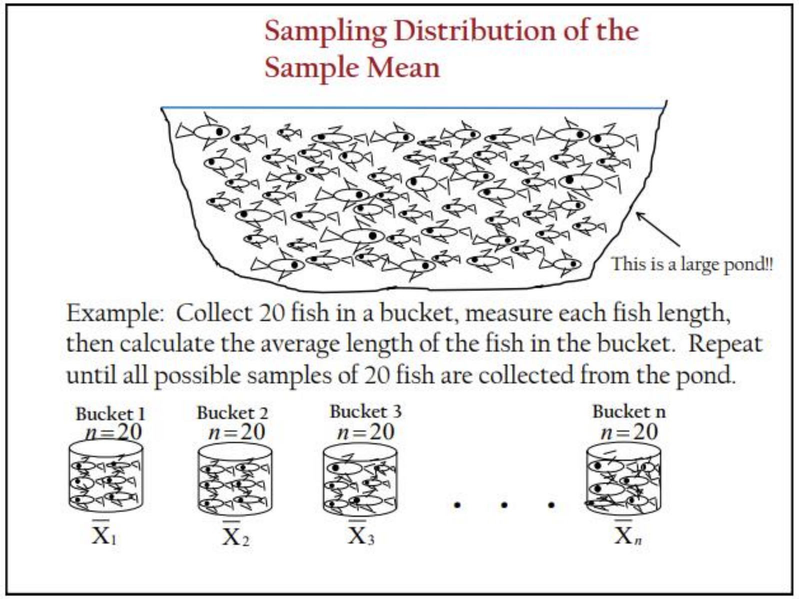
- Describe the characteristics of the sampling distributions for sample means and sample proportions
- Explain the importance of the Central Limit Theorem
- Calculate the z score for particular values of the sample mean or sample proportion
- Calculate the probability of obtaining particular values of the sample mean or sample proportion

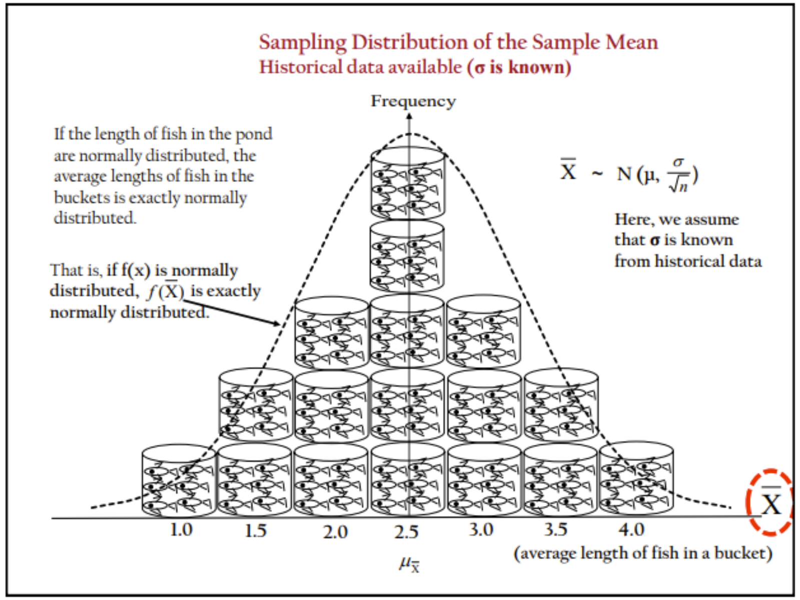
Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

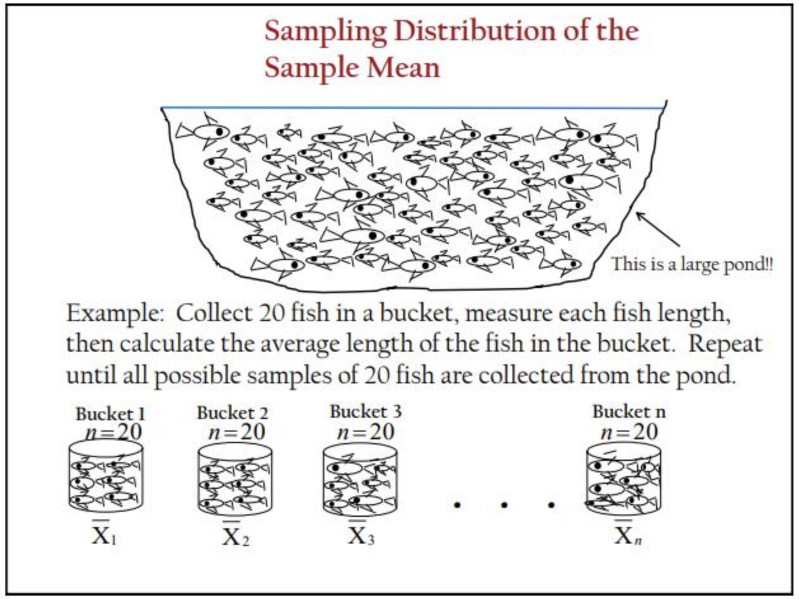
(ii) State the Central Limit Theorem and explain why it is important in statistics.

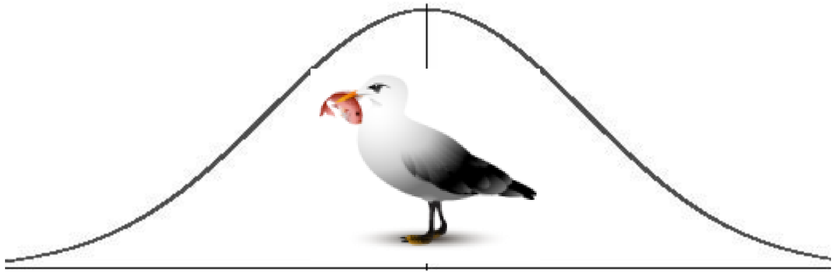


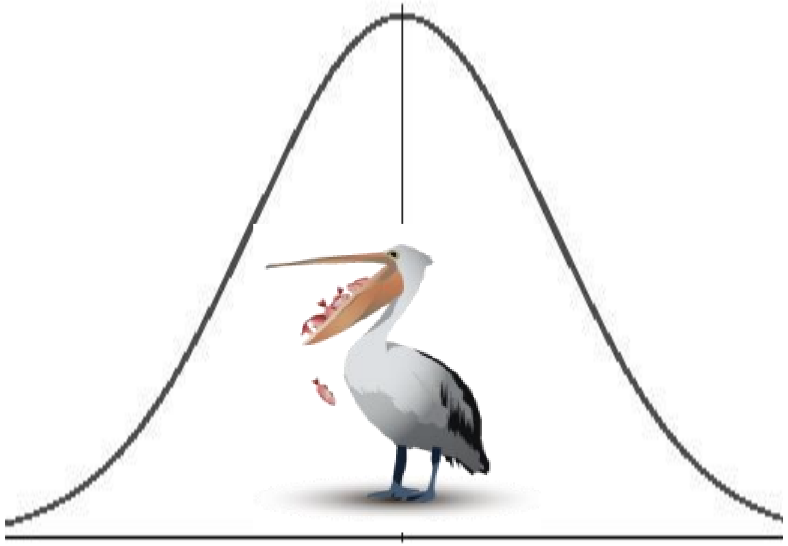


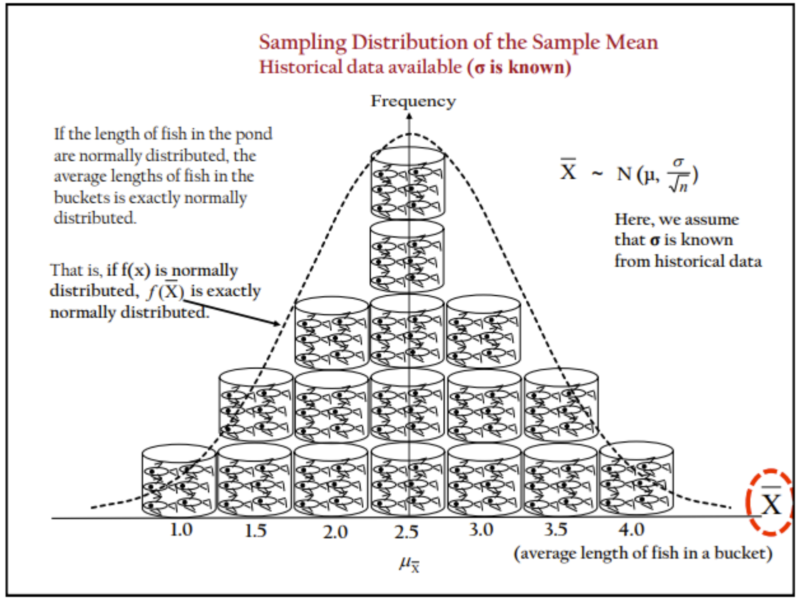
Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.



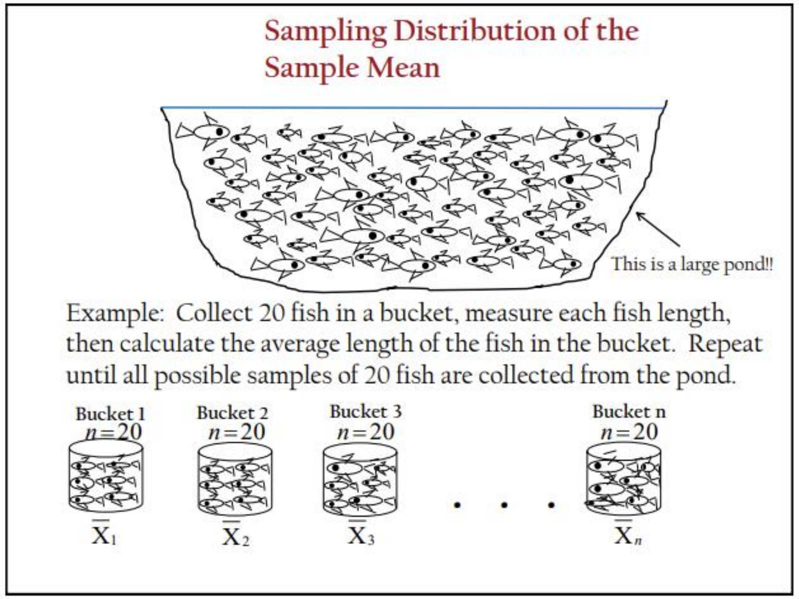


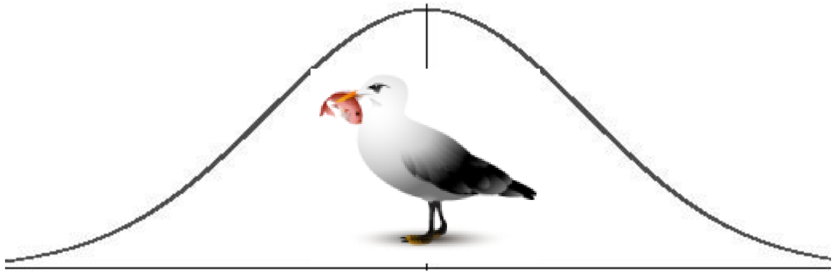


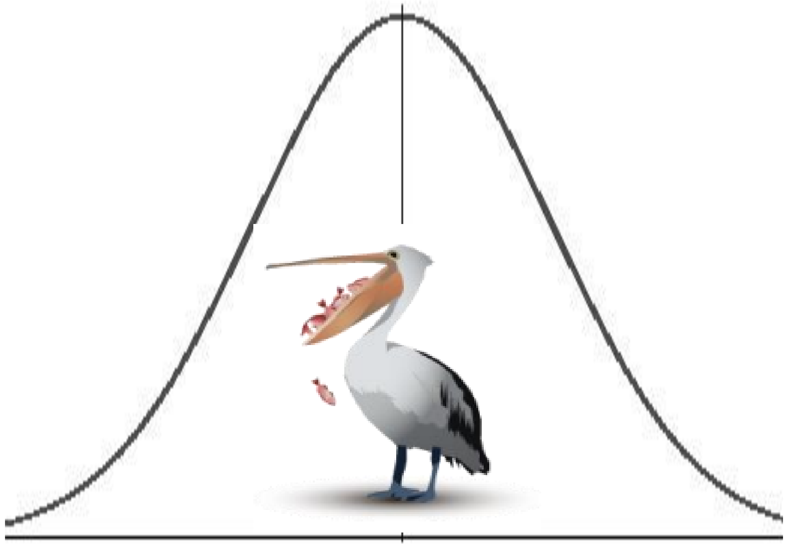


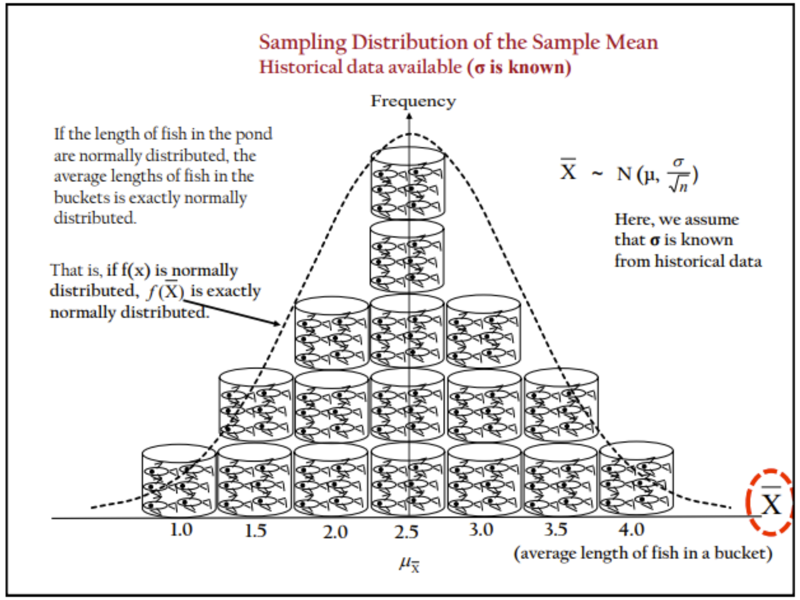
Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.









$$Z = \frac{X - \mu}{\sigma}$$

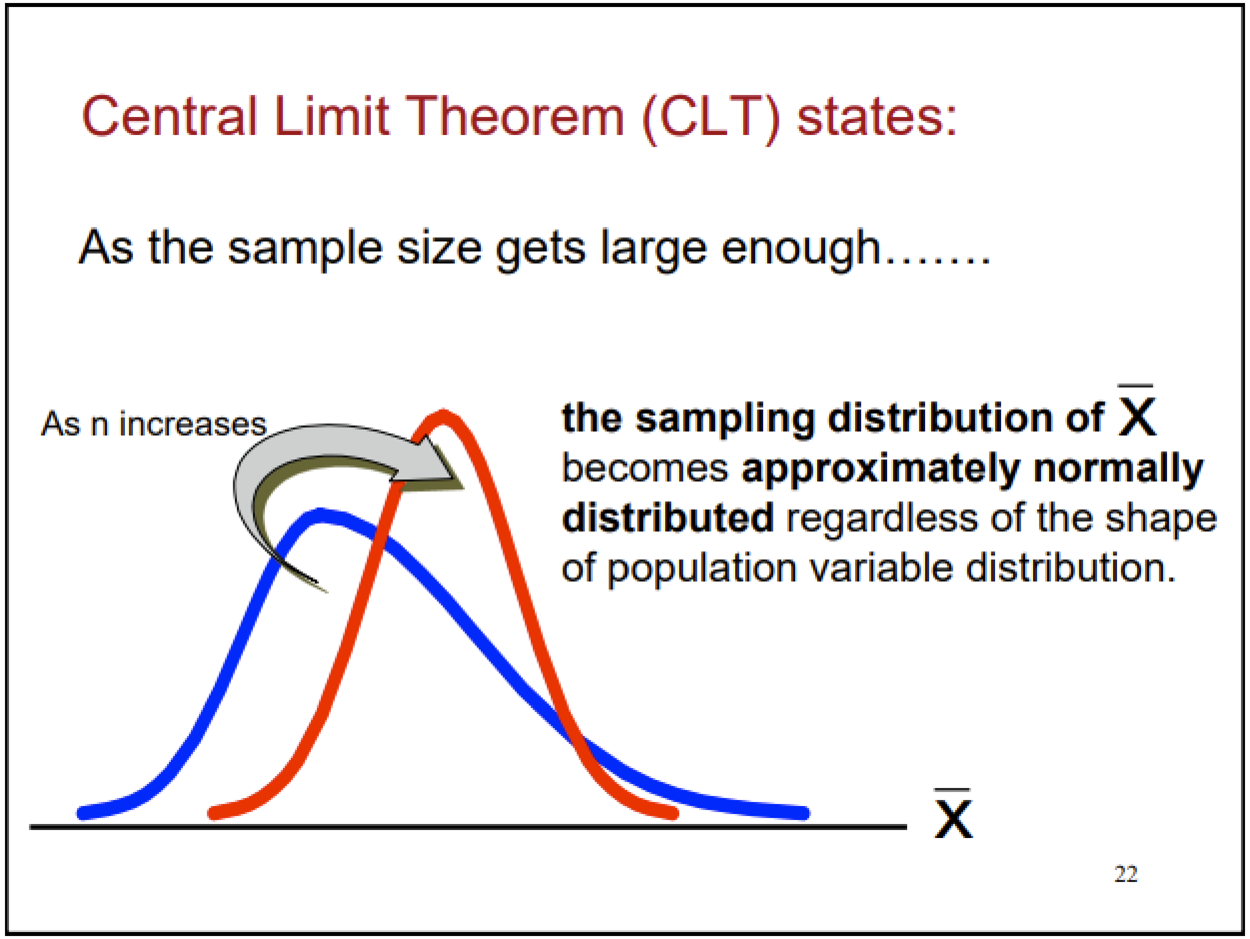
$$Z = \frac{(\bar{X} - \mu)}{\left(\frac{\sigma}{\sqrt{n}}\right)}$$

Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

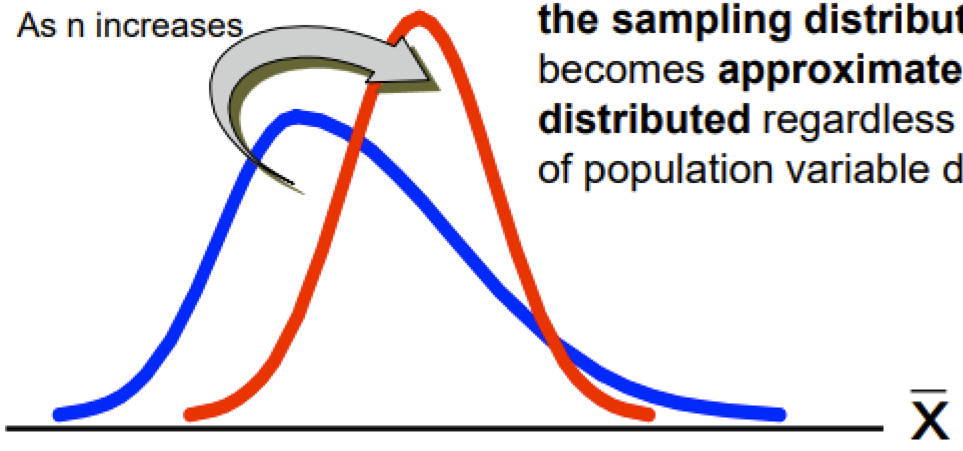


Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

Central Limit Theorem (CLT) states:

As the sample size gets large enough…….



the sampling distribution of $\bar{X}$ becomes **approximately normally distributed** regardless of the shape of population variable distribution.

22

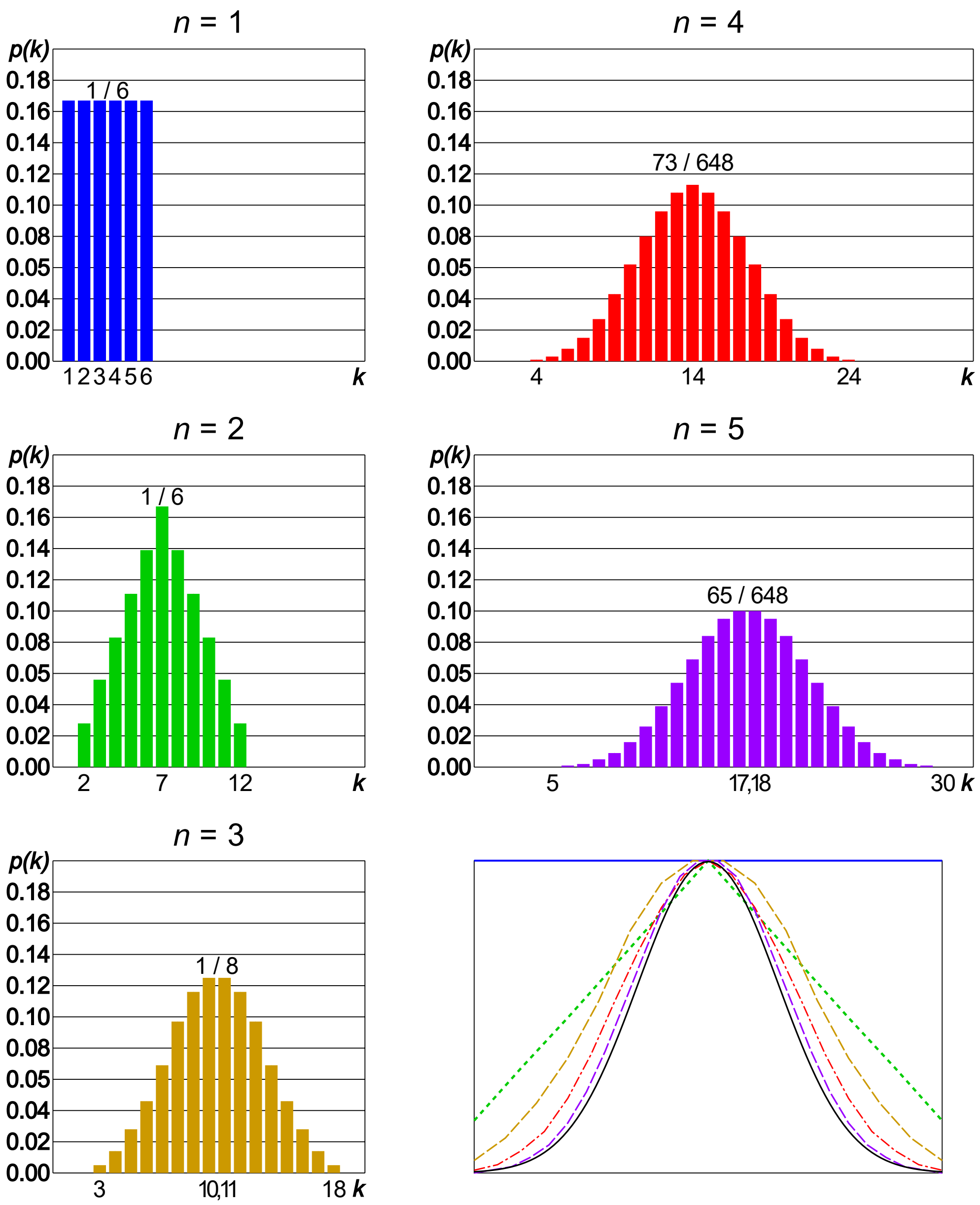
How large is large enough?

- For most population distributions, the CLT states *if **n ≥ 30,*** the **sampling distribution of sample means** will be **approximately** normally distributed.
- For a population variable that is **normally** distributed, the **sampling distribution of sample means** is always **exactly** normally distributed, for any size n.

23

Rolling dice…

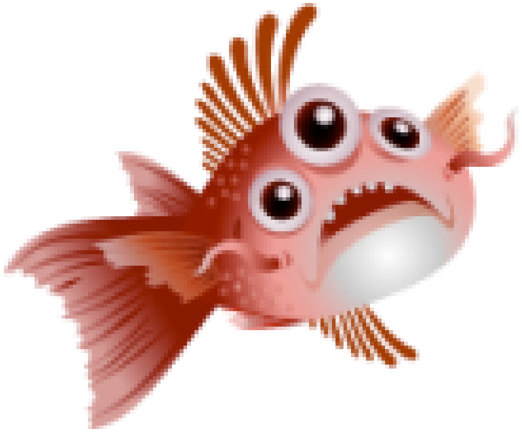
The larger the sample of dice, the closer the distribution of results gets to a normal distribution.



Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

But what about the sample proportion?

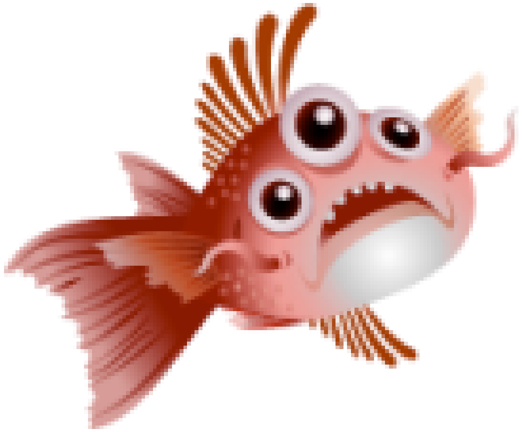


The **Freaky** Fish… my favourite… ☺

Q1. (i) Explain the theoretical development of the sampling distribution of $\bar{x}$. Define the mean and variance for this distribution.

(ii) State the Central Limit Theorem and explain why it is important in statistics.

But what about the sample proportion?



Conclusion:

The sampling distribution of the sample proportion, $\hat{p}$, can be **approximated by a normal distribution** if both:

$$np > 5 \quad \text{and} \quad n(1-p) > 5$$

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

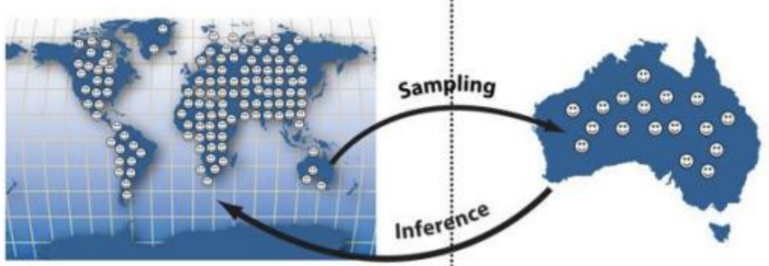
a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

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	=	$\hat{p}$

(Poll)

1. What symbol would you give to the value 50.4 hours? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

2. What symbol would you give to the value 149.24 hours squared? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

3. What symbol would you give to the value 42 households? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

adm T06 Q1 Q2 Q3 Q4

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

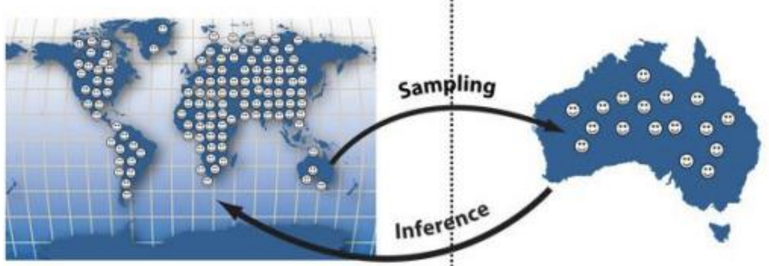
a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

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	=	$\hat{p}$

(Poll)

1. What symbol would you give to the value 50.4 hours? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

2. What symbol would you give to the value 149.24 hours squared? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

3. What symbol would you give to the value 42 households? (Single Choice) *

- N
- n
- μ (mu)
- $\bar{X}$ (X bar)
- σ^2 (sigma squared)
- s^2

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
P($\bar{X}$ > 52)

adm T06 Q1 Q2 Q3 Q4

The University of Queensland
Australia

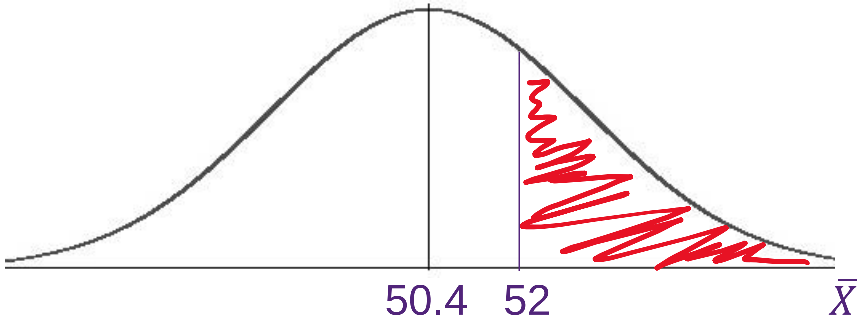
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
$\mu = 50.4$ hours
$\sigma^2 = 139.24$ hours squared
$n = 42$ households
$P(\bar{X} > 52)$

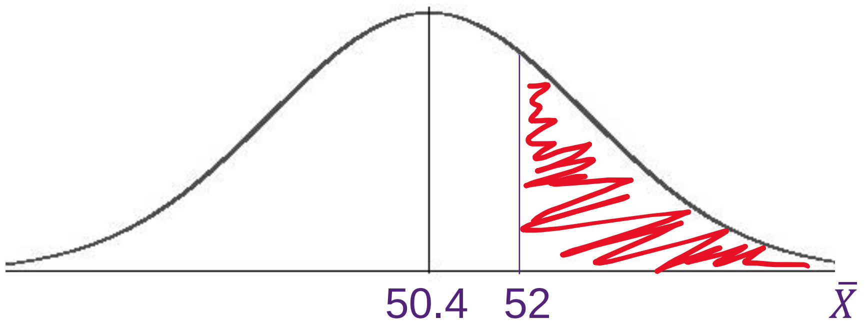


Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?



Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} > 52)$

Can we do a Z transformation?

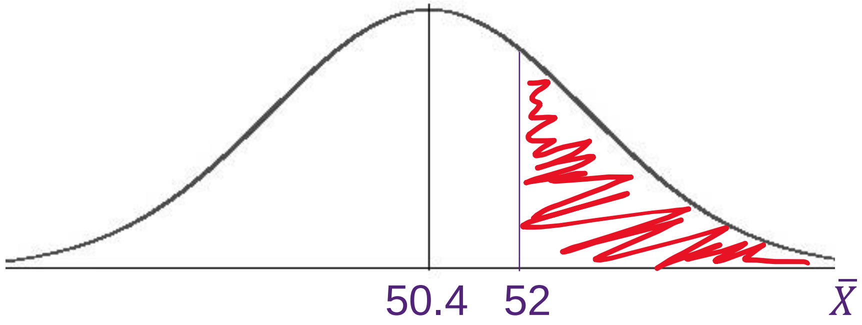
THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?



Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
P($\bar{X}$ > 52)

Can we do a Z transformation?
CLT: n ≥ 30 → 42 > 30, so we can! ✓

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

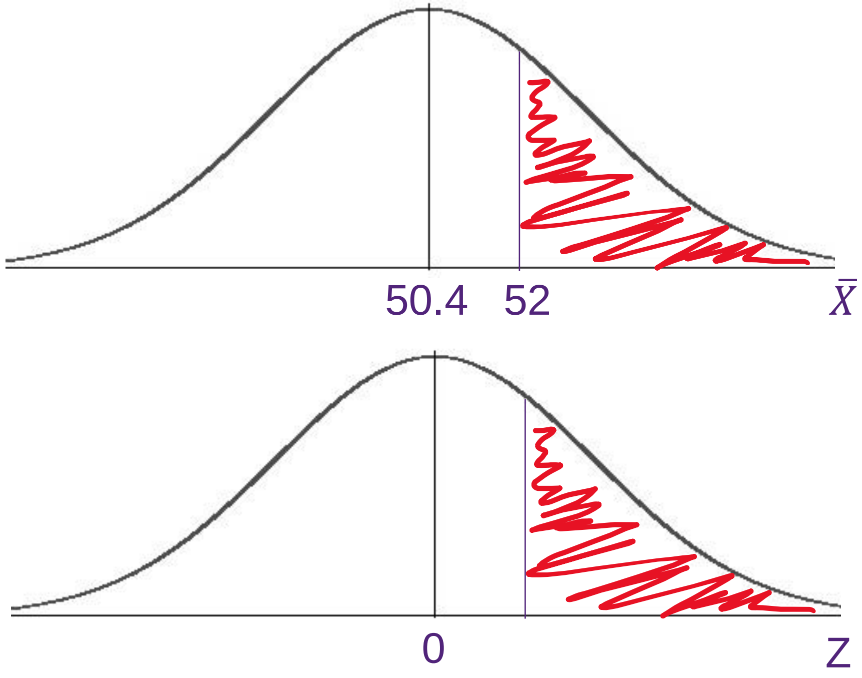
Variable of interest: TV viewing time per week

μ = 50.4 hours

σ^2 = 139.24 hours squared

n = 42 households

$P(\bar{X} > 52)$



Z transformation

$$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}} \text{ where } \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = ?$$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

adm T06 Q1 Q2 Q3 Q4

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

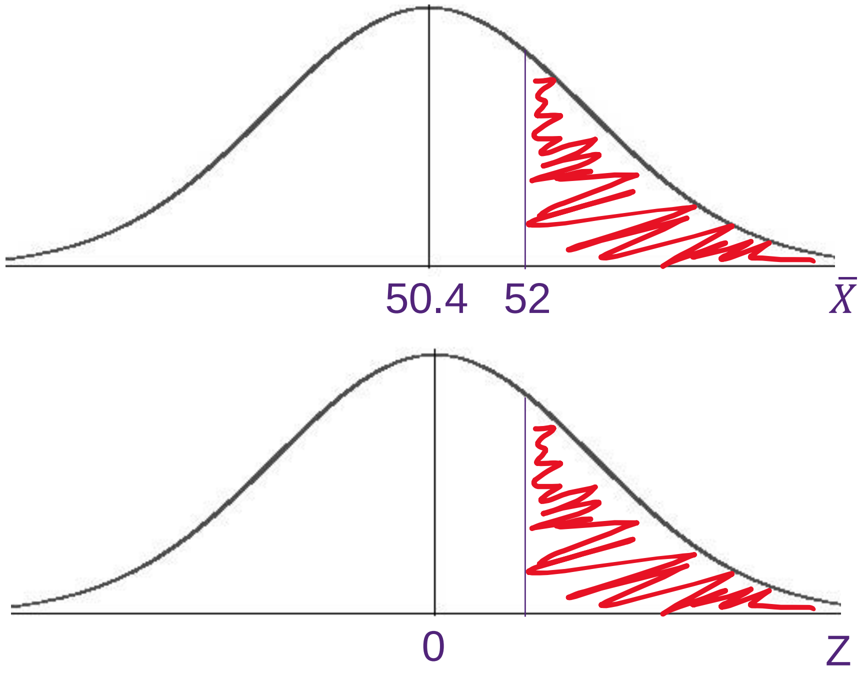
b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} > 52)$

Z transformation

$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$ where $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

adm T06 Q1 Q2 Q3 Q4

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

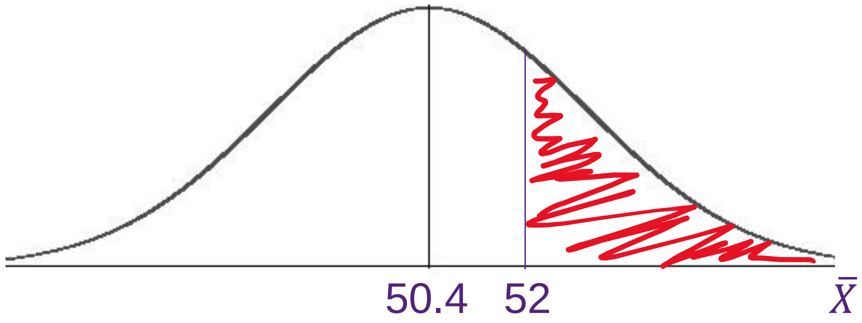
c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

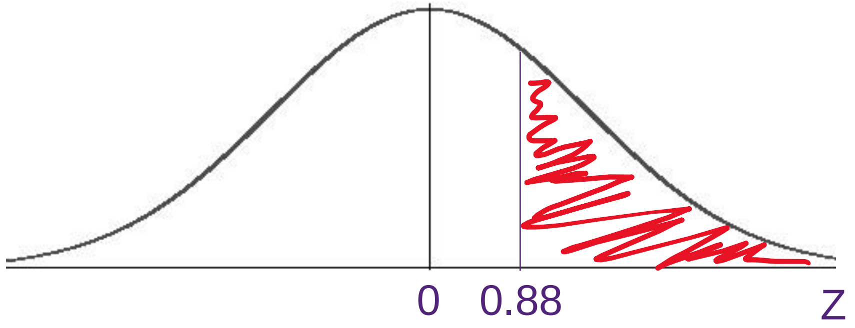
Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} > 52)$

Z transformation

$$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}} \text{ where } \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$$

$$P\left(Z > \frac{52 - 50.4}{1.8207795} \right) = P(Z > 0.88) = ?$$





Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

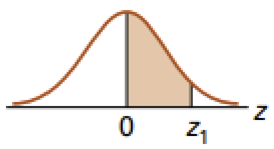
$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

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).

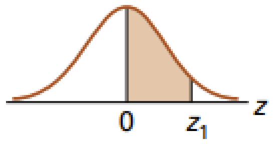


z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.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 T06 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).



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

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours

b. less than 47.5 hours

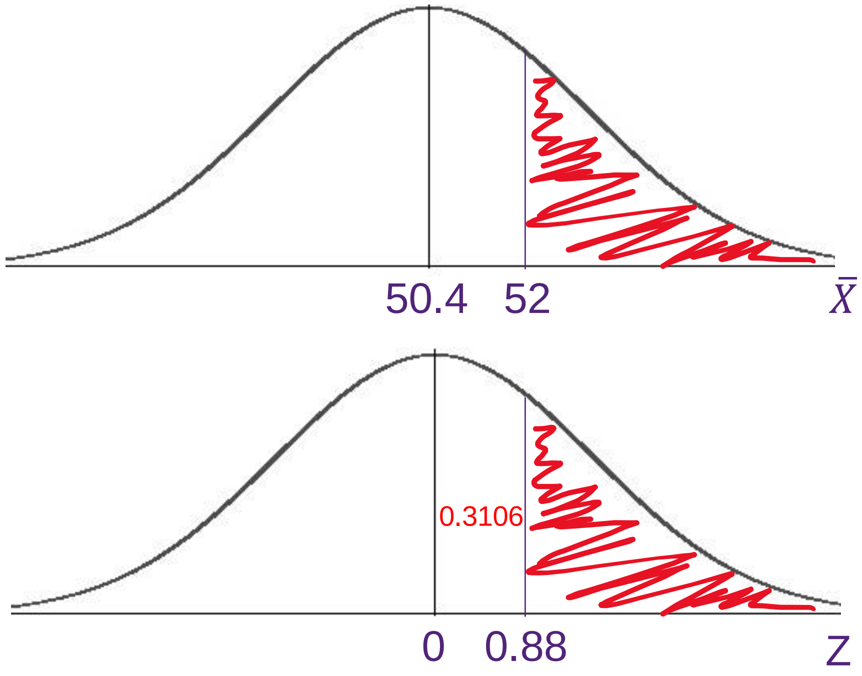
c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} > 52)$

Z transformation

$$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}} \text{ where } \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$$

$$P\left(Z > \frac{52 - 50.4}{1.8207795} \right) = P(Z > 0.88) = ?$$



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

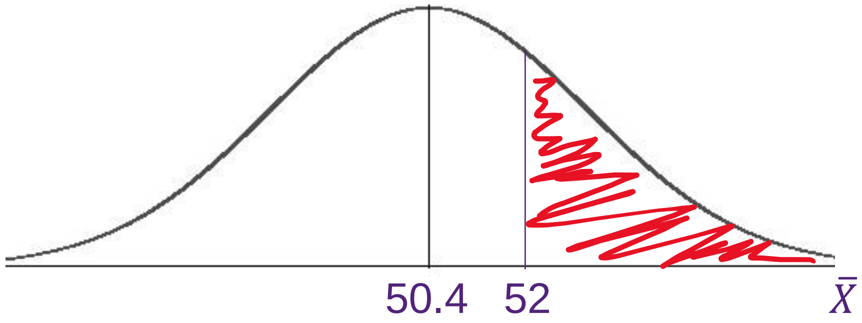
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
P($\bar{X}$ > 52)

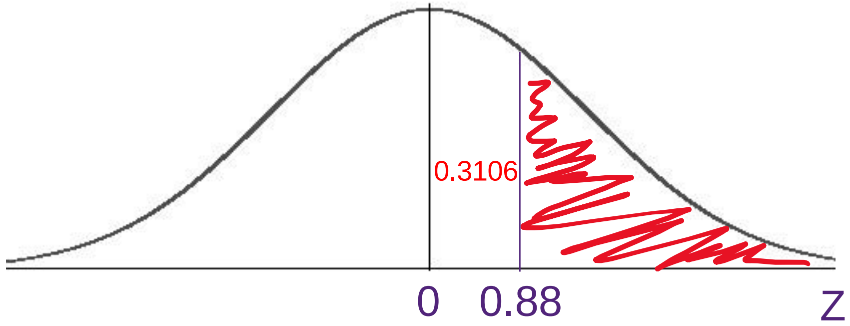


Z transformation

$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$ where $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$

$P\left(Z > \frac{52 - 50.4}{1.8207795}\right) = P(Z > 0.88) =$

0.5 – 0.3106 = 0.1894



Summary: Rearranged useful formulae

$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$

$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}}$ (*use correct sign of Z*)

$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}}$ (*use correct sign of Z*)

$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$

adm T06 Q1 Q2 Q3 Q4

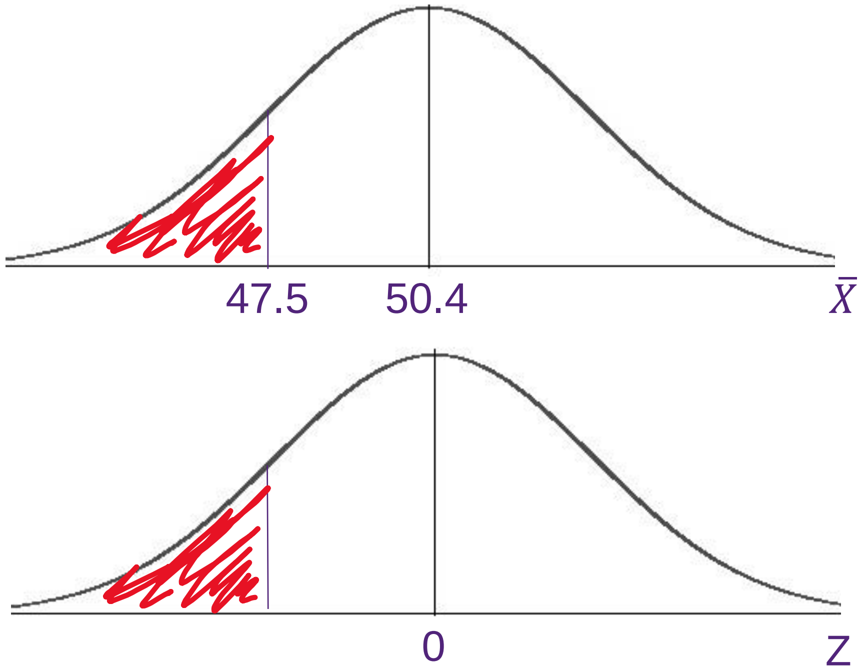
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} < 47.5)$



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (use\ correct\ sign\ of\ Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (use\ correct\ sign\ of\ Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

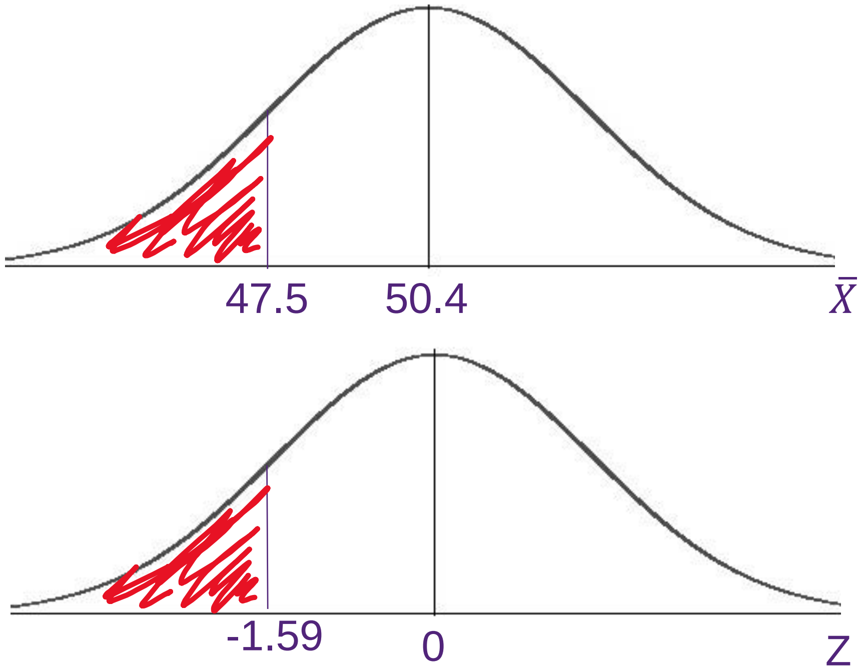
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours   0.1894

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} < 47.5)$



Z transformation

$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$ where $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$

$P(Z > \frac{47.5 - 50.4}{1.8207795}) = P(Z > -1.59) = ?$

Summary: Rearranged useful formulae

$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$

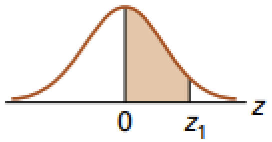
$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}}$ *(use correct sign of Z)*

$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}}$ *(use correct sign of Z)*

$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$

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

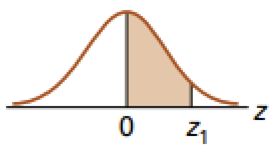
The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



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).



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

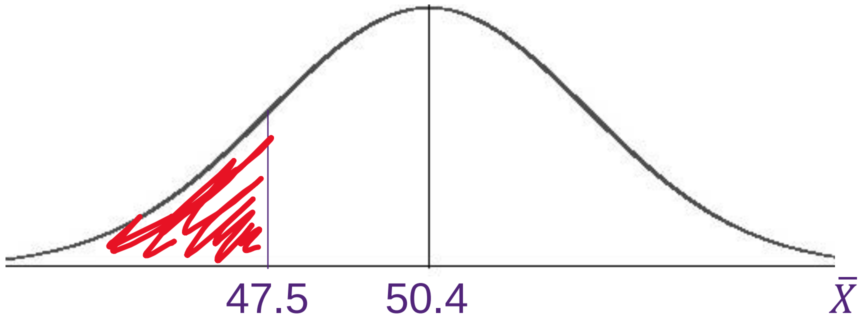
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

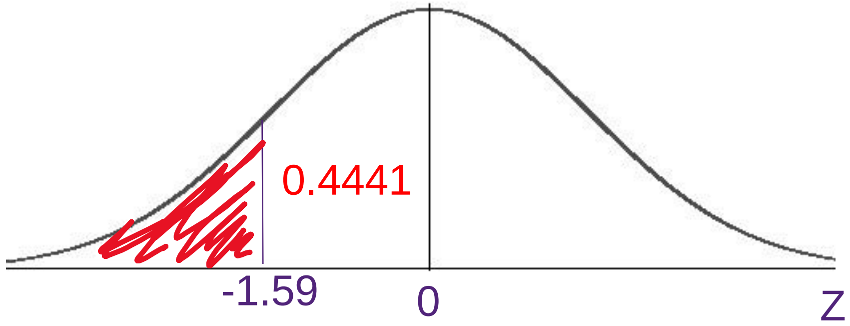
Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = 139.24 hours squared
n = 42 households
$P(\bar{X} < 47.5)$



Z transformation

$$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}} \text{ where } \sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$$

$$P\left(Z > \frac{47.5 - 50.4}{1.8207795} \right) = P(Z > -1.59) = ?$$



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

The University Of Queensland AUSTRALIA

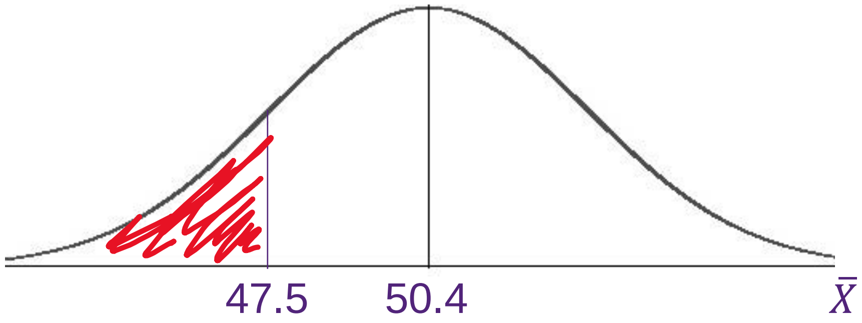
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
$\mu = 50.4$ hours
$\sigma^2 = 139.24$ hours squared
$n = 42$ households
$P(\bar{X} < 47.5)$

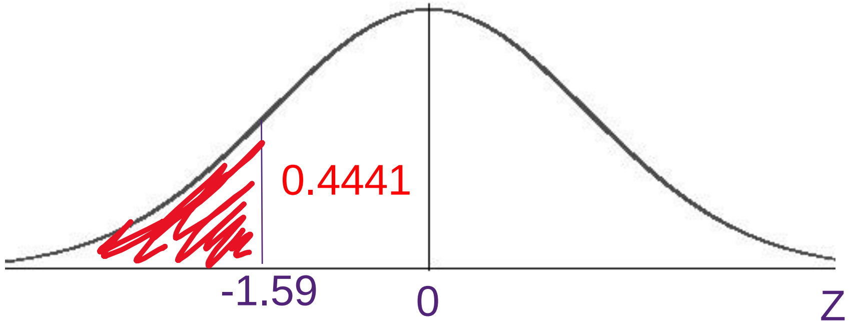


Z transformation

$Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$ where $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{139.24}}{\sqrt{42}} = 1.8207795$

$P(Z > \frac{47.5 - 50.4}{1.8207795}) = P(Z > -1.59) =$

$0.5 - 0.4441 = 0.0559$



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

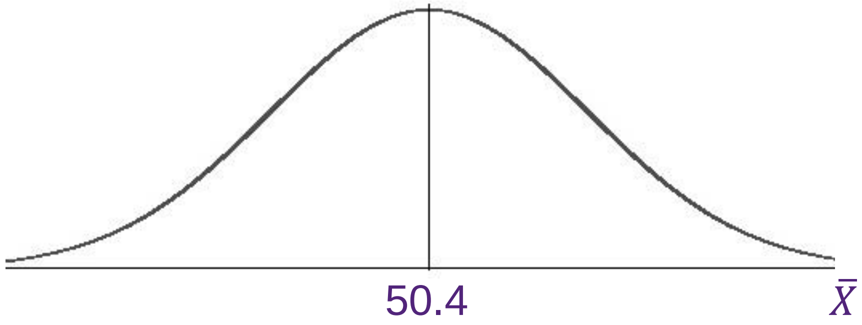
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = ?
n = 42 households



Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

adm T06 Q1 Q2 Q3 Q4

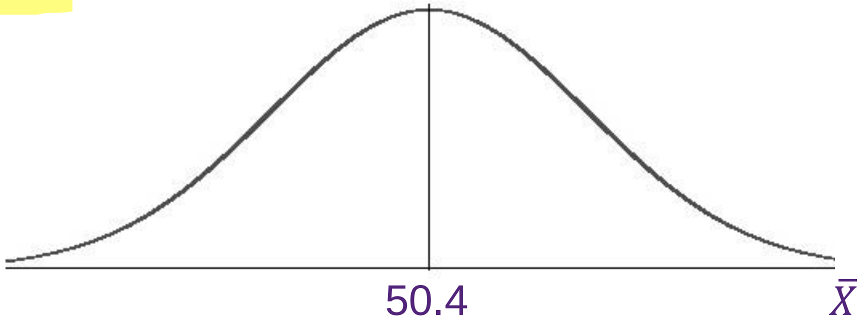
THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?



Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = ?
n = 42 households
$P(\bar{X} > 49) = 0.71$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

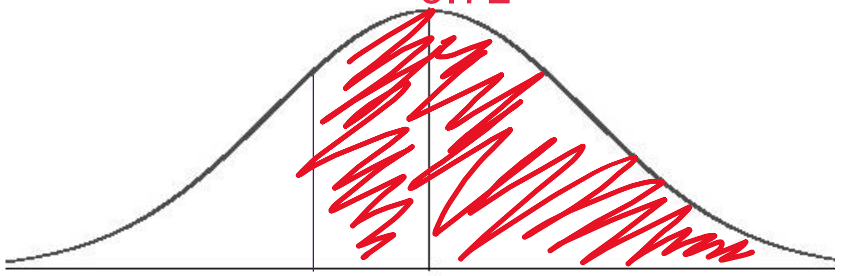
THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?



Variable of interest: TV viewing time per week
$\mu = 50.4$ hours
$\sigma^2 = ?$
$n = 42$ households
$P(\bar{X} > 49) = 0.71$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \textit{(use correct sign of Z)}$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

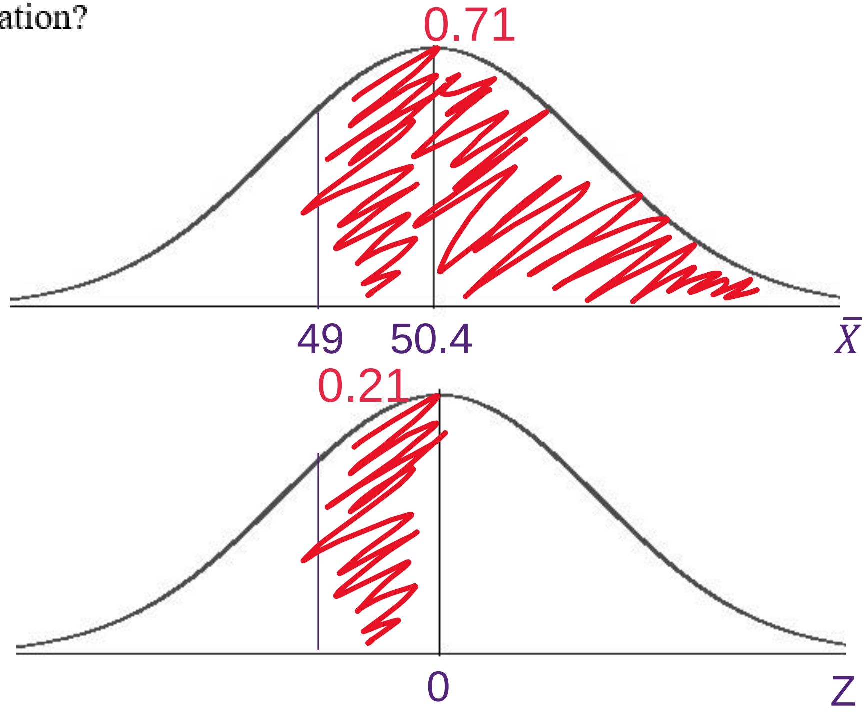
Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?

Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = ?
n = 42 households
$P(\bar{X} > 49) = 0.71$



Z transformation

$$P\left(Z > \frac{49 - 50.4}{\sigma/\sqrt{42}}\right) = 0.21 = P(Z > ?)$$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad \text{(use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad \text{(use correct sign of } Z)$$

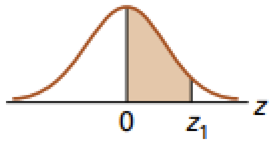
$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

adm T06 Q1 Q2 Q3 Q4

0.2100

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

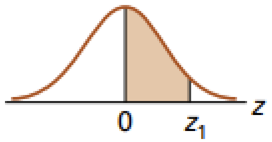
The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



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).



0.2100

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

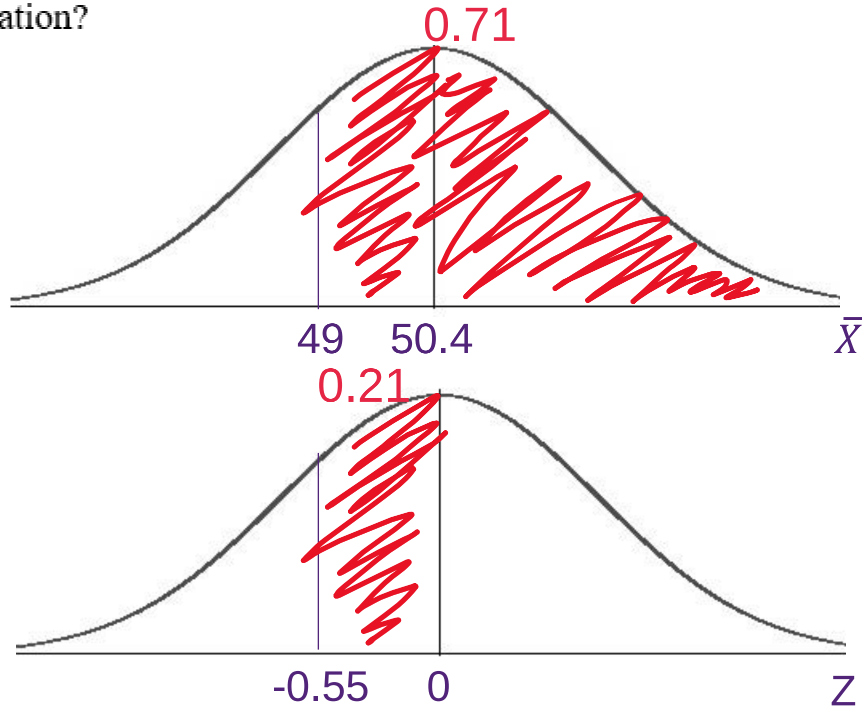
The University Of Queensland
AUSTRALIA

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation?



Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = ?
n = 42 households
P($\bar{X}$ > 49) = 0.71

Z transformation

$$P\left(Z > \frac{49 - 50.4}{\sigma/\sqrt{42}} \right) = 0.21 = P(Z > -0.55)$$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

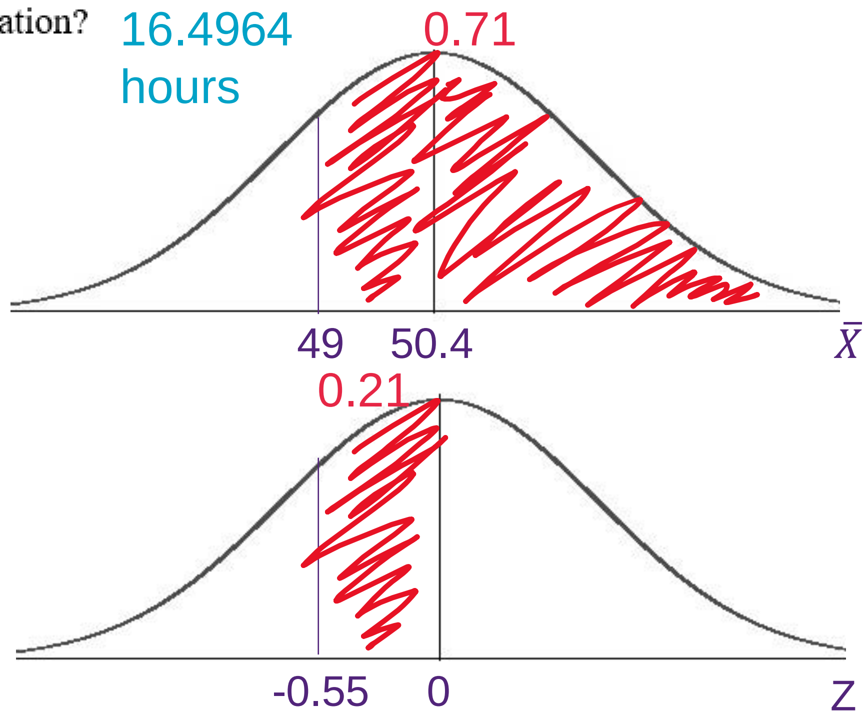
$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

Q2. According to Nielsen Media research, the average number of hours of TV viewing per household per week in the US is 50.4 hours. Suppose the variance is 139.24 hours squared and a random sample of 42 US households is taken. Find the probability that the sample average is:

a. more than 52 hours 0.1894

b. less than 47.5 hours 0.0559

c. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation? 16.4964 hours



Variable of interest: TV viewing time per week
μ = 50.4 hours
σ^2 = ?
n = 42 households
P($\bar{X}$ > 49) = 0.71

Z transformation

$$P\left(Z > \frac{49 - 50.4}{\sigma/\sqrt{n}}\right) = 0.21 = P(Z > -0.55)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z} = \frac{(49 - 50.4)\sqrt{42}}{-0.55} = 16.4964$$

Summary: Rearranged useful formulae

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

$$\mu = \bar{X} - Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\bar{X} = \mu + Z\frac{\sigma}{\sqrt{n}} \quad (\textit{use correct sign of } Z)$$

$$\sigma = \frac{(\bar{X} - \mu)\sqrt{n}}{Z}$$

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

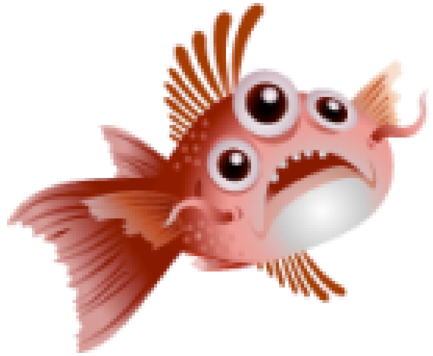
Q3.

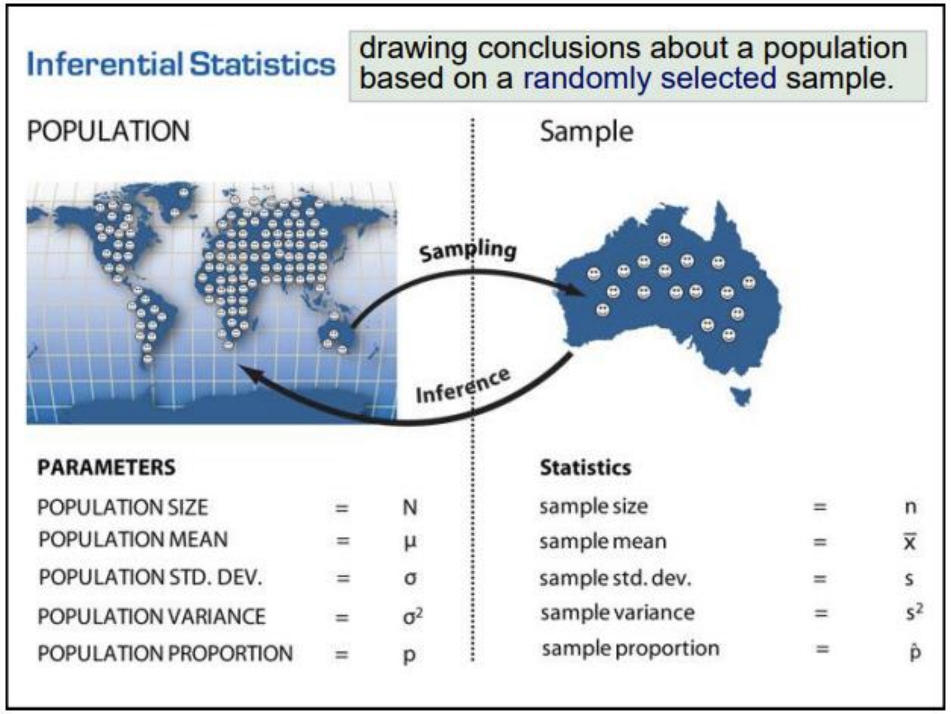
A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?





(Poll)

1. What is our variable of interest? (Single Choice)

- The travel association survey.
- The purpose of the visits.
- The proportion visiting relatives.
- The amount of travellers selected.
- The FREAKY fish.

2. What symbol would you give to the value 950 travellers? (Single Choice) *

- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

3. What symbol would you give to the value 19% of the respondents? (Single Choice) *

- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

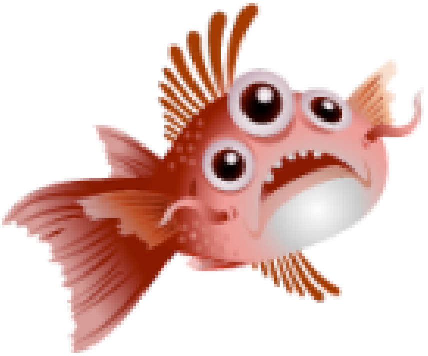
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

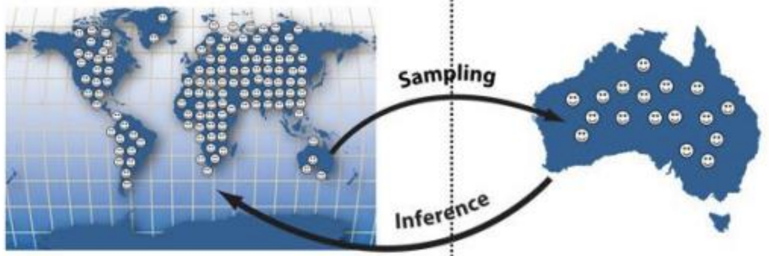


2. What symbol would you give to the value 950 travellers? (Single Choice) *

- N
- n
- p
- p̂ (p hat)
- σ² (sigma squared)
- s²

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	=	σ²	sample variance	=	s²
POPULATION PROPORTION	=	p	sample proportion	=	p̂

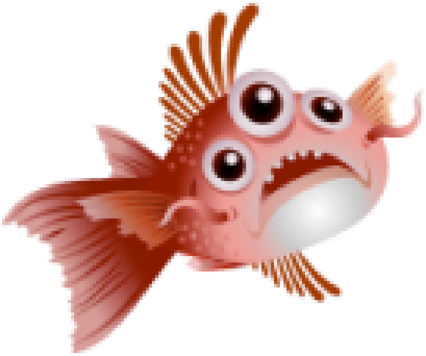
1. What is our variable of interest? (Single Choice)

- The travel association survey.
- The purpose of the visits.
- The proportion visiting relatives.
- The amount of travellers selected.
- The FREAKY fish.

3. What symbol would you give to the value 19% of the respondents? (Single Choice) *

- N
- n
- p
- p̂ (p hat)
- σ² (sigma squared)
- s²

adm T06 Q1 Q2 Q3 Q4



Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

$P(\hat{p} > 0.22) = ?$

adm T06 Q1 Q2 Q3 Q4

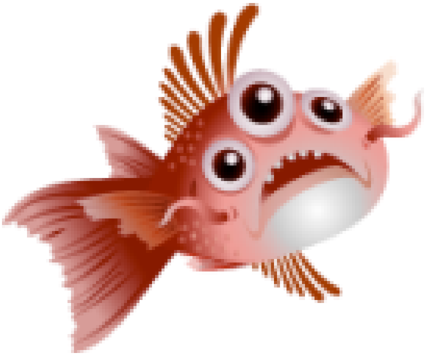
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

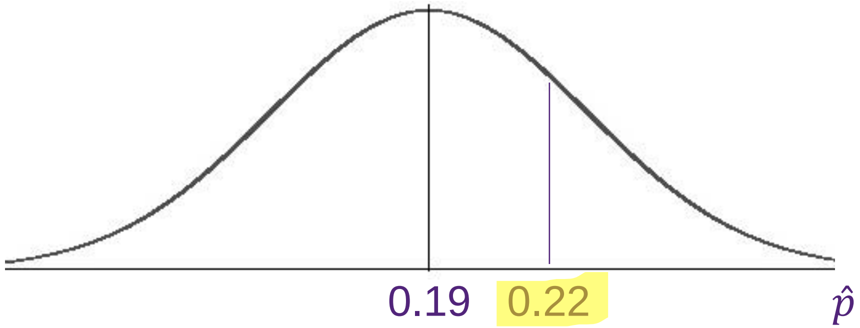


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

$P(\hat{p} > 0.22) = ?$



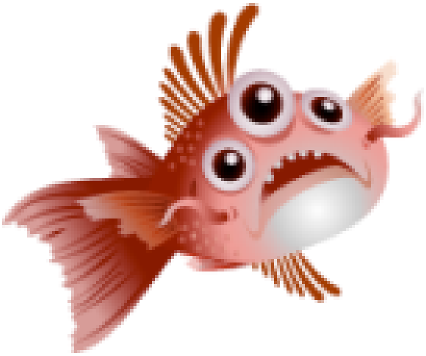
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

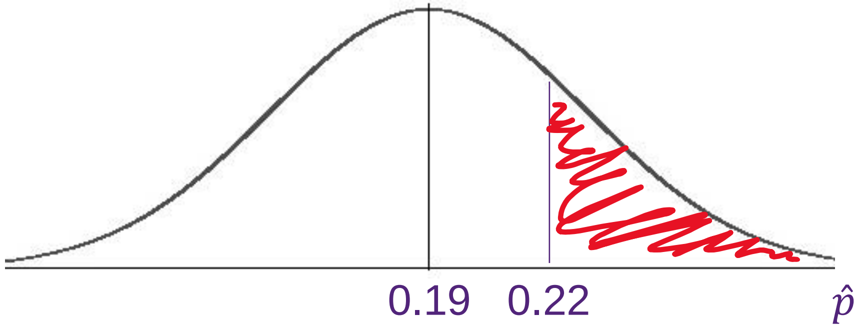


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P($\hat{p}$ > 0.22) = ?



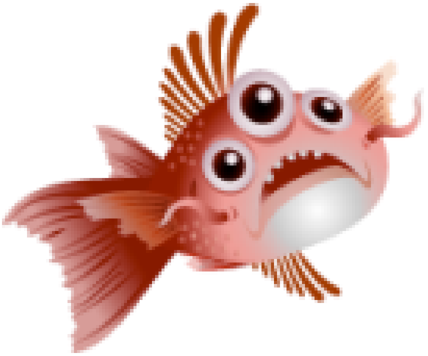
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

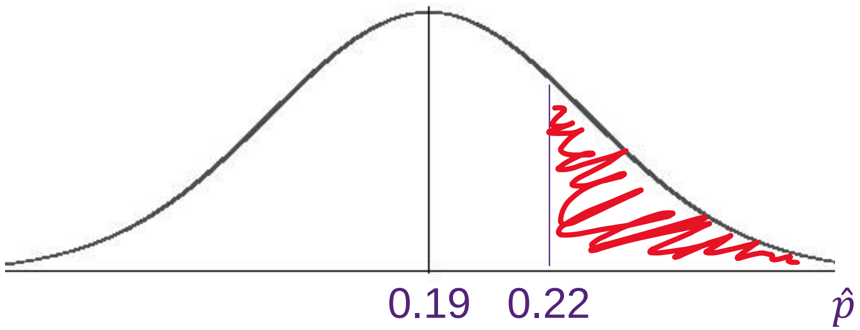


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P($\hat{p}$ > 0.22) = ?



Can we do a Z transformation? Let's check

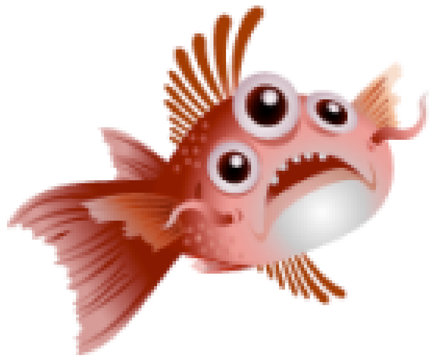
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

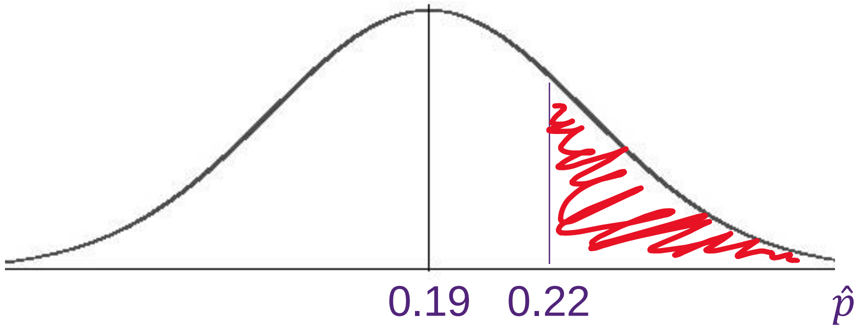


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P($\hat{p}$ > 0.22) = ?



Conclusion:

The sampling distribution of the sample proportion, $\hat{p}$, can be **approximated by a normal distribution** if both:

$$np > 5 \quad \text{and} \quad n(1-p) > 5$$

Can we do a Z transformation? Let's check

p = 0.5 ?

or

n * p > 5 ?

n * (p – 1) > 5 ?

(Poll)

adm T06 Q1 Q2 Q3 Q4

The University Of Queensland
AUSTRALIA

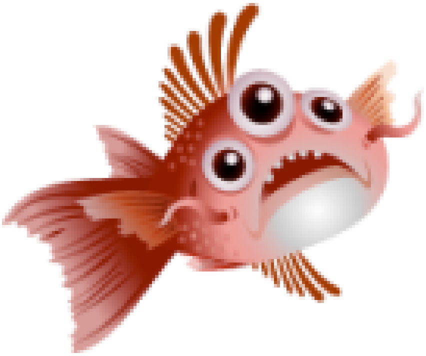
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

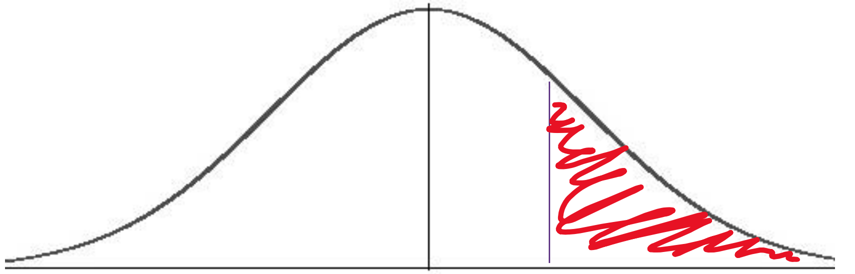


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P($\hat{p}$ > 0.22) = ?



Conclusion:

The sampling distribution of the sample proportion, $\hat{p}$, can be **approximated by a normal distribution** if both:

$$np > 5 \quad \text{and} \quad n(1-p) > 5$$

Can we do a Z transformation? Let's check

p = 0.5 No

or

n * p = 950 * 0.19 = 180.5 > 5 Yes

n * (p – 1) = 950 * 0.81 = 769.5 > 5 Yes

Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (\textit{use correct sign of } Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (\textit{use correct sign of } Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

adm T06 Q1 Q2 Q3 Q4

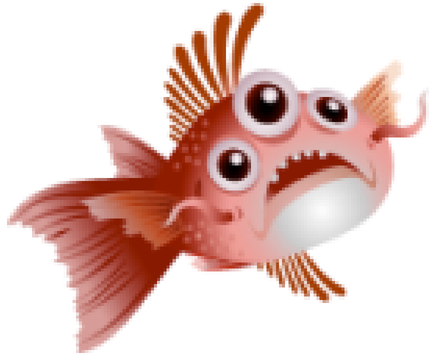
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?



Variable of interest: proportion visiting relatives

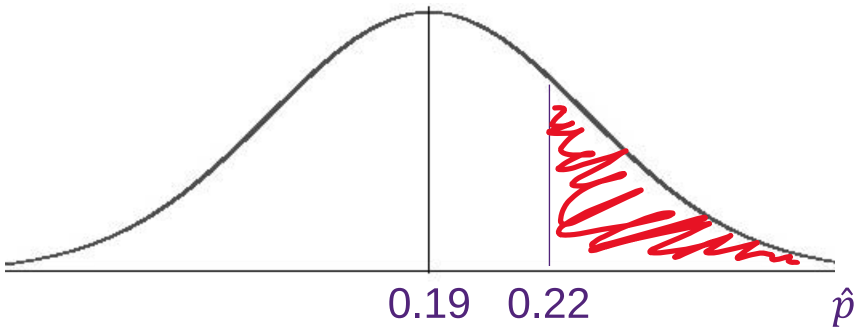
n = 950 households

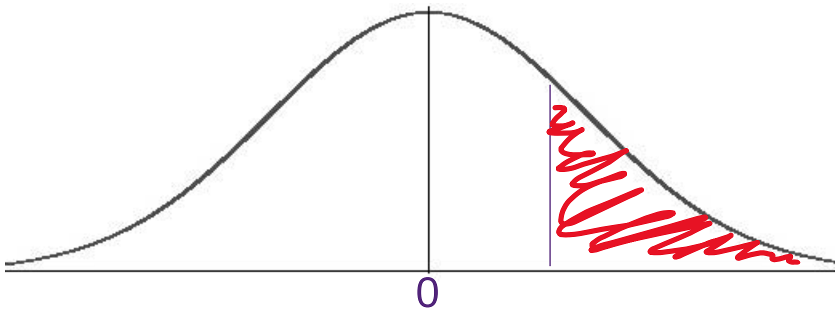
p = 19% = 0.19

P($\hat{p}$ > 0.22) = ?

Z transformation

$Z = \dfrac{\hat{p} - p}{\sigma_{\hat{p}}}$ where $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}} = ?$





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

adm T06 Q1 Q2 Q3 Q4

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

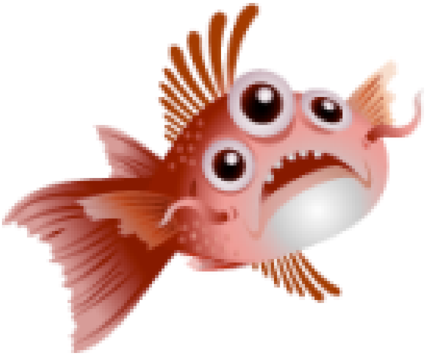
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22%

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?



Variable of interest: proportion visiting relatives

n = 950 households

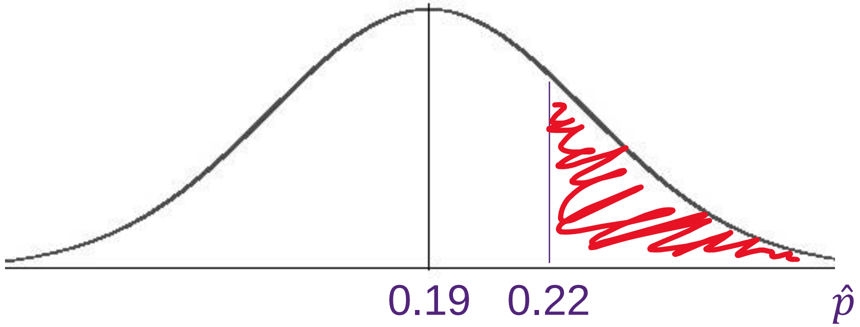
p = 19% = 0.19

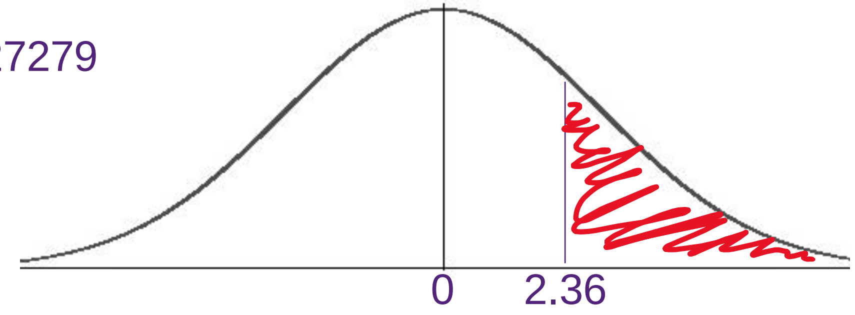
P($\hat{p}$ > 0.22) = ?

Z transformation

$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}}$ where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$

P($Z > \frac{0.22 - 0.19}{0.0127279}$) = P(Z > 2.36) = ?





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (*use correct sign of Z*)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (*use correct sign of Z*)

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

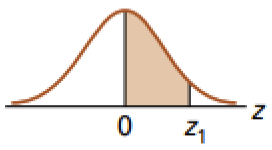
34

adm T06 Q1 Q2 Q3 Q4

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

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).



2.36

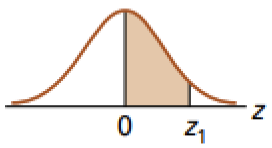
z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

2.36

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).

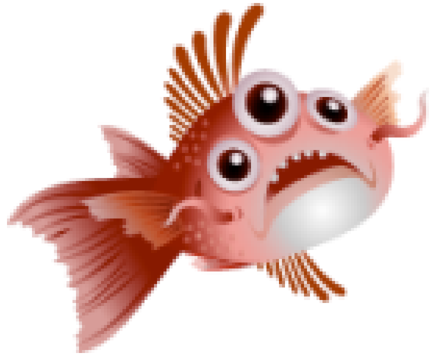


z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

adm T06 Q1 Q2 Q3 Q4

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:



a) more than 22% 0.0091

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

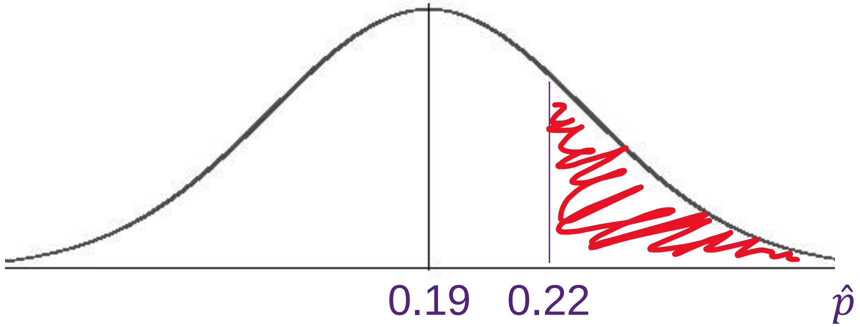
P($\hat{p}$ > 0.22) = ?

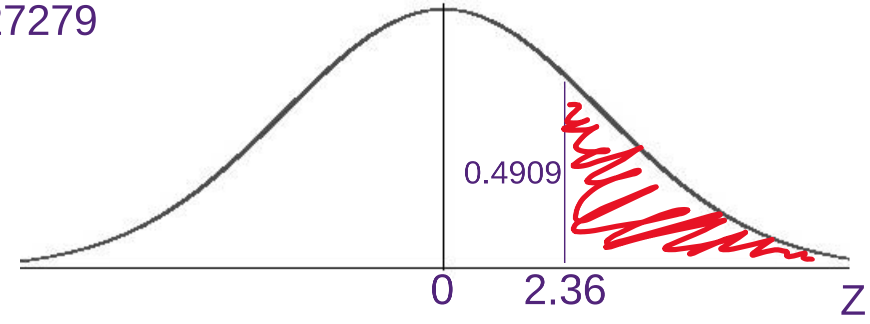
Z transformation

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} \text{ where } \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$$

$$P\left(Z > \frac{0.22 - 0.19}{0.0127279} \right) = P(Z > 2.36) =$$

0.5 – 0.4909 = 0.0091





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ *(use correct sign of Z)*

$\hat{p} = p + Z\sigma_{\hat{p}}$ *(use correct sign of Z)*

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

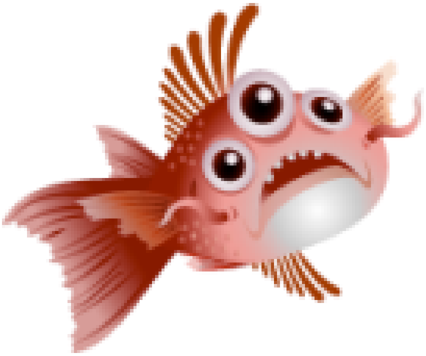
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

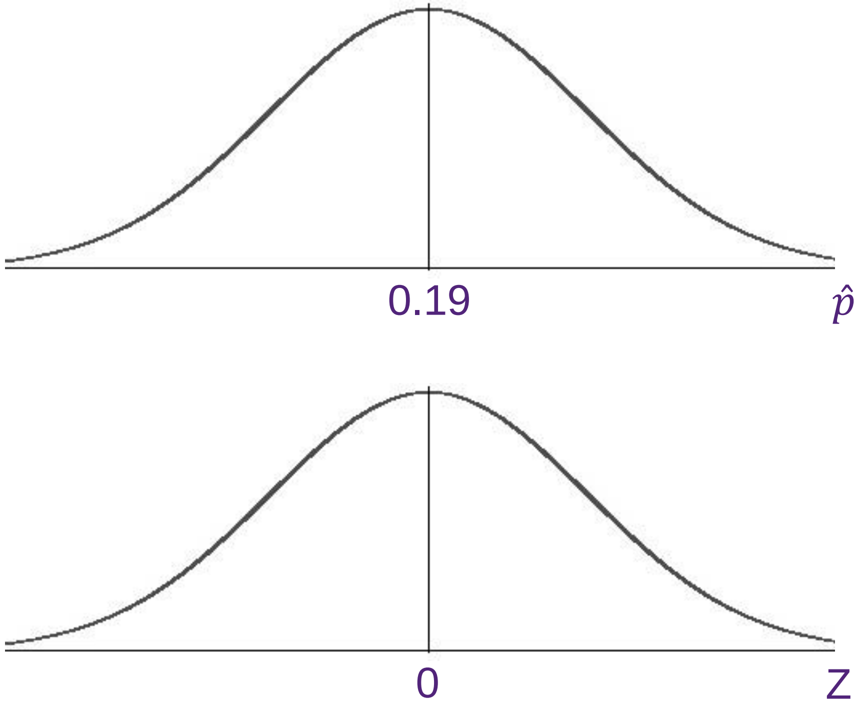


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P(0.15 < $\hat{p}$ < 0.20) = ?



Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

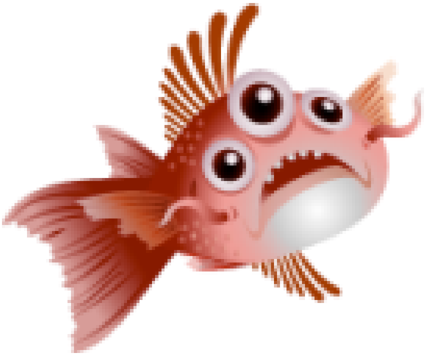
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

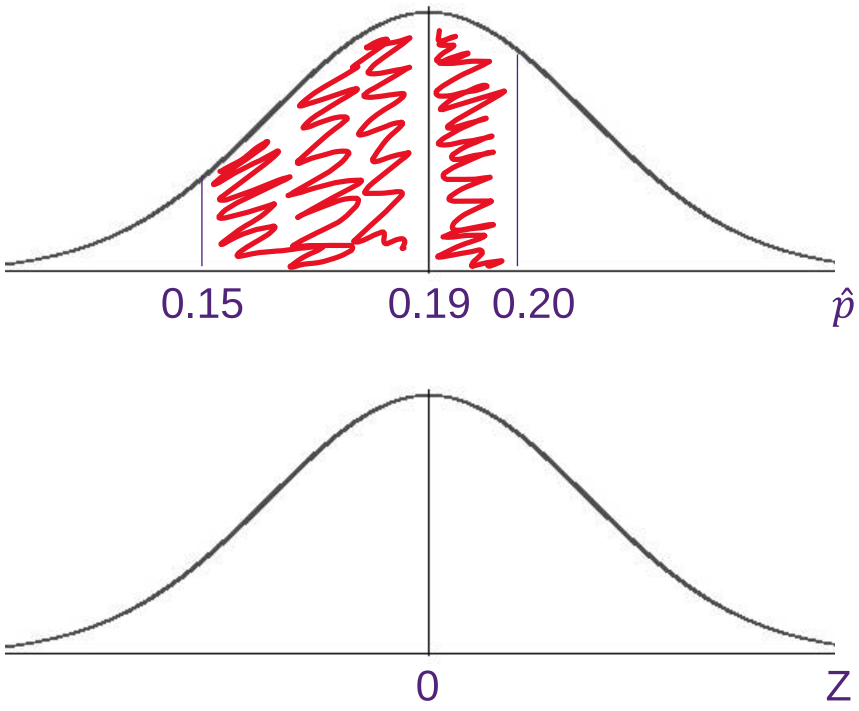


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P(0.15 < $\hat{p}$ < 0.20) = ?



Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

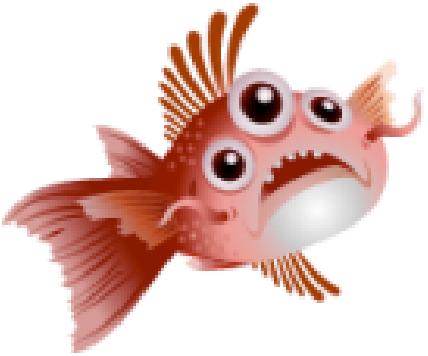
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%.

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?



Variable of interest: proportion visiting relatives

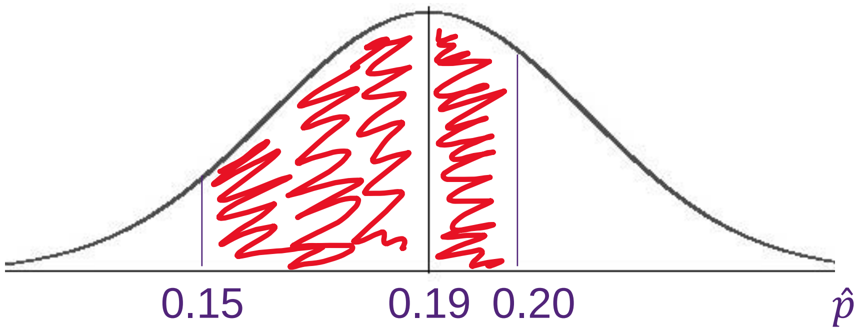
n = 950 households

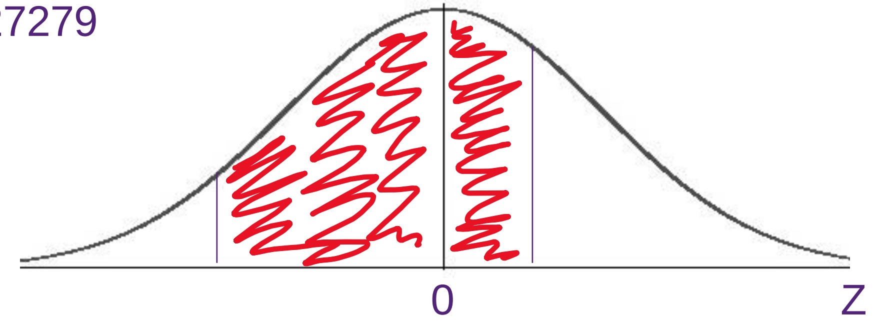
p = 19% = 0.19

P(0.15 < $\hat{p}$ < 0.20) = ?

Z transformation

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} \text{ where } \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$$





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

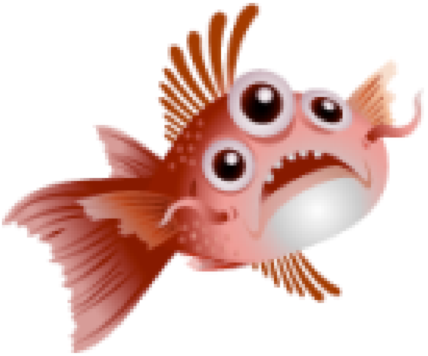
$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:



a) more than 22% 0.0091

b) between 15% and 20%.

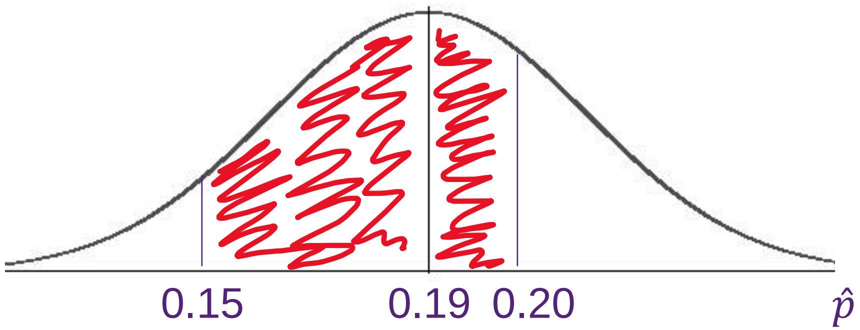
c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P(0.15 < $\hat{p}$ < 0.20) = ?

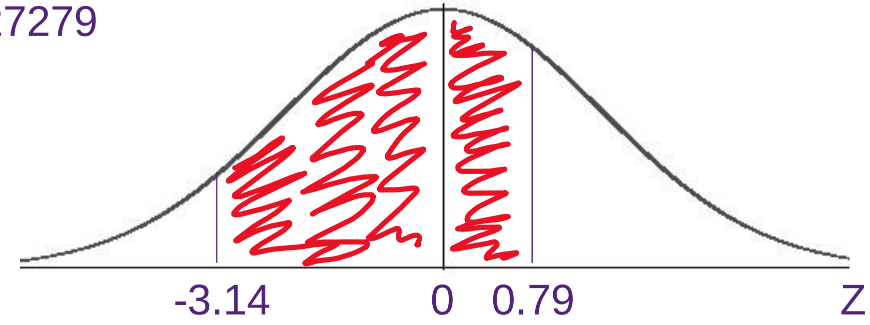


Z transformation

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} \text{ where } \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$$

$$P\left(\frac{0.15 - 0.19}{0.0127279} < Z < \frac{0.20 - 0.19}{0.0127279}\right) =$$

P(-3.14 < Z < 0.79) = ?



Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ *(use correct sign of Z)*

$\hat{p} = p + Z\sigma_{\hat{p}}$ *(use correct sign of Z)*

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

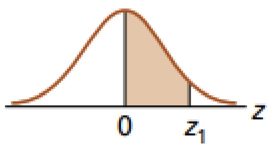
34

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

-3.14

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

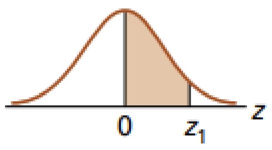
The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

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).

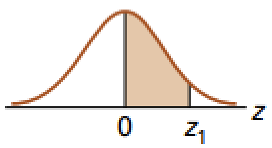


-3.14

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

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).



0.79

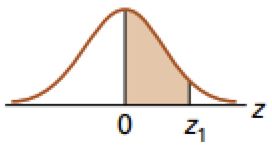
z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.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 T06 Q1 Q2 Q3 Q4

0.79

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

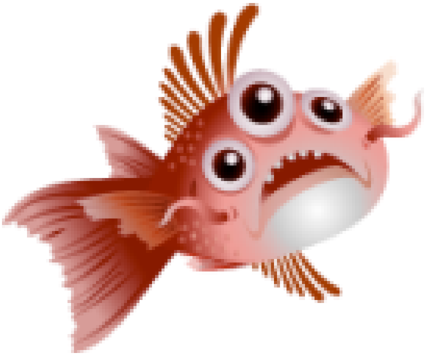
The entries in this table are the probabilities that a standard normal random variable is between 0 and z_1 (the shaded area).



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

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:



a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

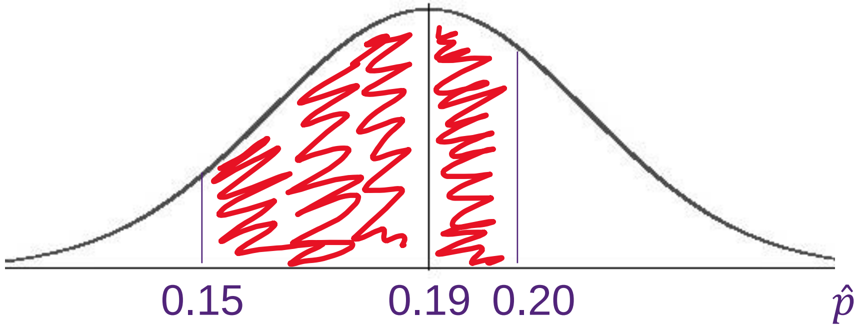
P(0.15 < $\hat{p}$ < 0.20) = ?

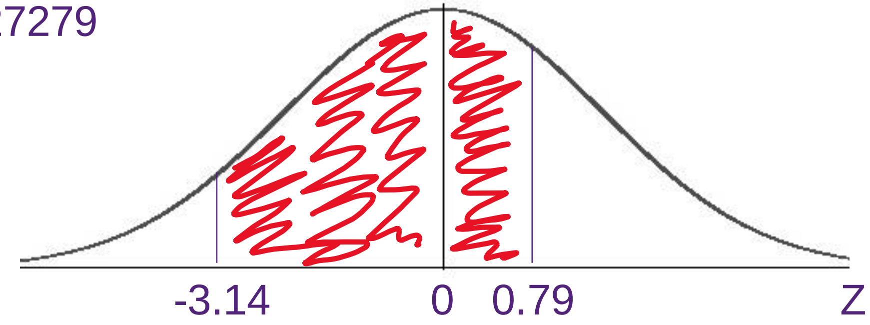
Z transformation

$Z = \dfrac{\hat{p} - p}{\sigma_{\hat{p}}}$ where $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}} = \sqrt{\dfrac{0.19(1-0.19)}{950}} = 0.0127279$

$P\left(\dfrac{0.15 - 0.19}{0.0127279} < Z < \dfrac{0.20 - 0.19}{0.0127279}\right) =$

P(-3.14 < Z < 0.79) = 0.4992 + 0.2852 = 0.7844





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

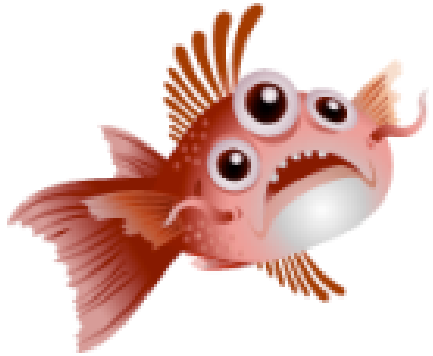
$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:



a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

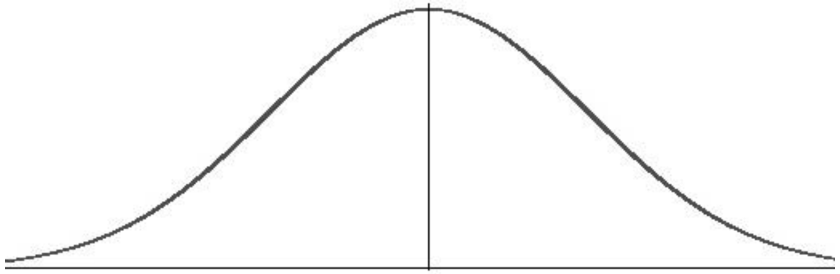
c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

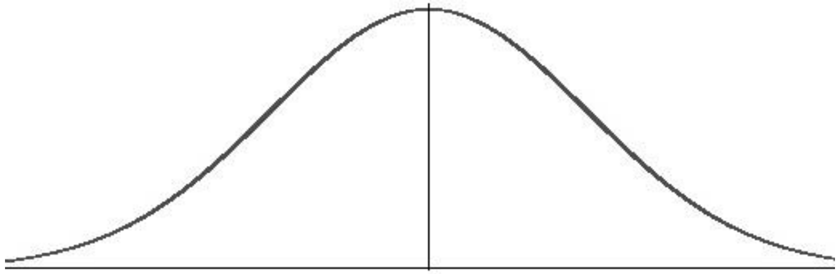
n = 950 households

p = 19% = 0.19

P(? < $\hat{p}$) = 0.05



0.19 $\hat{p}$



0 Z

Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (use\ correct\ sign\ of\ Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

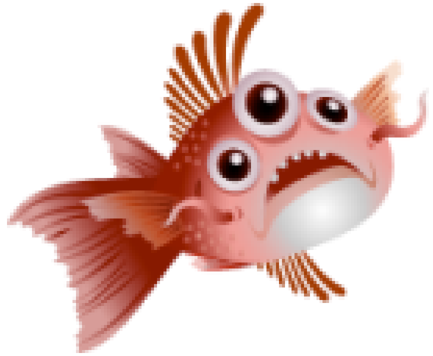
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

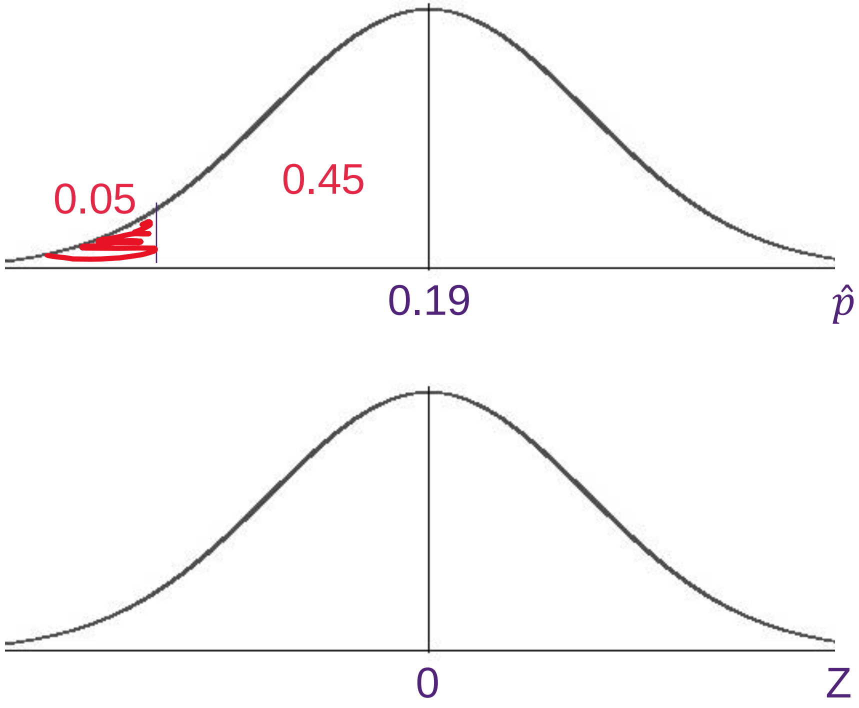


Variable of interest: proportion visiting relatives

n = 950 households

p = 19% = 0.19

P(? < $\hat{p}$) = 0.05



Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad \text{(use correct sign of Z)}$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad \text{(use correct sign of Z)}$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

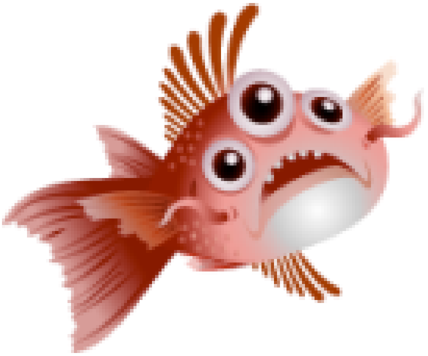
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?



Variable of interest: proportion visiting relatives

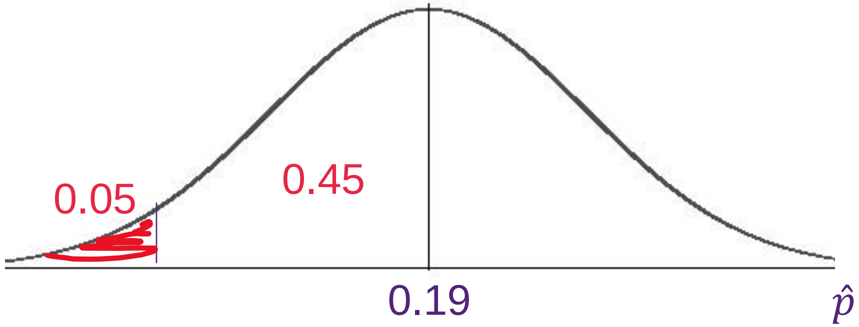
n = 950 households

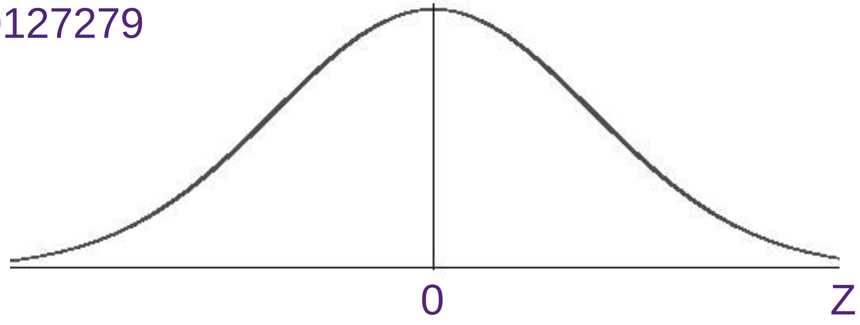
p = 19% = 0.19

P(? < $\hat{p}$) = 0.05

Z transformation

$\hat{p}$ = p + Z $\sigma_{\hat{p}}$ where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (\textit{use correct sign of } Z)$$

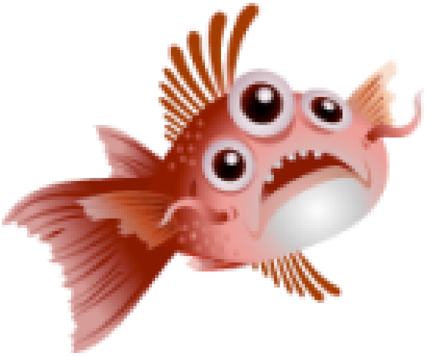
$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (\textit{use correct sign of } Z)$$

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:



a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

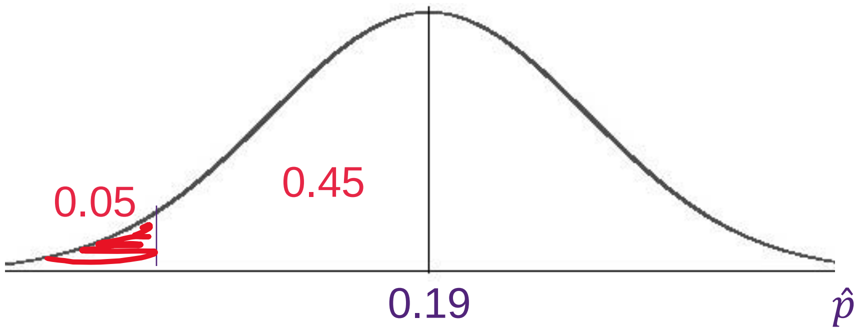
c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie?

Variable of interest: proportion visiting relatives

n = 950 households

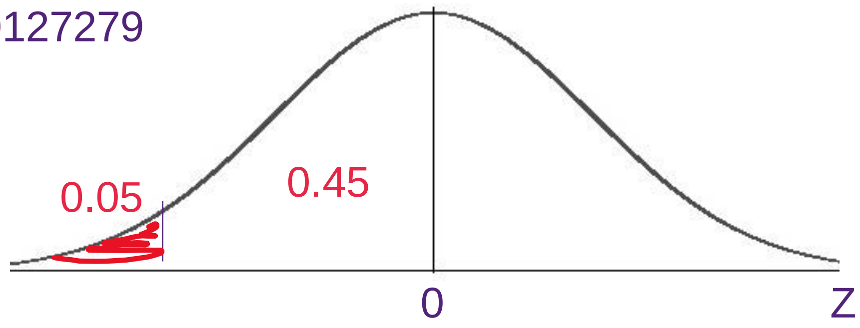
p = 19% = 0.19

P(? < $\hat{p}$) = 0.05



Z transformation

$\hat{p}$ = p + Z $\sigma_{\hat{p}}$ where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}} = 0.0127279$



Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

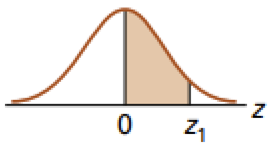
$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

adm T06 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).

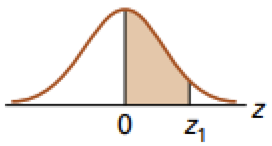


z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.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

0.05
or
0.45?

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
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767

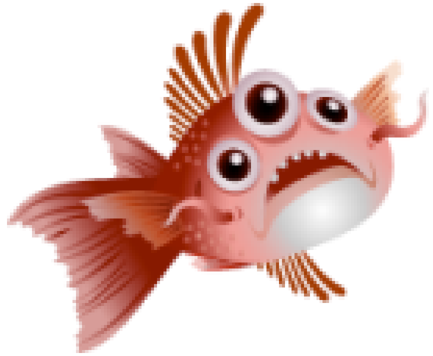
Q3.

A travel association survey asked travellers about the purpose of their visit. Nineteen per cent responded it was to visit relatives. Suppose 950 travellers are selected at random. What is the probability the proportion who say their reason for visiting relatives is:

a) more than 22% 0.0091

b) between 15% and 20%. 0.7844

c) What is the value of $\hat{p}$ below which 5% of all sample proportions lie? 0.1692



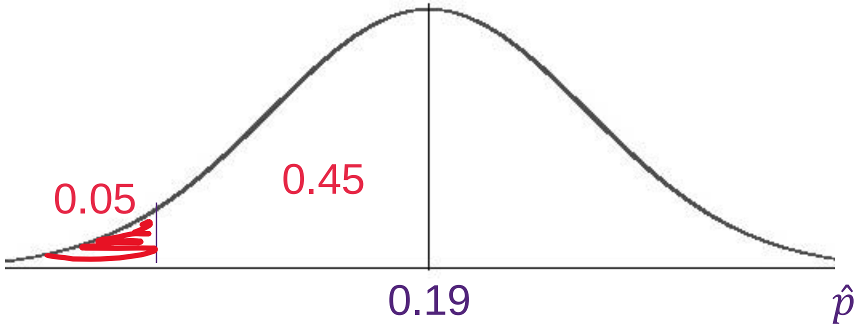
Variable of interest: proportion visiting relatives

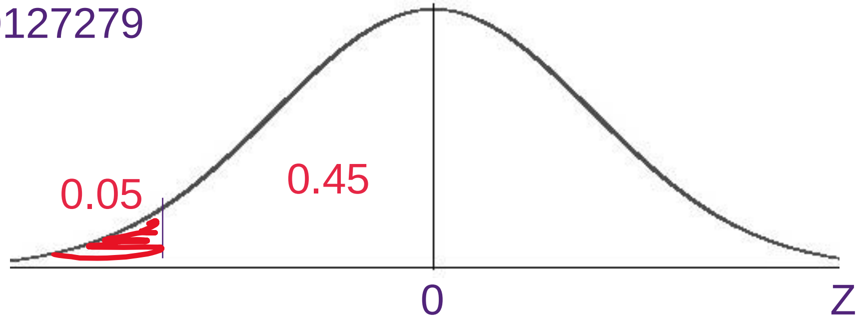
n = 950 households

p = 19% = 0.19

P(? < $\hat{p}$) = 0.05

Z transformation





$\hat{p}$ = p + Z $\sigma_{\hat{p}}$ where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.19(1-0.19)}{950}}$ = 0.0127279

$\hat{p}$ = 0.19 + (-1.645) * 0.0127279 = 0.1692

Summary: Rearranged useful formulae

$$Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}} = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

$$\sigma_{\hat{p}} = \frac{\hat{p}-p}{Z}$$

34

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

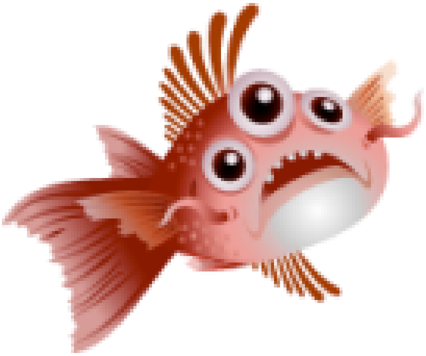
a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

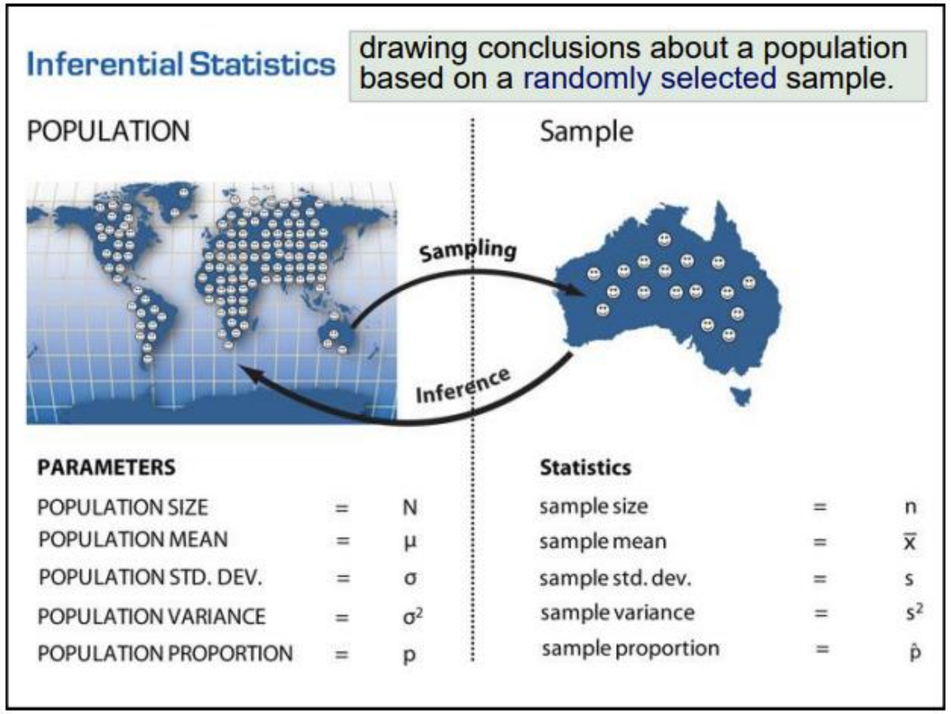
b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)





(Poll)

1. What is our variable of interest? (Single Choice) *

- The doctor beliefs.
- The proportion of patients fully recovered.
- How many days until recovery.
- The amount of medical records.
- A normal distribution.

2. What symbol would you give to the value 80% of all patients? (Single Choice) *

- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

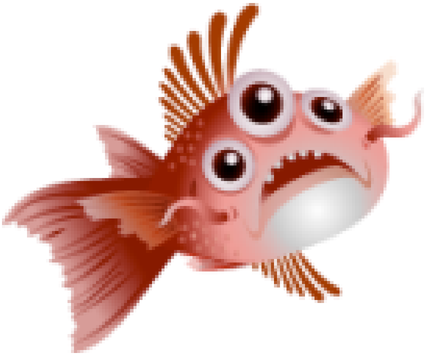
3. What symbol would you give to the value 20 medical records? (Single Choice) *

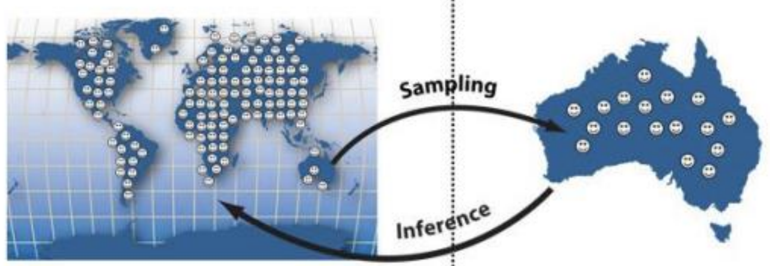
- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)





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	=	$\hat{p}$

(Poll)

1. What is our variable of interest? (Single Choice) *

- The doctor beliefs.
- The proportion of patients fully recovered.
- How many days until recovery.
- The amount of medical records.
- A normal distribution.

2. What symbol would you give to the value 80% of all patients? (Single Choice) *

- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

3. What symbol would you give to the value 20 medical records? (Single Choice) *

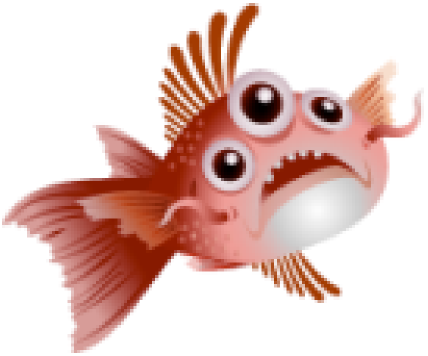
- N
- n
- p
- $\hat{p}$ (p hat)
- σ^2 (sigma squared)
- s^2

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 20 households

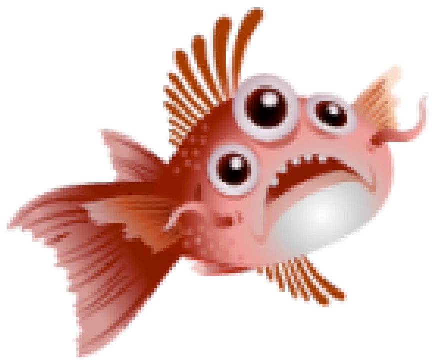
p = 80% = 0.80

adm T06 Q1 Q2 Q3 Q4

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 20 households

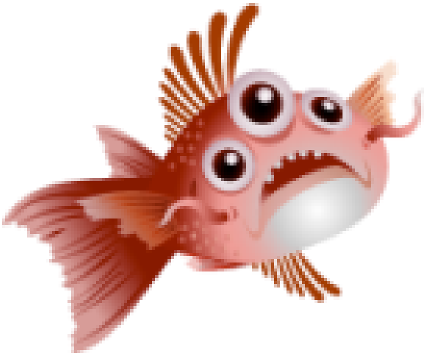
p = 80% = 0.80

Can we do a Z transformation? Let's check

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 20 households

p = 80% = 0.80

Can we do a Z transformation? Let's check

p = 0.5 ?

or

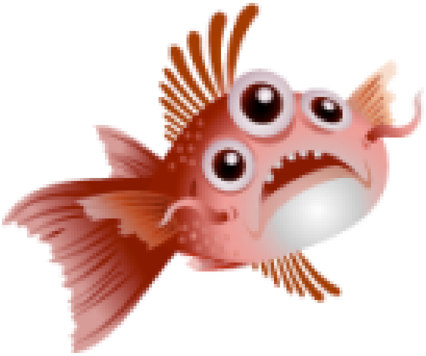
n * p > 5 ?

n * (p – 1) > 5 ?

(Poll)

adm T06 Q1 Q2 Q3 Q4

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.



We can't approximate to a normal distribution since $n * (1 – p) < 5$.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use $p = .8$)

Variable of interest: proportion of patients recovered

$n = 20$ households

$p = 80\% = 0.80$

Can we do a Z transformation? Let's check

$p = 0.5$ No

or

$n * p = 20 * 0.80 = 16 > 5$ Yes

$n * (p – 1) = 20 * 0.20 = 4 > 5$ No

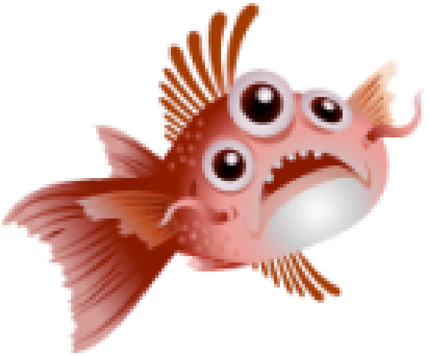
adm T06 Q1 Q2 Q3 Q4

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

We can't approximate to a normal distribution since n * (1 – p) < 5.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 20 households

p = 80% = 0.80

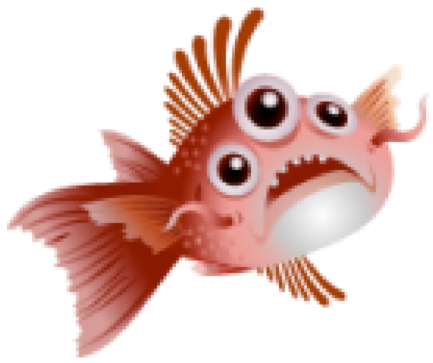
What can we do?

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

We can't approximate to a normal distribution since n * (1 – p) < 5.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 20 households

p = 80% = 0.80

What can we do?

We can change the size of the sample.

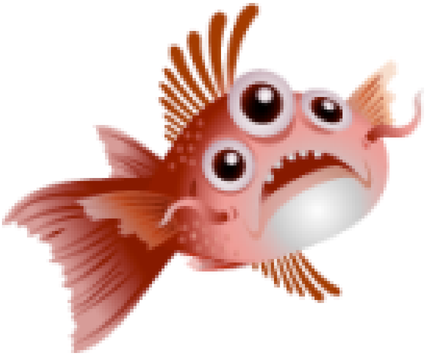
adm T06 Q1 Q2 Q3 Q4

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

We can't approximate to a normal distribution since n * (1 – p) < 5.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

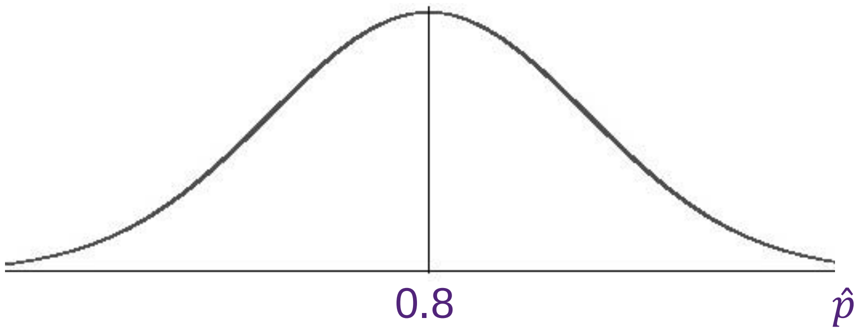
b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



Variable of interest: proportion of patients recovered

n = 80 households

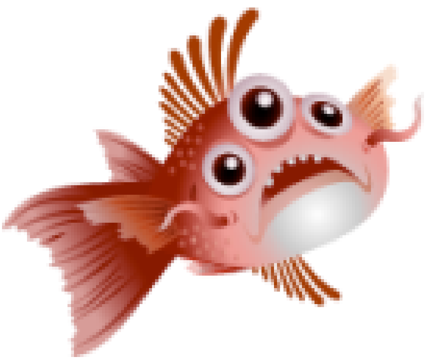
p = 80% = 0.80



Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



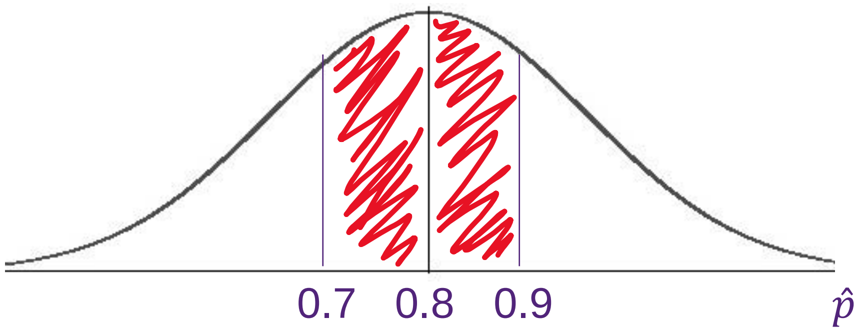
We can't approximate to a normal distribution since n * (1 – p) < 5.

Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

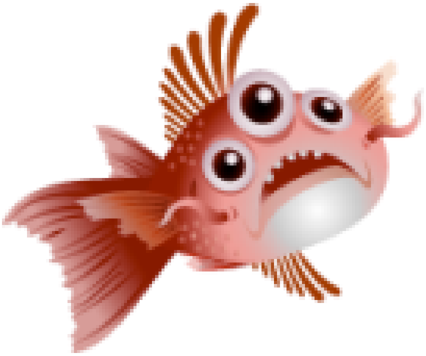
P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?



Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



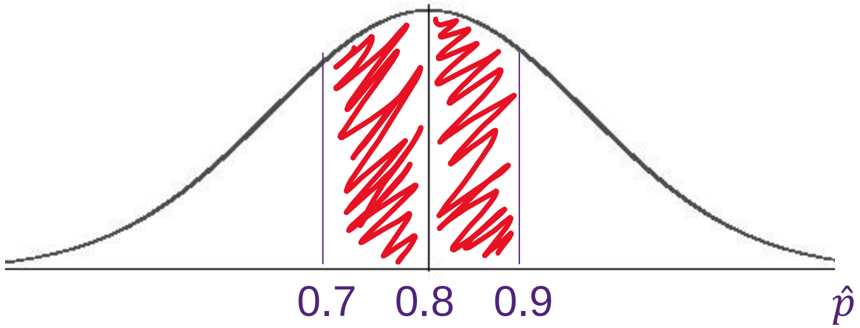
We can't approximate to a normal distribution since n * (1 – p) < 5.

Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?



Can we do a Z transformation? Let's check

p = 0.5 ?

or

n * p > 5 ?

n * (p – 1) > 5 ?

adm T06 Q1 Q2 Q3 Q4

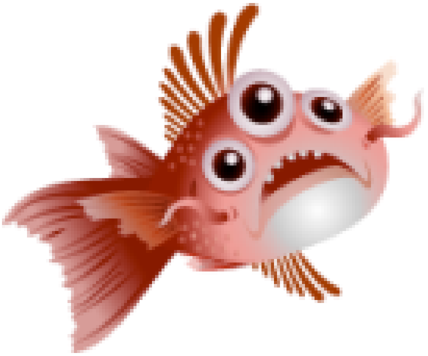
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)

We can't approximate to a normal distribution since n * (1 – p) < 5.

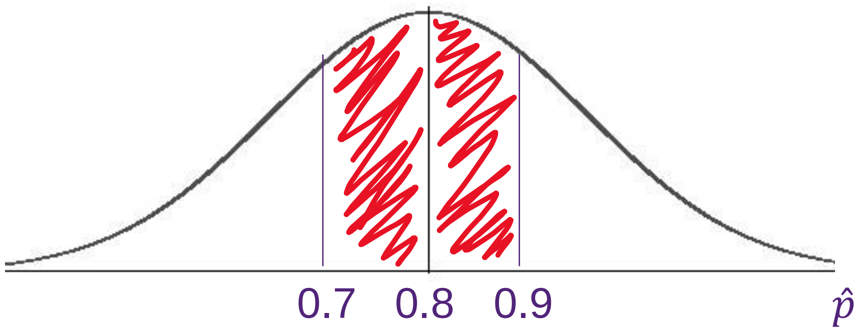


Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?



Can we do a Z transformation? Let's check
p = 0.5 No
or
n * p = 80 * 0.80 = 64 > 5 Yes
n * (p – 1) = 80 * 0.20 = 16 > 5 Yes

Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (*use correct sign of Z*)

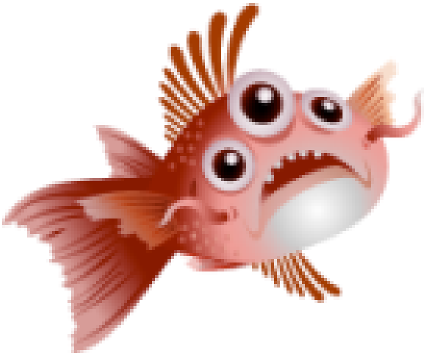
$\hat{p} = p + Z\sigma_{\hat{p}}$ (*use correct sign of Z*)

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

adm T06 Q1 Q2 Q3 Q4

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.



a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

We can't approximate to a normal distribution since n * (1 – p) < 5.

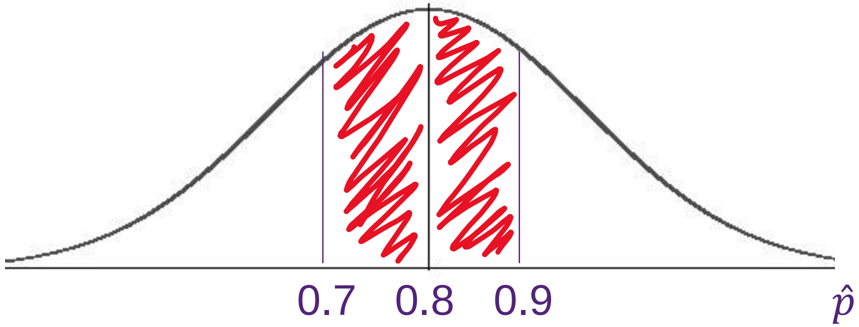
b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)

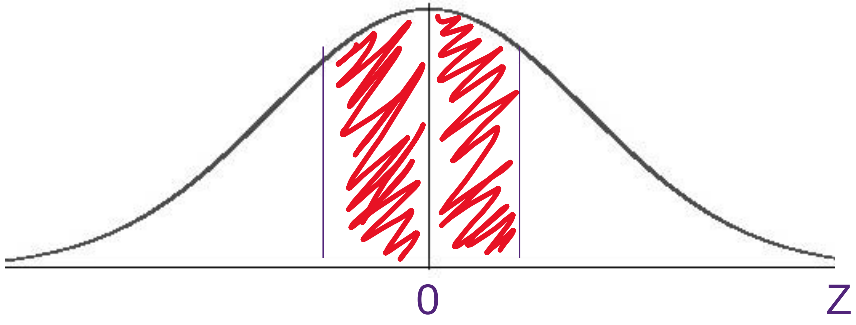
Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad (\text{use correct sign of } Z)$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad (\text{use correct sign of } Z)$$

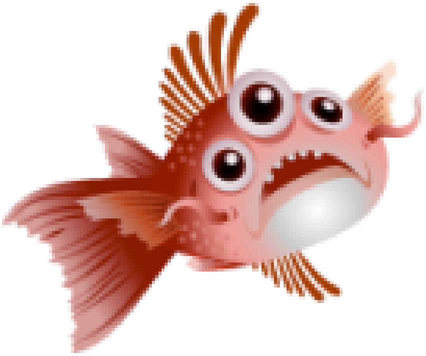
$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



We can't approximate to a normal distribution since n * (1 – p) < 5.

Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

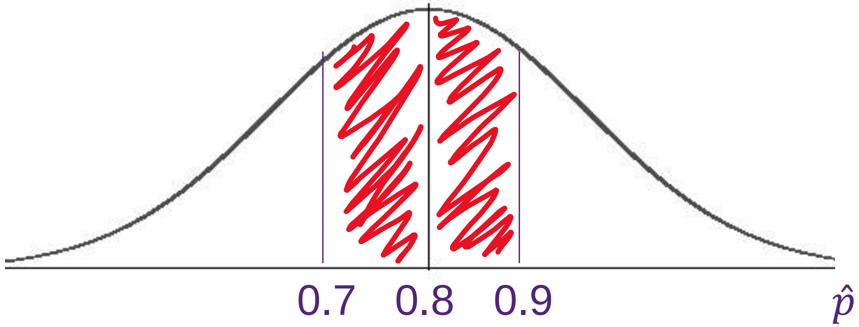
$P(0.8 - 0.1 < \hat{p} < 0.8 + 0.1) = P(0.7 < \hat{p} < 0.9) = ?$

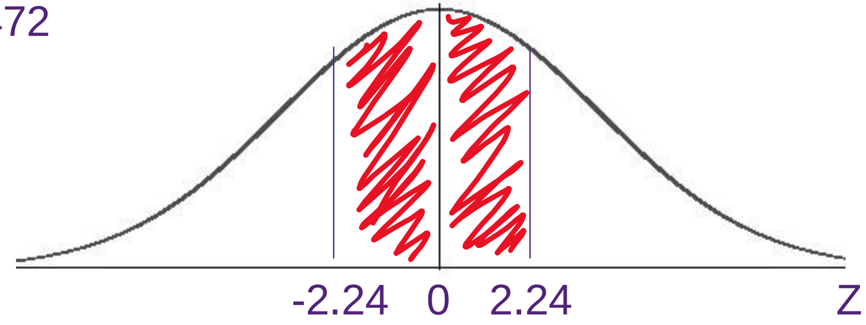
Z transformation

$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}}$ where $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.80(1-0.20)}{80}} = 0.04472$

$P\left(\frac{0.70 - 0.80}{0.04472} < Z < \frac{0.90 - 0.80}{0.04472}\right) =$

$P(-2.24 < Z < 2.24) = ?$





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$$p = \hat{p} - Z\sigma_{\hat{p}} \quad \text{(use correct sign of Z)}$$

$$\hat{p} = p + Z\sigma_{\hat{p}} \quad \text{(use correct sign of Z)}$$

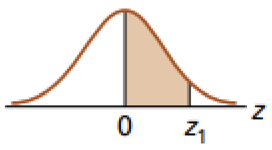
$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

adm T06 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).

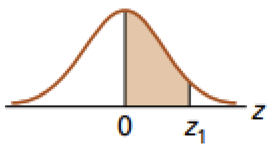


-2.24
and
2.24

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

adm T06 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).



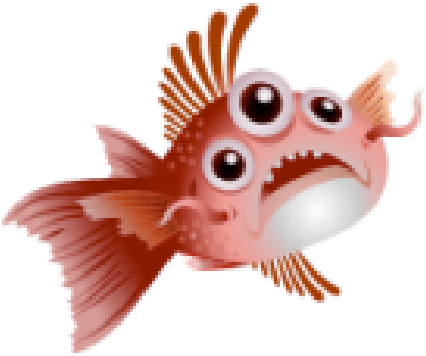
-2.24
and
2.24

z_1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998									
4.0	.49997									
4.5	.499997									
5.0	.4999997									
6.0	.499999999									

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)



We can't approximate to a normal distribution since n * (1 – p) < 5.

Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

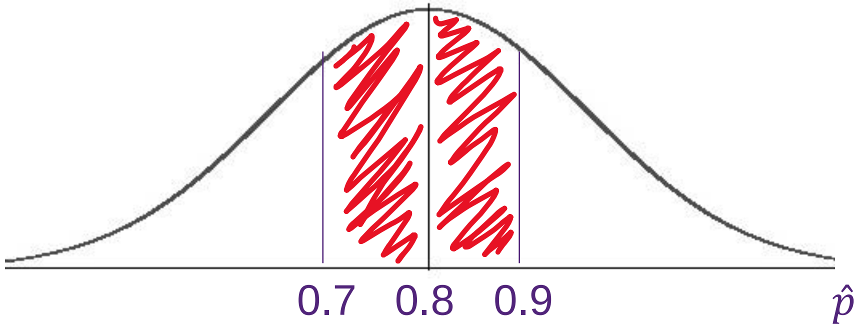
P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?

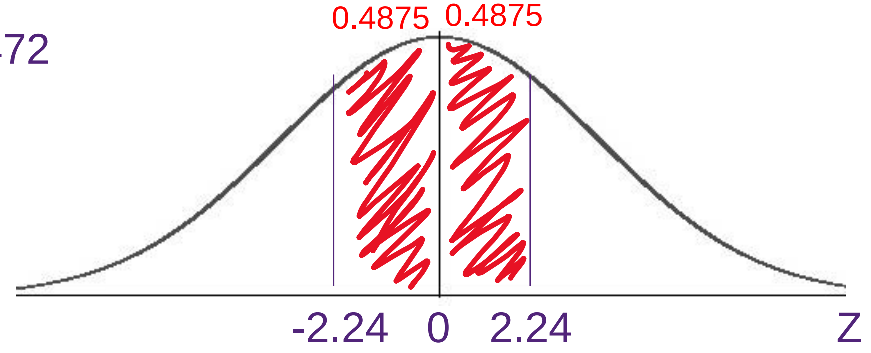
Z transformation

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} \text{ where } \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.80(1-0.20)}{80}} = 0.04472$$

$$P\left(\frac{0.70 - 0.80}{0.04472} < Z < \frac{0.90 - 0.80}{0.04472}\right) =$$

P(-2.24 < Z < 2.24) = ?





Summary: Rearranged useful formulae

$$Z = \frac{\hat{p} - p}{\sigma_{\hat{p}}} = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

$$\sigma_{\hat{p}} = \frac{\hat{p} - p}{Z}$$

34

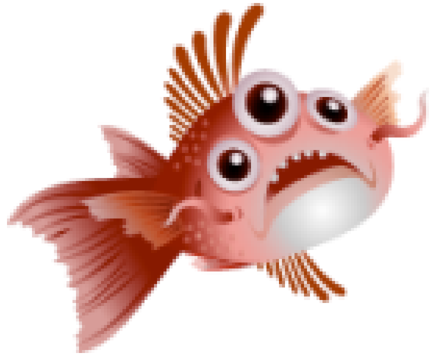
The University Of Queensland
AUSTRALIA

Q4. A doctor believes that 80% of all patients having a particular disease will be fully recovered within 3 days after receiving a new drug.

a) A simple random sample of 20 medical records will be used to develop an estimate of the proportion of patients who were fully recovered within 3 days after receiving the drug. If a data analyst suggests using a normal probability distribution to approximate the sampling distribution of $\hat{p}$, what would you say? Explain.

b) If the sample of patient records is increased to 80, what is the probability that the sample proportion will be within 0.1 of the population proportion? (Use p = .8)

0.9750



We can't approximate to a normal distribution since n * (1 – p) < 5.

Variable of interest: proportion of patients recovered

n = 80 households

p = 80% = 0.80

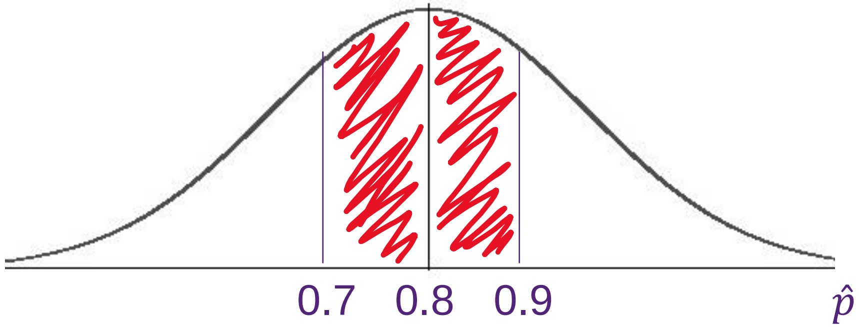
P(0.8 – 0.1 < $\hat{p}$ < 0.8 + 0.1) = P(0.7 < $\hat{p}$ < 0.9) = ?

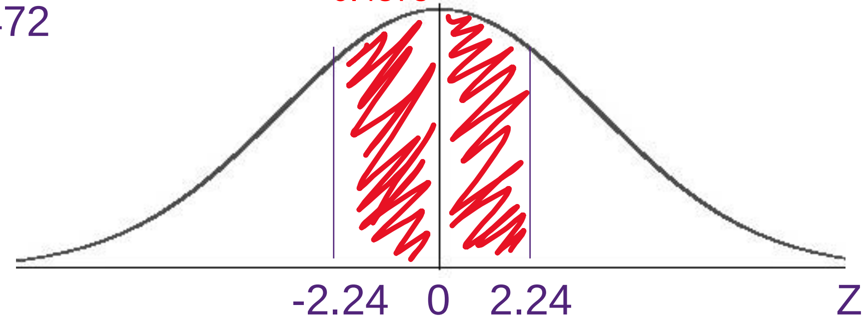
Z transformation

$Z = \dfrac{\hat{p} - p}{\sigma_{\hat{p}}}$ where $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}} = \sqrt{\dfrac{0.80(1-0.20)}{80}} = 0.04472$

$P\left(\dfrac{0.70 - 0.80}{0.04472} < Z < \dfrac{0.90 - 0.80}{0.04472}\right) =$

P(-2.24 < Z < 2.24) = 0.4875 + 0.4875 = 0.9750





Summary: Rearranged useful formulae

$Z = \dfrac{\hat{p} - p}{\sigma_{\hat{p}}} = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}}$

$p = \hat{p} - Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\hat{p} = p + Z\sigma_{\hat{p}}$ (use correct sign of Z)

$\sigma_{\hat{p}} = \dfrac{\hat{p} - p}{Z}$

34

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

ECON1310

Tutorial 6 – Week 7

SAMPLING DISTRIBUTIONS

At the end of this tutorial you should be able to

- Describe the characteristics of the sampling distributions for sample means and sample proportions
- Explain the importance of the Central Limit Theorem
- Calculate the z score for particular values of the sample mean or sample proportion
- Calculate the probability of obtaining particular values of the sample mean or sample proportion

THE UNIVERSITY OF QUEENSLAND AUSTRALIA | CREATE CHANGE

Thank you

Francisco Tavares Garcia

Academic Tutor | School of Economics

tavaresgarcia.github.io

Reference

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