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Quiz 10

Question 1

R-studio
```
> qnorm(1.98/2)
[1] 2.326348
```

The z-score associated with the 98 percent confidence interval is

a) 2.326

b) 1.985

c) 2.829

d) 2.254

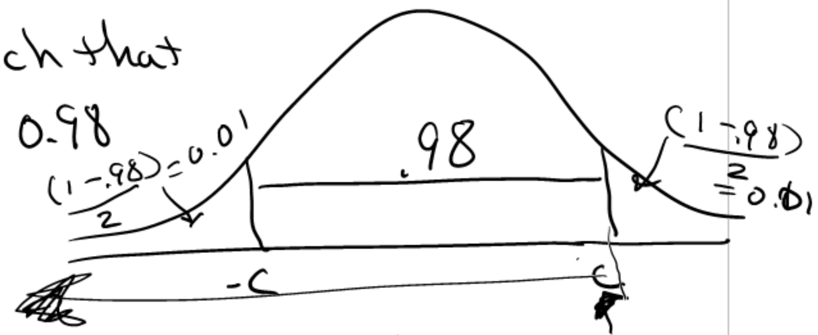
e) 2.054

f) None of the above

Confidence levels = .98

Determine c such that

$P(-c \le Z \le c) = 0.98$



$-c = qnorm(0.01)$

$= -2.326$

$c = qnorm(0.01 + 0.98) = qnorm(0.99)$

$= 2.326$

$\frac{1+.98}{2} = \frac{1.98}{2} = 0.99$

Question 2

What will reduce the width of a confidence interval?

→ reducing the margin of error

critical value * SE

a) Increase confidence level.

b) Decrease number in sample.

c) Increase variance.

d) Decrease variance.

Question 3

A simple random sample of 100 8th graders at a large suburban middle school indicated that 86% of them are involved with some type of after school activity. Find the margin of error associated with a 98% confidence interval that estimates the proportion of them that are involved in an after school activity.

a) 0.035

b) 0.071

c) 0.081

d) 0.131

e) 0.271

Confidence interval for proportion

$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Point estimate ± critical value * Standard error (SD)

⇓

margin of error

$m = 2.326 \sqrt{\frac{0.86(1-0.86)}{100}}$

```
> qnorm(1.98/2)*sqrt(0.86*(1-0.86)/100)
[1] 0.08072125
```

f) None of the above

Question 4

A simple random sample of 49 8th graders at a large suburban middle school indicated that 82% of them are involved with some type of after school activity. Find the 99% confidence interval that estimates the proportion of them that are involved in an after school activity.

$\hat{p}$ ± z^* SE

> 0.82+c(-1,1)*qnorm(1.99/2)*sqrt(0.82*(1-0.82)/49
[1] 0.6786284 0.9613716

$n = 49$ $\hat{p} = 0.82$ $C = .99$

CI for proportion

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$0.82 \pm qnorm(1.99/2)\sqrt{\frac{0.82(1-0.82)}{49}}$$

$0.82 \pm$

> qnorm(1.99/2)*sqrt(0.82*(1-0.82)/49)
[1] 0.1413716

$(0.82 - 0.1414, 0.82 + 0.1414)$

$(0.679, 0.961)$

width $= 0.961 - 0.679 = 0.282$

margin of error $= 0.141$

a) [0.679, 0.761]

b) [0.679, 0.961]

c) [0.729, 0.734]

d) [0.579, 0.911]

e) [0.599, 0.961]

f) None of the above

Question 5

Mars Inc. claims that they produce M&Ms with the following distributions:

Brown	30%	Red	20%	Yellow	20%
Orange	10%	Green	10%	Blue	10%

A bag of M&Ms was randomly selected from the grocery store shelf, and the color counts were:

Brown	21	Red	23	Yellow	19
Orange	16	Green	16	Blue	14

Find the 98% confidence interval for the proportion of brown M&Ms in that bag.

$n = 21 + 23 + 19 + 16 + 16 + 14 = 109$

$\hat{p} = 21/109 = 0.1927$

$1 - \hat{p} = 1 - 0.1927 = 0.8073$

$$0.1927 \pm qnorm(1.98/2) * \sqrt{\frac{0.1927 * 0.8073}{109}}$$

> 0.1927+c(-1,1)*qnorm(1.98/2)*sqrt(0.1927*0.8073/109)
[1] 0.104814 0.280586

a) [0.105, 0.081]

b) [0.105, 0.281]

c) [0.155, 0.160]

d) [0.005, 0.231]

e) [0.025, 0.281]

f) None of the above

Question 6

Mars Inc. claims that they produce M&Ms with the following distributions:

Brown	30%	Red	20%	Yellow	20%
Orange	10%	Green	10%	Blue	10%

A bag of M&Ms was randomly selected from the grocery store shelf, and the color counts were:

Brown	21	Red	23	Yellow	19
Orange	16	Green	16	Blue	14

$n = 109$

$\hat{p} = \frac{16}{109} = 0.1468$

Find the 98% confidence interval for the proportion of orange M&Ms in that bag.

$1 - \hat{p} = 0.8532$

$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

a) [0.068, 0.026]

b) [0.068, 0.226]

```
> 0.1468+c(-1,1)*qnorm(1.98/2)*sqrt(0.1468*0.8532/109)
[1] 0.06794126 0.22565874
```

c) [0.118, 0.123]

d) [-0.032, 0.176]

e) [-0.012, 0.226]

f) None of the above

Question 7

Mars Inc. claims that they produce M&Ms with the following distributions:

Brown	30%	Red	20%	Yellow	20%
Orange	10%	Green	10%	Blue	10%

How many M&Ms must be sampled to construct the 97% confidence interval for the proportion of orange M&Ms in that bag if we want a margin of error of ± .15?

$p^* = 0.1 \quad m = 0.15 \quad C = .97$

$n = ?$

$m = z^* \sqrt{\frac{p^*(1-p^*)}{n}}$ solve for n

a) 19

b) 18

c) 15

$n > p^*(1-p^*)\left(\frac{z^*}{m}\right)^2$

d) 14

```
> .1*(1-.1)*(qnorm(1.97/2)/0.15)^2
[1] 18.83717
```

e) 21

$n > 18.837$

f) None of the above

Question 8

An experimenter flips a coin 100 times and gets 58 heads. Find the 95% confidence interval for the probability of flipping a head with this coin.

c prop

a) [0.483, 0.477]

b) [0.483, 0.677]

c) [0.533, 0.538]

d) [0.383, 0.627]

e) [0.403, 0.677]

f) None of the above

$n = 100 \quad x = 58 \quad \hat{p} = 0.58 \quad C = .95$

$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

```
> .58+c(-1,1)*qnorm(1.95/2)*sqrt(.58*.42/100)
[1] 0.4832643 0.6767357
```

Question 9

Suppose that prior to conducting a coin-flipping experiment, we suspect that the coin is fair. How many times would we have to flip the coin in order to obtain a 98% confidence interval of **width** of at most .15 for the probability of flipping a head?

a) 187

b) 188

c) 241

d) 245

e) 240

f) None of the above

$p^* = 0.5 \quad n = ? \quad C = .98 \quad \text{width} = 0.15 \quad m = \frac{0.15}{2} = 0.075$

$n > p^*(1-p^*)\left(\frac{z^*}{m}\right)^2$

```
> 0.5*0.5*(qnorm(1.98/2)/0.075)^2
[1] 240.5286
```

$n > 240.52$

Question 10

It has been observed that some persons who suffer acute heartburn are diagnosed with it again within one year of the first episode. This is due, in part, to damage from the first episode. In order to examine the percentage of the persons who suffer acute heartburn a second time, a random sample of 1100 people who suffered acute heartburn was collected. It was observed that 17 of them again suffered acute heartburn within one year. Select a 99% confidence interval for the true proportion of those who suffer a second episode.

a) [0.00590, 0.0251]

b) [0.00690, 0.0551]

c) [0.0890, 0.0551]

d) [0.00690, 0.0351]

e) [0.00890, 0.0651]

$n = 1100 \quad X = 17 \quad C = 99\% \quad \hat{p} = \frac{17}{1100} = 0.0155$

```
> 0.0155+c(-1,1)*qnorm(1.99/2)*sqrt(0.0155*(1-0.0155)/1100)
[1] 0.005906116 0.025093884
```

f) None of the above

Question 11

When solving for the sample size required to estimate *p* to within a particular margin of error, under what circumstances do we use $\hat{p} = .5$?

a) When $\hat{p} = .4$ and $1 - \hat{p} = .6$

b) When the variance is equal to .5 or when we desire a most conservative sample size.

c) When the computed value of $\hat{p} = .5$

d) When we have no prior information on the approximate value of $\hat{p}$ or *p*.

e) When the margin of error desired is less than or equal to .5

f) None of the above

Question 12

Television viewers often express doubts about the validity of certain commercials. In an attempt to answer their critics, a large advertiser wants to estimate the true proportion of consumers who believe what is shown in commercials. Preliminary studies indicate that about 40% of those surveyed believe what is shown in commercials. What is the minimum number of consumers that should be sampled by the advertiser to be 97% confident that their estimate will fall within 2% of the true population proportion?

$p^* = 0.4 \quad C = 97\% \quad m = 0.02$

$n > 0.4 * (1-0.4) * \left(\frac{\text{qnorm}(1.97/2)}{0.02}\right)^2$

$n > 2825.575$

a) 2826

b) 2819

c) 2841

d) 2846

e) 2808

f) None of the above

Question 13

An oil company is interested in estimating the true proportion of female truck drivers based in five southern states. A statistician hired by the oil company must determine the sample size needed in order to make the estimate accurate to within 3% of the true proportion with 97% confidence. What is the minimum number of truck drivers that the statistician should sample in these southern states in order to achieve the desired accuracy?

$p^* = 0.5 \quad m = 0.03 \quad C = 97\%$

$n > 0.5(1-0.5)\left(\frac{\text{qnorm}(1.97/2)}{0.03}\right)^2$

a) 1325

b) 1295

$n > 1308.137$

c) 1309

d) 1324

e) 1302

f) None of the above

Question 14

It has been observed that some persons who suffer colitis, again suffer colitis within one year of the first episode. This is due, in part, to damage from the first episode. The performance of a new drug designed to prevent a second episode is to be tested for its effectiveness in preventing a second episode. In order to do this two groups of people suffering a first episode are selected. There are 118 people in the first group and this group will be administered the new drug. There are 145 people in the second group and this group wil be administered a placebo. After one year, 18% of the first group has a second episode and 13% of the second group has a second episode. Select a 95% confidence interval for the difference in true proportion of the two groups.

$n_1 = 118 \quad n_2 = 145$

$\hat{p}_1 = 0.18 \quad \hat{p}_2 = 0.13$

$C = 95\% \quad p_1 - p_2 = ?$

use two-sample proportions

$(\hat{p}_1 - \hat{p}_2) \pm \text{qnorm}(1.95/2) * \text{sqrt}\left(\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}\right)$

```
> (0.18-0.13)+c(-1,1)*qnorm(1.95/2)*sqrt(0.18*0.82/118+0.13*0.87/145)
[1] -0.03832563  0.13832563
```

a) [-0.138, -0.085]

b) [-0.066, 0.166]

c) [-0.166, 0.066]

d) [-0.038, 0.138]

e) [-0.538, 0.638]

f) None of the above

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Quiz 11

Question 1

width = 2*me

As the length of the confidence interval for the population mean increases, the degree of confidence in the interval's actually containing the population mean

a) decreases

b) increases

c) does not change

Question 2

The gas mileage for a certain model of car is known to have a standard deviation of 6 mi/gallon. A simple random sample of 64 cars of this model is chosen and found to have a mean gas mileage of 27.5 mi/gallon. Construct a 97.5% confidence interval for the mean gas mileage for this car model.

$\sigma = 6$ population SD $n = 64$ $\bar{x} = 27.5$ $c = 97.5\%$

z-CI for mean

$$\bar{x} \pm z^* \frac{\sigma}{\sqrt{n}}$$

```
> 27.5+c(-1,1)*qnorm(1.975/2)*6/sqrt(64)
[1] 25.81895 29.18105
```

a) [15.740, 39.260]

b) [25.819, 29.181]

c) [27.290, 27.710]

d) [26.030, 28.970]

e) [14.054, 40.946]

f) None of the above

Question 3

If the 90% confidence limits for the population mean are 45 and 55, which of the following could be the 99% confidence limits

a) [48, 55]

b) [49, 53]

c) [42, 58]

d) [46, 51]

e) [49, 51]

f) None of the above

Question 4

A 95% confidence interval for the mean of a population is to be constructed and must be accurate to within 0.3 unit. A preliminary sample standard deviation is 2.3. The smallest sample size n that provides the desired accuracy is

$m = z^* \frac{\sigma}{\sqrt{n}}$ $n = ?$ solve for n

a) 230

b) 226

$n > \left(\frac{z^* \sigma}{m} \right)^2$

c) 215

d) 223

$n > \left(\frac{\text{qnorm}(1.95/2) * 2.3}{0.3} \right)^2$

e) 232

f) None of the above

$n > 225.79$

Question 5

An SRS of 28 students at UH gave an average height of 5.9 feet and a standard deviation of .1 feet. Construct a 90% confidence interval for the mean height of students at UH.

$n = 28$ $\bar{x} = 5.9$ $s = 0.1$ sample SD $c = 90\%$

t - confidence interval:

$df = n - 1 = 27$

$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$

$\bar{x} \pm t^* \frac{s}{\sqrt{n}}$

```
> 5.9+c(-1,1)*qt(1.9/2,27)*.1/sqrt(28)
[1] 5.867811 5.932189
```

a) [5.868, 5.932]

b) [4.400, 7.700]

c) [5.730, 6.070]

d) [4.650, 7.350]

e) [5.894, 5.906]

f) None of the above

Question 6

Which test statistic should be used when computing a confidence interval given only the number in a sample, the sample mean and sample standard deviation?

a) z

b) t

~~**c)** μ~~

Question 7

Location is known to affect the number, of a particular item, sold by an auto parts facility. Two different locations, A and B, are selected on an experimental basis. Location A was observed for 13 days and location

B was observed for 18 days. The number of the particular items sold per day was recorded for each location. On average, location A sold 39 of these items with a sample standard deviation of 8 and location B sold 55 of these items with a sample standard deviation of 2. Select a 90% confidence interval for the difference in the true means of items sold at location A and B.

a) [-17.95, -14.05]

b) [-19.85, -12.15]

c) [35.78, 42.22]

d) [90.78, 97.22]

e) [51.78, 58.22]

f) None of the above

Location A: $n_1 = 13$, $\bar{x}_1 = 39$, $s_1 = 8$

Location B: $n_2 = 18$, $\bar{x}_2 = 55$, $s_2 = 2$

90% CI for $\mu_1 - \mu_2$

$(\bar{x}_1 - \bar{x}_2) \pm qt(1.9/2, 12) * \sqrt{\frac{8^2}{13} + \frac{2^2}{18}}$

```
> (39-55)+c(-1,1)*qt(1.9/2,12)*sqrt(8^2/13+2^2/18)
[1] -20.04281 -11.95719
```

Question 8

An auditor for a hardware store chain wished to compare the efficiency of two different auditing techniques. To do this he selected a sample of nine store accounts and applied auditing techniques A and B to each of the nine accounts selected. The number of errors found in each of techniques A and B is listed in the table below:

Errors in A	Errors in B
45	31
48	37
46	39
48	37
52	54
50	45
49	49
40	41
45	50

D = A - B

Select a 99% confidence interval for the true mean difference in the two techniques.

$\mu_D \Rightarrow$ paired t-test

a) [-7.557, 7.557]

b) [-3.113, 12.001]

c) [2.195, 6.693]

d) [1.084, 7.804]

e) [1.925, 6.963]

f) None of the above

```
> a
[1] 45 48 46 48 52 50 49 40 45
> b
[1] 31 37 39 37 54 45 49 41 50
> t.test(a,b,conf.level = .99,paired = T)
```

← input

```
Paired t-test

data:  a and b
t = 1.9761, df = 8, p-value = 0.08356
alternative hypothesis: true difference in means is not equal to 0
99 percent confidence interval:
 -3.10230 11.99119
sample estimates:
mean of the differences
              4.444444
```

Question 9

An automobile manufacturer claims his best product has an average lifespan of exactly 20 years. A skeptical product evaluator asks for evidence (data) that might be used to evaluate this claim. The product evaluator was provided data collected from a random sample of 45 people who used the product. Using the data, an average product lifespan of 21 years and a standard deviation of 8 years was calculated. Select the 99%, confidence interval for the true mean lifespan of this product.

a) [17.422, 24.578]

b) [16.923, 23.077]

c) [-3.0769, 3.0769]

d) [20.541, 21.459]

e) [17.923, 24.077]

f) None of the above

Question 10

An important problem in industry is shipment damage. A electronics distribution company ships its product by truck and determines that it cannot meet its profit expectations if, on average, the number of damaged items per truckload is greater than 12. A random sample of 12 departing truckloads is selected at the delivery point and the average number of damaged items per truckload is calculated to be 11.3 with a calculated sample of variance of 0.49. Select a 99% confidence interval for the true mean of damaged items.

a) [48.26, -30.02]

b) [10.67, 11.93]

c) [-0.6285, 0.6285]

d) [10.69, 11.91]

e) [11.37, 12.63]

f) None of the above