Practice Exam (2)

Q1 Let X be a random variable that is distributed according to the normal distribution with mean 30 and variance I00. A random sample of size 30 is taken, then the distribution of the sample average is:

A)Bin (30 ,6) B) N(30,100) C) N(30,3.33) D) N(30,36) E) none

Q2 Suppose the weights of a certain population are normally distributed with mean 70 and variance 100. if a random sample of size 50 is to be drawn, what is the probability their total weight exceeds 1500:

A) 28.3 B) 1 C) -28.3 D) 4.4 E) none

Q3 Using t-tables, Report the t-table for the 80% confidence interval with d.f. = 10

A) 2.797 B) 2.060 C) 1.316 D) 1.372 E) None

Q4 Suppose that a random sample of size 100 is drown from a population with mean 70 & standard deviation 20. what is the probability that the sample mean $\bar{X}$ is More than 70:

A) 0.9944 B) 0.8921 C) 0.5 D) 1

Q5 A hospital specializes in treating overweight patients. These patients have weight that are independently, normally distributed with mean 200kg and standard deviation 15kg. The elevator in the hospital will break if the total weight of people inside it exceeds 6060kg. 30 patients enter the elevator. The probability that the elevator will break equals:

A) 0.7673 B) 0.6064 C) 0.2327 D) 0.1357 E) 0.0143

Q6 Determine whether the statement is true or false.

1) As the sample size increases, the mean of the distribution of sample means increases.
2) As the sample size increases, the standard deviation of the distribution of sample means increases.
3) A sampling distribution is normal only when the population is normal.

Q7 From 1975 through 2016, the mean gain of the Dow Jones Industrial Average was 456. A random sample of 32 years is selected from this population. What is the probability that the mean gain for the sample was between 200 and 500?
Assume σ = 1215

Q8 Let $X_1, X_2, \ldots, X_9 \sim N(50, \sigma^2)$. If the sample standard deviation is 16.13.

I. $P(\bar{X} > 60)$

A) 0.95 B) 0.99 C) 0.05 D) 0.2343

II. the 90th percentile of $\bar{X}$.

A) 57.51 B) 0.99 C) 56.1 D) 72.53

Q9 It is known that 60% of the male students are smoking. In a sample of size 100, let $\hat{P}$ be the sample proportion. The standard deviation of $\hat{P}$

A) 0.24 B) 0.049 C) 0.034 D) 0.0024

Q10 A sample of size 16 is chosen from a population with mean 250 and the sample standard deviation 25. In such a case, the probability that the sample mean is less than 236.68 is:

A) 0.025 B) 0.25 C) 0.50 D) 0.655

Q11 A sampling distribution is the probability distribution for which one of the following:

A) A population B) A population parameter

C) A sample D) A sample statistics

Q12 You randomly select 25 newly constructed houses. The sample mean construction cost is $181,000 and the population standard deviation is $28,000. Assuming construction costs are normally distributed, should you use the standard normal distribution?

Q13 It is known that 35 percent of the members of a certain population suffer from one or more chronic diseases. What is the probability that in a sample of 200 subjects drawn at random from this population 80% or more will have at least one chronic disease?

Q14 About 63% of the residents in a town are in favor of building a new high school. One hundred five residents are randomly selected. What is the probability that the sample proportion in favor of building a new school is less than 55%?

Q15 About 74% of the residents in a town say that they are making an effort to conserve water or electricity. One hundred ten residents are randomly selected. Write the distribution of sample proportion?

Q16 In a random sample of 1000 student, 75% prefer to study at the school campus. The standard error (standard deviation) of the sample proportion is:

A)0.0126 B) 0.0145 C) 0.7500 D) 0.2500 E) 0.0137

Q17 In a simple random survey of 89 students of faculty of medicine at the University of Jordan, 73 said that principles of statistics was the most satisfying, most enjoyable course they had ever studied, A 98% confidence interval estimate of the proportion of all faculty of medicine students who feel this way is:

A)0.820 ± 0.095 B) 0.820 ± 0.041 C) 0.820 ± 0.84

D)0.820 ± 0.223 E)0.820 ± 0004

Q18 What is the sample size for which a 95% confidence interval for the population proportion (p) has margin of error equal to 0.04?

A) 601 B) 600 C) 600.25 D) 24 E) 24.5

Q19 Which of the following statement is true?

1. The center of a confidence interval is a population parameter.
2. The bigger the margin of error, the smaller the confidence interval .
3. The confidence interval is a type of point estimate.
4. A population mean is an example of a point estimate.

A) 1 Only B) 2 Only C) 3 Only D) 4 Only E) None

Q20 Suppose the height of university trees (in meters) is normally distributed with mean μ and standard deviation σ. If we wish to construct a 95% C.I for the mean of the heights, we can minimize the error of estimation by:

A)Increasing the variance B) increasing the sample size

C) decreasing the sample size D) none

Q21 Which statistic is the best unbiased estimator for μ?

A) S B) $\bar{X}$ C) The median D) The mode

Q22 For the same sample statistics, which level of confidence would produce the widest confidence interval? Explain your reasoning.

A) 90% B) 95% C) 98% D) 99%

Q23 A government agency reports a confidence interval of (26.2, 30.1) when estimating the mean commute time (in minutes) for the population of workers in a city. Use the confidence interval to find the estimated margin of error. Then find the sample mean.

A) $\bar{X}$ = 1.95 and E=28.15 B) E=1.95 and $\bar{X}$=28.15

C) E=26.2 and $\bar{X}$=30.1 D) we can't find them.

Q24 From a random sample of 48 business days from November 14, 2017, through January 23, 2018, London's crude oil prices had a mean of \$59.23. Assume the population standard deviation is \$2.79. Use this information to construct 95% confidence interval for the population mean.

Q25 In a random sample of eight people, the mean commute time to work was 35.5 minutes and the standard deviation was 7.2 minutes. Assume the population is normally distributed, find the margin of error and construct a 95% confidence interval for the population mean.

Q26 Write the claim as a mathematical statement. State the null and alternative hypotheses and identify which represents the claim.

1. The mean of the sale price of a bike is no more than \$225.
2. According to a recent survey, 73% of college students did not use student loans to pay for college.

Q27 To compare the dry braking distances from 60 to 0 miles per hour for two makes of automobiles, a safety engineer conducts braking tests for 23 models of Make A and 24 models of Make B. The mean braking distance for Make A is 137 feet. Assume the sample standard deviation is 5.5 feet. The mean braking distance for Make B is 132 feet. Assume the sample standard deviation is 6.7 feet. At α = 0.10, find the test statistics?

Q28 A demographics researcher claims that the mean household income in a recent year is greater in Cuyahoga County, Ohio, than it is in Wayne County, Michigan. In Cuyahoga County, a sample of 19 residents has a mean household income of $45,600 and a standard deviation of $2,800. In Wayne County, a sample of 15 residents has a mean household income of $41,500 and a standard deviation of $1,310. At α = 0.05, find the pooled standard deviation?

Q29 We want to test $H_0 : M = 60$ Vs $H_1 : M \neq 60$ using a random sample of size 25 , selected from a population N~(M , 49) of $\alpha = 0.01$. In such a case we reject H_0 if the value of the test statistic is :

A) Between -2.57 and 2.57
B) Between -1.96 and 1.96
C) Smaller than -2.57 and Bigger than 2.57
D) Smaller than -1.64 and Bigger than 1.64

Q30 A tire manufacturer claims that a new design of their radial tires will drive and last for 50,000 miles . A consumer affair representative believes the tires will drive on the average for less than 50,000 miles. The correct pair of hypotheses to test this belief is :

A)$H_0 : \mu < 50,000$ VS. $H1: \mu \neq 50,000$

B) $H_0 : \mu = 50,000$ VS. $H1: \mu > 50,000$

C) $H_0 : \mu = 50,000$ VS. $H1 : \mu < 50,000$

D) $H_0 : \mu < 50,000$ VS. $H1 : \mu = 50,000$

E) $H_0 : \mu < 50,000$ VS $H1 : \mu > 50,000$

Q31 In testing: $H_0: \mu \geq \mu_0$ vs $H_1: \mu < \mu_0$

If the null hypothesis is not rejected when the alternative hypothesis is true

A) A type 1 error is committed
B) A type 2 error is committed
C) A power of the test is committed
D) A two tailed test is made
E) A test statistic is found

Q32 Test the claim about the population mean μ at the level of significance α. Assume the population is normally distributed.
Claim: $\mu \neq 40$; $\alpha = 0.05$; $\sigma = 1.97$ Sample statistics: $\bar{X} = 39.2$, n = 25.

Q33 A stock market analyst claims that four of the stocks that make up the Dow Jones Industrial Average lost value from one hour to the next on one business day. The table shows the prices (in dollars per share) of the four stocks at one time during the day and then an hour later. At $\alpha = 0.01$, compute the test statistics?

Stock	1	2	3	4
Price (First hour)	183.72	31.46	64.26	68.11
Price (Second hour)	182.85	31.62	64.20	68.20

Answers:

Q1 $\overline{X} \sim N\left(30, \frac{100}{30}\right) = N(30\,, 3.33) \rightarrow C$

Q2 $P(\Sigma x_i > 1500) = P\left(\frac{\Sigma x_i}{50} > \frac{1500}{50}\right) = P(\overline{X} > 30) = P\left(z > \frac{30-70}{10\sqrt{50}}\right)$

$= P(Z > -28.3) \quad = P(z < 28.3) = 1 \rightarrow B$

Q3 $1 - \alpha = 0.80 \rightarrow \alpha = 0.2 \rightarrow \frac{\alpha}{2} = 0.1 \rightarrow 0.80 + 0.10 = 0.90 \rightarrow t_{0.90}^{(10)} = 1.372 \rightarrow D$

Q4 $\overline{X} \sim N\left(70\,, \frac{20^2}{100}\right)$

$P(\bar{X} > 70) = P\left(Z > \frac{70-70}{20/\sqrt{100}}\right) = P(Z > 0) = 1 - P(Z < 0) = 1 - 0.5 = 0.5 \rightarrow C$

Q5 $\mu = 200$, $\sigma = 15$, n = 30

$P(\sum X_i \geq 6060) = P\left(\frac{\sum X_i}{n} \geq \frac{6060}{30}\right) = P(\bar{X} \geq 202) = P\left(Z \geq \frac{202-200}{15/\sqrt{30}}\right)$

$= P(Z \geq 0.73) = 1 - P(Z < 0.73) = 0.2327 \rightarrow C$

Q6

1) False, it doesn't change.
2) False, the standard deviation will decrease.
3) False, A sampling distribution is normal when either $n \geq 30$ or the The population is normal.

Q7 $n = 32\,, \mu = 456\,, \sigma = 1215$

$P(200 < \bar{x} < 500) = P\left(\frac{200-456}{\frac{1215}{\sqrt{32}}} < \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}} < \frac{500-456}{\frac{1215}{\sqrt{32}}}\right) =$

$P(-1.19 < z < 0.20) = P(z < 0.20) - P(z < -1.19)$

$= 0.5793 - 0.1170 = 0.4623$

Q8 $X_9 \sim N(50\,, \sigma^2)$ $, S = 16.13$

i) σ unknown, $\quad$ $d.f = 8$

$P(\overline{X} > 60) = P\left(t > \frac{60-50}{16.13/\sqrt{9}}\right) = P(t > 1.86) = 0.05 \rightarrow C$

ii) $P(\overline{X} < P_{90}) = 0.90 \rightarrow P\left(t < \frac{P_{90}-50}{16.13/\sqrt{9}}\right) = 0.90$

$P\left(t > \frac{P_{90}-50}{16.13/\sqrt{9}}\right) = 0.10 \quad , \quad d.f = 8$

$\therefore \frac{P_{90}-50}{16.13/3} = 1.397 \rightarrow P_{90} = 57.51 \rightarrow A$

Q9

$\widehat{P} \sim N\left(0.60\,, \frac{0.6(0.4)}{100}\right) \rightarrow \text{std} = \sqrt{\frac{0.6(0.4)}{100}} = 0.049 \rightarrow B$

Q10

σ is unknown → t – distribution.

$P(\bar{X} < 236.68) = P(\frac{\bar{X}-\mu}{S/\sqrt{n}} < \frac{236.68-250}{25/\sqrt{16}}) = P(t < -2.131)$ with d.f = 15

P(t < -2.131) = P(t > 2.131) “since it is symmetric ”

P(t > 2.131) = 0.025 → A

Q11 The answer is D.

Q12 $n = 25, \bar{x} = 181{,}000, \sigma = 28{,}000$

Yes, because the population standard deviation σ is known

Q13 $p = 0.35\,, n = 200$

$$P(\hat{p} \geq 0.80) = P\left(\frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}} \geq \frac{0.80-0.35}{\sqrt{\frac{0.35(0.65)}{200}}}\right) = P(z > 13.3) \; = P(z < -13.3) = 0$$

Q14 $p = 0.63\,, n = 105$

$$P(\hat{p} \leq 0.55) = \left(\frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}} \geq \frac{0.55-0.63}{\sqrt{\frac{0.63(0.37)}{105}}}\right) = P(z \leq -1.697) = P(z < -1.7) = 0.0446$$

Q15 $\hat{p} \sim N\left(p, \frac{p(1-p)}{n}\right) \equiv N\left(0.74, \frac{0.74(1-0.74)}{110}\right)$

Q16 SE = $\sqrt{\frac{\hat{P}(1-\hat{P})}{n}}$ = $\sqrt{\frac{0.75*0.25}{1000}}$ = 0.0137 → E

Q17 $\hat{P} = \frac{X}{n} = \frac{73}{89}$ = 0.820

$Z^*_{0.98}$ = 2.33

$\hat{P} \mp Z_{\frac{\alpha}{2}} * \sqrt{\frac{\hat{P}(1-\hat{P})}{n}}$ = 0.820 ∓ 2.33 * $\sqrt{\frac{0.82*0.18}{89}}$ = 0.820 ∓ 0.095 → A

Q18 $\hat{P}$ is not given , so assume $\hat{P}$ = 0.5 and $Z^*_{0.95}$ = 1.96

n = $(\frac{Z_{\alpha/2}}{E})^2 * \hat{P}(1-\hat{P}) = \left(\frac{1.96}{0.04}\right)^2$ * 0.5*0.5 = 600.25 = 601 → A

Q19 The answer is none → E

Q20 we can minimize the error of estimation by increasing the sample size → B

Q21 $\bar{X} \rightarrow B$

Q22 As the confidence level increases, the error of the estimation increases and the C.I becomes wider → D

Q23 (26.2,30.1) → C.I

Sample mean $\bar{X} = \frac{L+U}{2} + \frac{26.2+30.1}{2} = 28.15$

$(\bar{X} - E, \bar{X} + E) = (26.2,30.1)$

$26.2 = \bar{X} - E \rightarrow 26.2 = 28.15 - E \rightarrow E = 1.95 \rightarrow B$

Q24 $n = 48, \bar{X} = 59.23, \sigma = 2.79$

$Z_{95\%} = 1.96$

$$\bar{X} \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}} = 59.23 \pm 1.96\frac{2.79}{\sqrt{48}} \equiv (58.44,60.02)$$

Q25 $n = 8, \bar{x} = 35.5\ , S = 7.2\ \rightarrow \sigma$ not given $\rightarrow t$

$$1 - \alpha = 0.95 \rightarrow t = 0.05 \rightarrow \frac{\alpha}{2} = 0.025 \rightarrow 0.95 + 0.025 = 0.975\ \rightarrow\ t_{0.025}^{(7)} = 2.365$$

$$E = 2.365\frac{7.2}{\sqrt{8}} = 6.02$$

$$\bar{x} \pm t_{\alpha}2\frac{S}{\sqrt{n}} = 35.5 \pm 6.02 = (29.48,41.52)$$

Q26

1) H_0: $M = 225$ Vs. H_1: $M \leq 225$.
2) H_0: $P = 0.73$ Vs. H_1: $P \neq 0.73$.

Q27

Make (A)	Make (B)
$n = 23$	$m = 24$
$\bar{x} = 137$	$\bar{Y} = 132$
$S_1 = 5.5$	$S_2 = 6.7$

$$Sp = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}} = \sqrt{\frac{22(5.5)^2 + 23(6.7)^2}{23 + 24 - 2}} = 6.14$$

$$t = \frac{\bar{x} - \bar{y}}{S\sqrt{\frac{1}{n} + \frac{1}{m}}} = \frac{137 - 132}{6.14 * \sqrt{\frac{1}{23} + \frac{1}{24}}} = 2.79$$

Q28

Cuyahoga Country	Wayne Country
$n = 19$	$m = 15$
$S_1 = 2{,}800$	$S_2 = 1{,}310$

$$Sp = \sqrt{\frac{(n-1)S_1^2 + (m-1)S_2^2}{n+m-2}} = \sqrt{\frac{(18)(2{,}800)^2 + (14)(1{,}310)^2}{19+15-2}} = 2271.74$$

Q29 It is two tailed test $\alpha = 0.01 \rightarrow \frac{\alpha}{2} = 0.005 \rightarrow Z_{0.005} = \mp 2.57 \rightarrow$ C

Q30 Testing that the average is less than 50,000 $\rightarrow$ C

Q31 The answer is B.

Q32

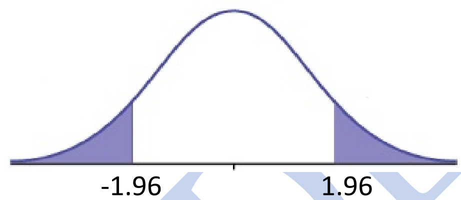
$n = 25, \bar{x} = 39.2, \sigma = 1.97, \alpha = 0.05$

$H_0: \mu = 40$ vs. $H_1: \mu \neq 40$

$Z = \frac{\bar{x}-\mu_0}{\sigma/\sqrt{n}} = \frac{39.2-40}{1.97/\sqrt{25}} = -2.03$

$\alpha = 0.05 \rightarrow \frac{\alpha}{2} = 0.025 \rightarrow Z_{0.025} = 1.96$

$\therefore$ We reject H_0



Q33

	1	2	3	4	$Total$
$1st$	183.72	31.46	64.26	68.11	
$2nd$	182.85	31.62	64.20	68.30	
d_i	0.87	-0.16	0.06	-0.09	0.68
d_i^2	0.7569	0.0256	0.0036	0.0081	0.7942

$\bar{d} = \frac{\sum d_i}{n} = \frac{0.68}{4} = 0.17$

$S^2 = \frac{\sum d_i^2}{n-1} - \frac{(\sum d_i)^2}{n(n-1)} = \frac{0.7942}{3} - \frac{(0.68)^2}{4(3)} = 0.2262$

$\therefore S = \sqrt{0.2262} = 0.476$

$t = \frac{\bar{d}-\mu_d}{sd/\sqrt{n}} = \frac{0.17-0}{0.476/\sqrt{4}} = 0.714$