Practice Quiz: Math 10 Chapter 7 (Chapter 5, 6, 7) for Central Limit Theorem for Averages

For each question, draw shade and label a graph. Show work finding the answer. Write the final answer in the form of a symbolic mathematical probability statement.

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1. The weights of apple pies made by Sue's Bakery follow a normal distribution with a mean weight of 32 ounces and a standard deviation of 1.6 ounces. We ae interested in the average weight for a sample of 5 pies.

a. In words, state what X and $\overline{X}$ represent for this problem and write their distributions.

$X =$ _____

$\overline{X} =$ _____

$X \sim$ _____ $\overline{X} \sim$ _____

b. Find the probability that the weight of a randomly selected apple pie is under 30 ounces.

c. The 30% of pies that are the heaviest weigh _____ or more ounces.

d. Find the 34th percentile of pie weights.

e. For a **sample of 5 pies**, find the probability that the **average weight** of the pies in the sample is under 30 ounces.

f. For **samples of 5 pies**, find the first quartile of sample average weights..

3. Suppose the amount of time it takes for an electrical component to fail follows an exponential distribution with an average time of 4 years. We are interested in the average amount of time until failure for a random sample of 75 electrical components.

a. In words, state what X and $\bar{X}$ represent for this problem and write their distributions.

$X =$ _____

$\bar{X} =$ _____

$X \sim$ _____ $\bar{X} \sim$ _____

Use the workspace below to show any calculations you needed to do to determine the distributions.

b. Find the probability that the time until failure for one of these electrical components is less than 4.5 years.

c. Find the probability that the **average time** until failure for a **sample of 75 electrical components** is less than 4.5 years.

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4. Suppose the ages of children in TOTS CARE day care center is uniformly distributed between 1.5 and 5 years old. We are interested in the average age of a random sample of 20 children.

a. In words, state what X and $\bar{X}$ represent for this problem and write their distributions.

$X =$ _____

$\bar{X} =$ _____

$X \sim$ _____ $\bar{X} \sim$ _____

Use the workspace below to show any calculations you needed to do to determine the distributions.

b. Find the probability that a randomly selected child at TOTS CARE day care center is less than 4 years old.

c. Find the probability that the **average age for a sample of 20 children** at TOTS CARE is less than 4 years old.

Practice Quiz: Math 10 Chapter 7 (Chapter 5, 6, 7) for Central Limit Theorem for Averages

For each question, draw shade and label a graph. Show work finding the answer. Write the final answer in the form of a symbolic mathematical probability statement. KEY

1. The weights of apple pies made by Sue's Bakery follow a normal distribution with a mean weight of 32 ounces and a standard deviation of 1.6 ounces. We ae interested in the average weight for a sample of 5 pies.

a. In words, state what X and $\bar{X}$ represent for this problem and write their distributions.

X = weight of one pie

$\bar{X}$ = average weight for a sample of 5 pies

$X \sim N(32, 1.6)$ $\quad \bar{X} \sim N(32, .7155)$ $\quad \sigma/\sqrt{n} = 1.6/\sqrt{5} = .7155$

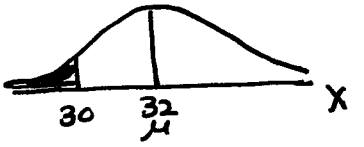
b. Find the probability that the weight of a randomly selected apple pie is under 30 ounces.

X = weight of one pie

$X \sim N(32, 1.6)$

normalcdf(-10^99, 30, 32, 1.6)

$P(X < 30) = .1056$



c. The 30% of pies that are the heaviest weigh 32.84 or more ounces.

X = weight of one pie

$X \sim N(32, 1.6)$

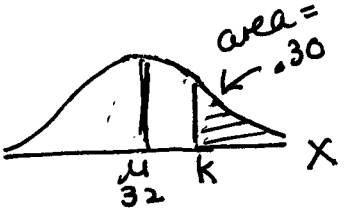
area to right = .3

area to left = 1 - .3 = .7

invnorm(.7, 32, 1.6) = k on most calculators

k = 32.84

$P(X \geq 32.84) = .30$



d. Find the 34th percentile of pie weights.

X = weight of one pie

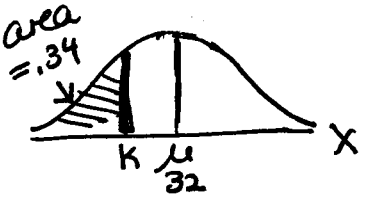
$X \sim N(32, 1.6)$

area to left = .34

invnorm(.34, 32, 1.6) = k on most calculators

k = 31.34

$P(X \leq 31.34) = .34$



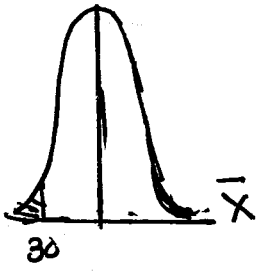
e. For a **sample of 5 pies**, find the probability that the **average weight** of the pies in the sample is under 30 ounces.

$\bar{X}$ = average weight for a sample of n=5 pies

$\bar{X} \sim N(32, .7155)$

normalcdf(-10^99, 30, 32, .7155)

$P(\bar{X} < 30) = .00259$



f. For **samples of 5 pies**, find the first quartile of sample average weights.

$\bar{X}$ = average weight for a sample of n=5 pies

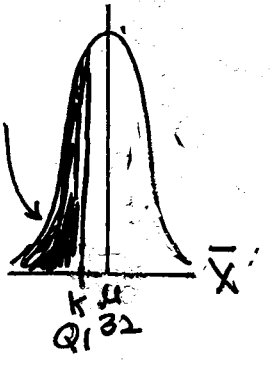
$\bar{X} \sim N(32, .7155)$

area to left = .25

invnorm(.25, 32, .7155) on most calculators

Q1 = 31.52

$P(\bar{X} < 31.52) = .25$



3. Suppose the amount of time it takes for an electrical component to fail follows an exponential distribution with an average time of 4 years. We are interested in the average amount of time until failure for a random sample of 75 electrical components.

a. In words, state what X and $\bar{X}$ represent for this problem and write their distributions.

X = time until failure for one electrical component

$\bar{X}$ = average time until failure for a sample of n = 75 components

$X \sim Exp(.25)$ $\bar{X} \sim N(4, .462)$

Use the workspace below to show any calculations you needed to do to determine the distributions.

$\mu = 4$

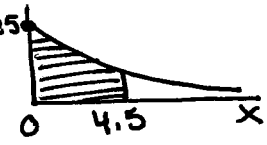
$m = \frac{1}{\mu} = \frac{1}{4} = .25$

$\sigma = \mu = 4$ so $\frac{\sigma}{\sqrt{n}} = \frac{4}{\sqrt{75}} = .462$

b. Find the probability that the time until failure for one of these electrical components is less than 4.5 years.

X = time until failure for one component

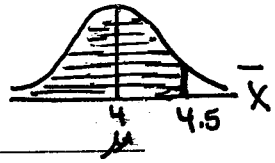
$X \sim Exp(.25)$ $1 - e^{-.25 * 4.5}$ $\boxed{P(X < 4.5) = .6753}$



c. Find the probability that the **average time** until failure for a **sample of 75 electrical components** is less than 4.5 years.

$\bar{X}$ = average time until failure for a sample of n = 75 components $\boxed{P(\bar{X} < 4.5) = .8604}$

$\bar{X} \sim N(4, .462)$ normalcdf(-10^99, 4.5, 4, .462)



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4. Suppose the ages of children in TOTS CARE day care center is uniformly distributed between 1.5 and 5 years old. We are interested in the average age of a random sample of 20 children.

a. In words, state what X and $\bar{X}$ represent for this problem and write their distributions.

X = age of a child at TOTS CARE

$\bar{X}$ = average age of a sample of 20 children at TOTSCARE

$X \sim U(1.5, 5)$ $\bar{X} \sim N(3.25, .226)$

Use the workspace below to show any calculations you needed to do to determine the distributions.

If $X \sim U(1.5, 5)$

$\mu = (1.5+5)/2 = 3.25$

$\sigma = (5-1.5)/\sqrt{12} = 1.01$

then $\frac{\sigma}{\sqrt{n}} = \frac{1.01}{\sqrt{20}} = .226$

b. Find the probability that a randomly selected child at TOTS CARE day care center is less than 4 years old.

X = age of one child

$X \sim U(1.5, 5)$

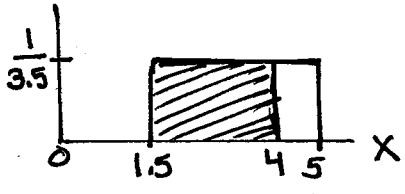
$f(x) = h = \frac{1}{5-1.5} = \frac{1}{3.5} = .2857$

(base)(height)

$= (4-1.5)(1/3.5)$

$= (2.5)(\frac{1}{3.5}) = .714$

$\boxed{P(X < 4) = .714}$



c. Find the probability that the **average age for a sample of 20 children** at TOTS CARE is less than 4 years old.

$\bar{X}$ = average age of 20 children

$\bar{X} \sim N(3.25, .226)$ normalcdf(-10^99, 4, 3.25, .226)

$\boxed{P(\bar{X} < 4) = .9995}$