

1. For problem #1, fill in the blank column in the two tables.

Consider the very simplistic population made up of only the 5 numbers

$\{1, 3, 5, 7, 9\}$

Suppose we select a simple random sample of 2 items from this population.

<u>Possible Outcomes</u>	<u>Probability</u>	<u>Possible Sample Mean $\bar{x}$</u>
1, 3		2
1, 5		3
1, 7		4
1, 9		5
3, 5		4
3, 7		5
3, 9		6
5, 7		6
5, 9		7
7, 9	_____	8
	1.0	

Combine rows with the same possible sample mean:

<u>Possible Sample Mean $\bar{x}$</u>	<u>Probability</u>
2	
3	
4	
5	
6	
7	
8	_____
	1.0

This is a list of all the possible values for a variable, and the probabilities associated with each of those possible values; i.e. this is a probability distribution.

Unlike other probability distributions we've seen so far, the "variable" of interest here is not an individual outcome, but rather is a sample statistic. In this case it is the mean of a sample, which is denoted by $\bar{x}$.

The probability distribution for a sample statistic is called a "Sampling Distribution". In problem #2 we will calculate the mean of this distribution, so we will be calculating "the mean of the possible sample means".

2. NOTE: For this problem, if you wish to use technology, it might be helpful to read the StatCrunch tutorial "STATCRUNCH Tutorial for expected value and standard deviation of a random variable (Chapter 5)(b).pdf"

For this Sampling Distribution (Frequency Distribution), what is the:

(a) Mean (Expected Value) $\mu = \sum [x \cdot P(x)]$

(no need to show work if using technology, just mention what you used)

NOTE: With more precise notation we might have written:

$\mu_{\bar{x}} = \sum [\bar{x} \cdot P(\bar{x})]$ to indicate we taking the mean of the population of all possible sample means

Thinking about how the symbol for a sample mean $\bar{x}$ shows up in the same equation as the symbol for a population mean μ may help you think about what a sampling distribution is. When we list all the possible values for something, we are describing a population. So when we list all the possible values for sample means, we have a population of sample means. We are taking the mean of that population, so again we are taking the "mean of the sample means".

(b) Shape/pattern you would expect, according to the Central Limit Theorem (no need to draw it, just describe it).

(c) What is the mean of the original population given in problem #1 (the original five numbers)?

How does this compare to the answer from (b)?

(d) What is the standard deviation σ of the original population given in problem #1?

(no need to show work if using technology, just mention what you used)

(e) What is the standard deviation of the sampling distribution?

HINT: We could calculate this from the sampling distribution. However we also know that the standard error of the mean, which is the standard deviation of the sampling distribution that we are looking for here, is given by:

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

(Show your calculation)

For the following problems, it might be helpful to read "STATCRUNCH Tutorial for normal probability (Chapter 6).pdf".

Use the equation $z = \frac{x - \mu}{\sigma}$ (which indicates a z-score is the number of standard deviations x is from the mean) to solve the following:

Sitting Back-To-Knee Length (inches)

	Mean	St. Dev.	Distribution
Males	23.5 in	1.1 in	Normal
Females	22.7 in	1.0 in	Normal

3. Find the probability that a female has a back-to-knee length greater than 24.0 in.:

(a) First find the z-score corresponding to 24.0 in (show calculation):

$z =$

(b) Use table A-2, what is the probability of a length less than 24.0 in?

$P(X < 24) =$

(c) Complement (b) to find the probability of a length greater than 24.0.

$P(X > 24) = 1 - P(X < 24) =$

(d) Use technology to directly find the answer. Describe what you did in some detail. If using StatCrunch, for instance, state what each field on the calculation screen was set to.

4. Find the probability that a male has a back-to-knee length between 24.0 in. and 26.0 in:

(a) First find the z scores corresponding to 26.0 in and 24.0 in (show calculations):

26 in: $z =$

24 in: $z =$

(b) Use table A-2, what is the probability of a length less than 26.0 in and the probability of a length less than 24.0?

$P(X < 26) =$

$P(X < 24) =$

(c) Subtract the two numbers from (b) to find the probability of a length between 24.0 and 26.0.

$P(24 < X < 26) = P(X < 26) - P(X < 24) =$

(d) Use technology to directly find the answer. Describe what you did in some detail. If using StatCrunch, for instance, state what each field on the calculation screen was set to.

For the following problems, it might be helpful to read "STATCRUNCH Tutorial for normal probability (Chapter 6).pdf".

Use the equation from #3, first solving for x to obtain $x = \mu + z\sigma$, to solve the following:

5. Men's heights are normally distributed with mean 68.6 and standard deviation 2.8 in. If the U.S. Air Force height requirements for men are set to exclude only the tallest 2.5% of men and the shortest 2.5% of men, calculate the height requirements in inches using the following steps:

(a) Using Table A-2 "in reverse", find the z-scores corresponding to 2.5% and 97.5%. Use the closest values to the probabilities in the tables, no need to interpolate.

$P < 0.975$: $z =$

$P < 0.025$: $z =$

(b) From the z scores, find the corresponding x values.

Be sure to include units and show your calculations.

0.975: $x =$

0.025: $x =$

So they are excluding men _____ than _____ in height and excluding men _____ than _____ in height.

(c) Use technology to verify the answer from (b). Describe what you did in some detail. If using StatCrunch, for instance, state what each field on the calculation screen was set to.

0.975: $x =$

0.025: $x =$