

How do you calculate sampling distributions in Excel?

Authored by
stats writer

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The process of calculating sampling distributions in Excel involves using statistical functions and formulas to analyze a sample of data and make inferences about the larger population from which the sample was taken. This can be done by first organizing the sample data in a spreadsheet and then using functions such as AVERAGE, STANDARDIZE, and CONFIDENCE to calculate measures such as the sample mean, standard deviation, and confidence intervals. These calculations can help determine the central tendency and variability of the sample data, and allow for the estimation of population parameters. Excel also offers the option to create graphs and charts to visually represent the sampling distribution. Overall, utilizing Excel for sampling distribution calculations can provide a reliable and efficient method for analyzing data and making statistical inferences.

Calculate Sampling Distributions in Excel

A sampling distribution is a probability distribution of a certain statistic based on many random samples from a single .

This tutorial explains how to do the following with sampling distributions in Excel:

Generate a sampling distribution. Visualize the sampling distribution. Calculate the mean and standard deviation of the sampling distribution. Calculate probabilities regarding the sampling distribution.

Generate a Sampling Distribution in Excel

Suppose we would like to generate a sampling distribution composed of 1,000 samples in which each sample size is 20 and comes from a normal distribution

with a mean of 5.3 and a standard deviation of 9.

We can easily do this by typing the following formula in cell A2 of our worksheet:

=NORM.INV(RAND(), 5.3, 9)

We can then hover over the bottom right corner of the cell until a tiny + appears and drag the formula to the right 20 cells and down 1,000 cells:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20
2	-14.3478	9.427724	6.41191	12.41153	-8.24302	6.381618	11.5354	14.50201	5.103956	11.26152	5.878546	26.79076	5.257913	22.77662	-6.071	-1.76196	18.22686	11.31325	13.93815	0.479712
3	27.16546	25.44272	0.882208	4.039182	4.181897	9.708091	11.48947	11.12963	11.78162	8.597135	7.193303	18.64945	4.876111	13.41833	19.22029	9.507522	9.241467	-3.73597	6.762841	19.90909
4	13.79445	-5.98839	0.809056	12.59813	4.707145	8.149118	-3.08282	9.212429	14.83148	-0.16035	17.50281	9.990323	10.28493	2.317118	16.60559	-2.24892	-5.34456	3.556385	1.854363	3.002711
5	-4.78071	-3.29673	12.86278	1.434419	12.67984	1.387565	-0.6056	6.770139	3.290494	12.07852	-0.36996	-13.3463	3.944265	22.6152	3.833341	-1.15977	0.814789	8.223065	13.30782	-9.23518
6	17.02983	3.375123	4.306389	0.911502	1.181418	10.45451	-10.6861	3.255356	-10.0396	-1.41185	1.717989	4.332279	8.355191	-1.47665	4.267777	1.589566	8.90931	2.660249	-6.3752	3.829714
7	-3.23865	26.52023	-1.5878	-6.26995	8.71232	-3.73426	4.818732	-5.32073	1.121144	12.11585	-3.69324	0.018888	-0.86529	8.679084	6.37755	-0.44015	6.191809	7.541581	-8.42945	5.261255
8	-2.87737	-9.55328	-8.2743	1.022951	17.4909	-3.42453	4.051349	-3.83616	6.251832	13.11334	3.644683	7.531315	8.776285	14.13575	7.215605	-9.33324	4.986041	14.52475	9.902011	15.87092
9	15.63742	-4.39394	6.285594	10.41558	10.52037	17.08537	-12.8884	-4.34923	-2.62318	16.49861	1.329042	13.54197	0.361993	10.35637	17.32712	7.771755	14.26686	8.609849	6.172321	7.860733
10	3.26881	7.722144	2.722006	1.755557	0.299	0.64552	11.40958	13.69103	-12.7907	1.22483	16.58394	4.196994	3.651579	-3.36173	15.33022	15.12278	13.10987	-5.74766	-11.3612	-1.22457
11	14.08954	-7.4207	18.07621	7.623785	-0.67097	18.88473	-9.94538	-1.88383	4.788754	16.42689	8.532977	12.70508	-11.3424	-4.72177	4.802661	0.222133	-1.63861	5.718594	-3.5927	2.335083
12	-5.63741	-7.02729	5.518323	19.37283	7.551738	5.985714	3.159656	3.889748	7.563939	27.52694	-1.89179	1.751063	2.013756	-0.42772	28.72887	10.74831	-3.17044	10.53117	7.14759	11.57939
13	15.79509	2.727566	1.487302	2.770588	15.1024	5.978842	7.69092	7.08799	4.570933	2.98918	0.595897	-11.8499	3.196037	8.761552	0.440966	11.51041	2.987297	15.49738	-1.31741	20.23163
14	5.367749	10.46109	9.583662	0.647727	8.837532	4.590372	12.11238	-0.29913	28.07044	3.09704	-4.04612	-0.39319	7.842675	3.864414	-9.83307	11.39651	1.114558	7.08748	-4.3725	-3.0126
15	8.907808	23.75535	11.17992	8.050923	6.318122	0.480674	1.686195	-0.3514	-1.69552	3.920678	-2.39118	3.419415	21.62053	1.701101	0.409567	12.63149	11.59317	-9.11533	12.85583	23.30873
16	-3.53068	-0.11266	14.20008	4.819141	9.376628	-12.1205	19.49012	3.791216	3.908823	2.319907	15.86166	8.473103	18.36289	1.892983	9.143392	0.356941	10.99721	4.457816	8.78991	1.907188
17	4.47008	17.64061	15.2252	8.729333	-12.836	-3.36272	4.663955	15.15908	-8.82142	-8.41252	16.79467	3.714213	10.31241	13.844	18.1205	-0.44859	1.707714	10.75024	13.46804	10.99492
18	-4.48259	16.44781	-4.13243	18.75596	17.05798	9.045342	0.11317	4.298675	-1.72524	4.139834	-14.3815	6.208324	16.99288	-0.50087	6.08703	1.692208	3.47329	-5.88791	8.492441	14.32321
19	28.27343	-0.11177	-0.77956	-5.10458	10.993	1.573969	-1.76437	10.06757	9.946887	6.244451	-8.23187	1.495842	21.15129	17.02533	-11.9013	-1.20163	20.53252	0.706525	19.89147	-2.46186
20	-2.57817	-1.75948	6.682566	2.331538	0.061475	3.255007	0.337898	-7.52274	2.497519	0.416612	10.04643	10.48019	23.1283	-5.11329	-1.07627	3.837494	17.58466	2.474282	-3.21888	9.963007
21	-5.64917	15.54493	0.113937	9.955225	-9.55085	-6.794	9.143788	12.43555	-3.2781	-1.5712	5.71225	0.554566	-0.04992	1.309828	-5.22846	19.35693	-1.83687	-2.26399	21.88116	19.49978
22	8.762842	-2.0507	3.104038	11.36072	1.442022	6.946865	11.49612	8.949299	14.2931	-6.16227	11.60043	1.684628	7.028243	-2.62814	4.313823	-2.43979	3.573794	7.44069	-5.16497	6.494702
23	-0.54716	-1.76507	6.236773	-2.53364	5.74823	1.340863	-4.25959	20.7382	16.13412	1.34754	8.211887	2.30144	19.84482	13.65197	-2.24629	-11.5175	16.40694	-3.43766	2.801031	6.446707
24	11.9622	-4.53673	8.319412	-3.85999	2.904457	20.70921	14.69749	11.56554	4.846614	2.225501	14.55177	12.13013	10.57308	22.07002	11.88017	17.96653	-5.34646	-8.11144	10.80995	11.36282

Each row represents a sample of size 20 in which each value comes from a normal distribution with a mean of 5.3 and a standard deviation of 9.

Find the Mean & Standard Deviation

To find the mean and standard deviation of this

sampling distribution of sample means, we can first find the mean of each sample by typing the following formula in cell U2 of our worksheet:

=AVERAGE(A2:T2)

We can then hover over the bottom right corner of the cell until a tiny + appears and double click to copy this formula to every other cell in column U:

	P	Q	R	S	T	U	V
5	Sample 16	Sample 17	Sample 18	Sample 19	Sample 20	Mean	
1	-1.76196	18.22686	11.31325	13.93815	0.479712	7.563684	
9	9.507522	9.241467	-3.73597	6.762841	19.90909	10.97299	
9	-2.24892	-5.34456	3.556385	1.854363	3.002711	5.61955	
1	-1.15977	0.814789	8.223065	13.30782	-9.23518	3.5224	
7	1.589566	8.90931	2.660249	-6.3752	3.829714	2.309342	
5	-0.44015	6.191809	7.541581	-8.42945	5.261255	2.688946	
5	-9.33324	4.986041	14.52475	9.902011	15.87092	4.560943	
2	7.771755	14.26686	8.609849	6.172321	7.860733	6.989309	
2	15.12278	13.10987	-5.74766	-11.3612	-1.22457	3.812402	
1	0.222133	-1.63861	5.718594	-3.5927	2.335083	3.649505	
7	10.74831	-3.17044	10.53117	7.14759	11.57939	6.745719	
5	11.51041	2.987297	15.49738	-1.31741	20.23163	5.812735	
7	11.39651	1.114558	7.08748	-4.3725	-3.0126	4.605851	
7	12.63149	11.59317	-9.11533	12.85583	23.30873	6.914303	
2	0.356941	10.99721	4.457816	8.78991	1.907188	6.119259	
5	-0.44859	1.707714	10.75024	13.46804	10.99492	6.765686	
3	1.692208	3.47329	-5.88791	8.492441	14.32321	4.80088	
3	-1.20163	20.53252	0.706525	19.89147	-2.46186	5.817264	
7	3.837494	17.58466	2.474282	-3.21888	9.963007	3.591407	
5	19.35693	-1.83687	-2.26399	21.88116	19.49978	3.964269	
3	-2.43979	3.573794	7.44069	-5.16497	6.494702	4.502273	
9	-11.5175	16.40694	-3.43766	2.801031	6.446707	4.745179	
7	17.96653	-5.34646	-8.11144	10.80995	11.36282	8.336015	

We can see that the first sample had a mean of

7.563684, the second sample had a mean of 10.97299, and so on.

We can then use the following formulas to calculate the mean and the standard deviation of the sample means:

	V	W	X	Y	Z
		Mean	5.367869	=AVERAGE(U2:U1001)	
		SD	2.075396	=STDEV(U2:U1001)	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Theoretically the mean of the sampling distribution should be 5.3. We can see that the actual sampling mean in this example is 5.367869, which is close to 5.3.

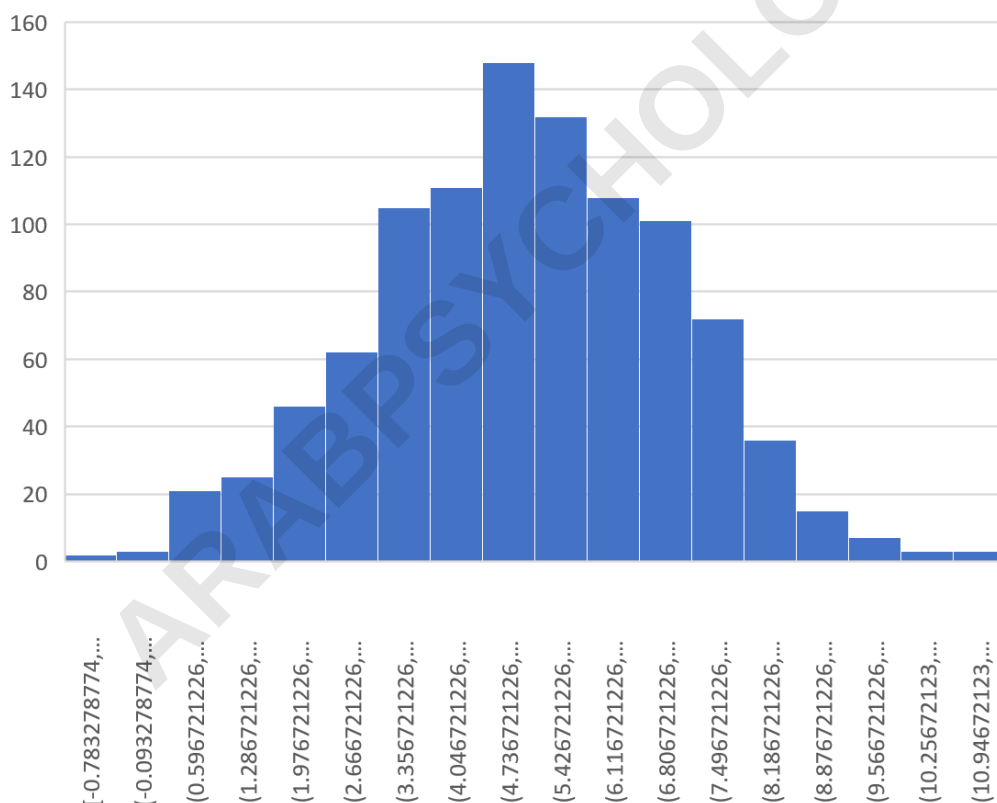
And theoretically the standard deviation of the sampling distribution should be equal to $s/\sqrt{n}$, which would be $9 / \sqrt{20} = 2.012$. We can see that the actual standard deviation of the sampling distribution is 2.075396, which is close to 2.012.

Visualize the Sampling Distribution

We can also create a simple histogram to visualize the sampling distribution of sample means.

To do so, simply highlight all of the sample means in column U, click the Insert tab, then click the Histogram option under the Charts section.

This results in the following histogram:



We can see that the sampling distribution is bell-shaped with a peak near the value 5.

From the tails of the distribution, however, we can see that some samples had means greater than 10 and some had means less than 0.

Calculate Probabilities

We can also calculate the probability of obtaining a certain value for a sample mean, based on a population mean, population standard deviation, and sample size.

For example, we can use the following formula to find the probability that the sample mean is less than or equal to 6, given that the population mean is 5.3, the population standard deviation is 9, and the sample size is:

`=COUNTIF(U2:U1001, "<=6")/COUNT(U2:U1001)`

	V	W	X	Y	Z	AA	AB	AC
		Mean	5.367869	=AVERAGE(U2:U1001)				
5		SD	2.075396	=STDEV(U2:U1001)				
2								
7		Prob mean<=6	0.638	=COUNTIF(U2:U1001, "<=6")/COUNT(U2:U1001)				
3								
5								
4								
7								
1								
9								
1								
1								
6								
3								
4								
7								
8								
8								
7								
2								

We can see that the probability that the sample mean is less than or equal to 6 is 0.638.

This is very close to the probability calculated by the Sampling Distribution Calculator:

μ (population mean)

σ (population standard deviation)

n (sample size)

X (random variable)

CALCULATE

$P(\bar{X} \leq 6): 0.63602$

$P(\bar{X} \geq 6): 0.36398$

An Introduction to Sampling Distributions

Sampling Distribution Calculator

An Introduction to the Central Limit Theorem