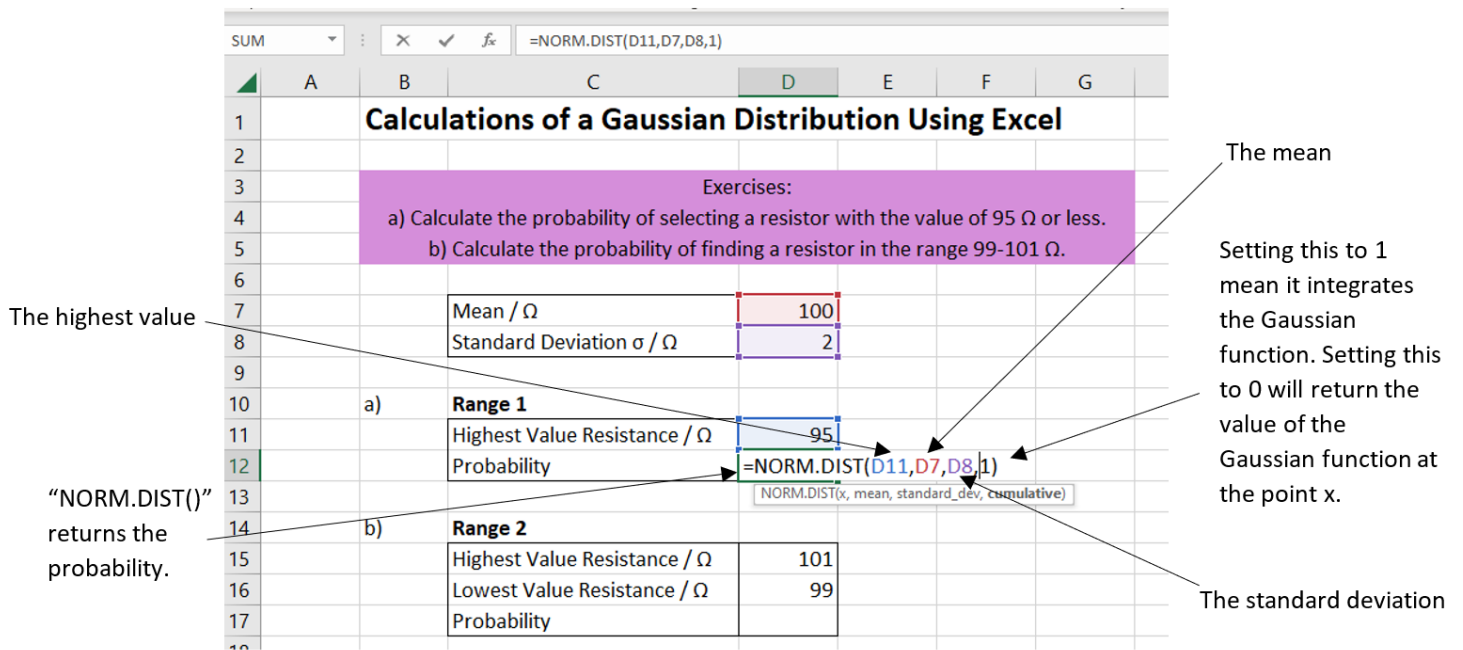


Answers: Gaussian and Poisson Distributions

Contents:

- [Gaussian Distribution](#)
- [Poisson Distribution](#)

Gaussian Distribution:



Calculations of a Gaussian Distribution Using Excel

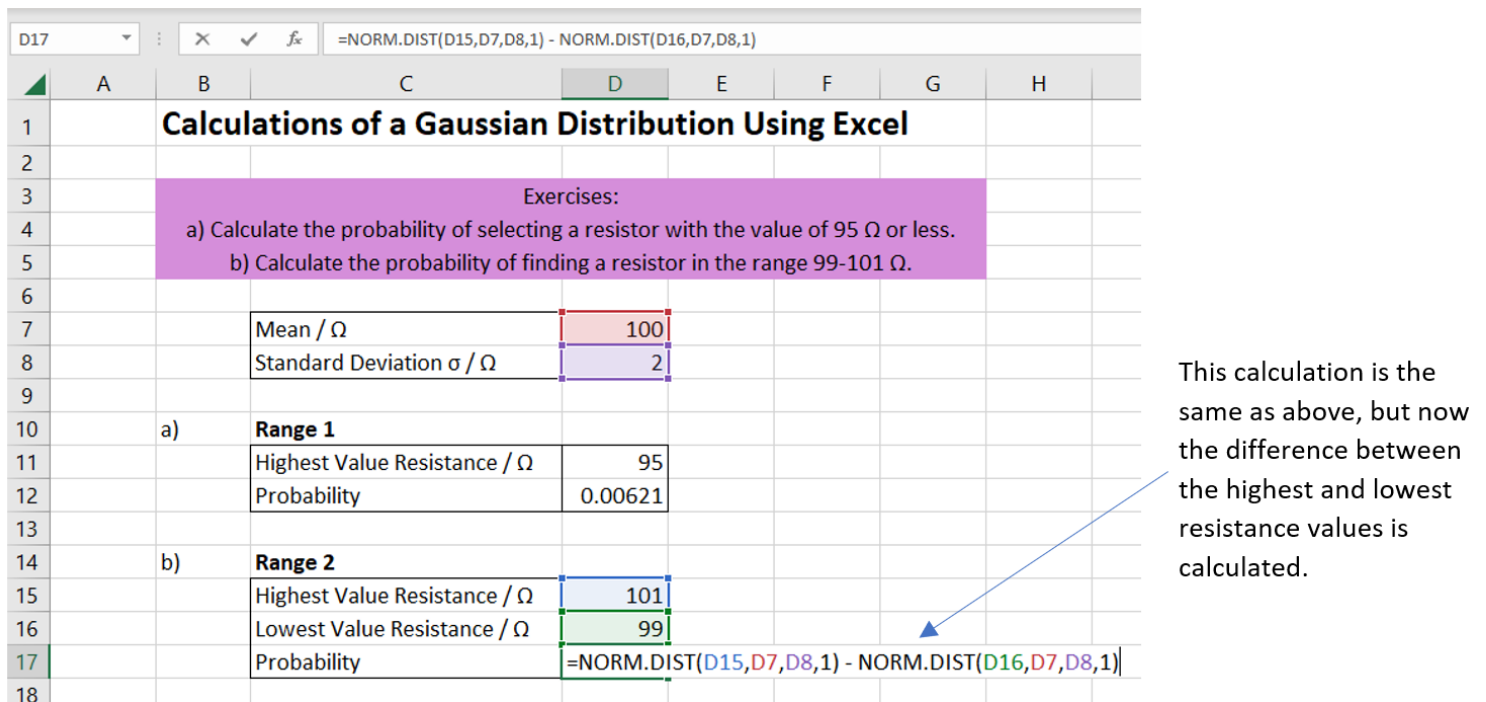
Exercises:

a) Calculate the probability of selecting a resistor with the value of 95 Ω or less.
 b) Calculate the probability of finding a resistor in the range 99-101 Ω .

Mean / Ω	100
Standard Deviation σ / Ω	2
a) Range 1	
Highest Value Resistance / Ω	95
Probability	=NORM.DIST(D11,D7,D8,1)
b) Range 2	
Highest Value Resistance / Ω	101
Lowest Value Resistance / Ω	99
Probability	

Annotations:

- The mean
- Setting this to 1 mean it integrates the Gaussian function. Setting this to 0 will return the value of the Gaussian function at the point x.
- The standard deviation
- The highest value
- "NORM.DIST()" returns the probability.



Calculations of a Gaussian Distribution Using Excel

Exercises:

a) Calculate the probability of selecting a resistor with the value of 95 Ω or less.
 b) Calculate the probability of finding a resistor in the range 99-101 Ω .

Mean / Ω	100
Standard Deviation σ / Ω	2
a) Range 1	
Highest Value Resistance / Ω	95
Probability	0.00621
b) Range 2	
Highest Value Resistance / Ω	101
Lowest Value Resistance / Ω	99
Probability	=NORM.DIST(D15,D7,D8,1) - NORM.DIST(D16,D7,D8,1)

Annotation:

- This calculation is the same as above, but now the difference between the highest and lowest resistance values is calculated.

Poisson Distribution:

In Excel, the Poisson distribution is calculated using the POISSON.DIST() function.

	A	B	C	D	E	F
1		Calculations of a Poisson Distribution Using Excel				
2						
3		Exercises:				
4		Calculate the count rate per minute and its error.				
5		Calculate the probability of 13 counts being recorded in a random 1 min interval.				
6		Calculate the probability that the safety system will trip.				
7						
8		Time / hours	10		Count limit	13
9		Time / mins	600		Probability of reaching the count limit	
10		Total Counts / counts	1980		Probability of reaching the count limit or higher	
11		Error in Number of Counts / counts	=SQRT(C10)			
12		Mean Count Rate / counts per min	3.3			
13		Error in count rate / counts per min	0.07416			
14						

Need in mins as the count limit is in counts per min.

Need in mins as the count limit is in counts per min.

The error in the count rate is the (error in the total number of counts) / (time in mins).

As mentioned above, the error in the number of counts is the square root of the total counts, the SQRT() function is used for this.

	A	B	C	D	E	F	G	H	
1		Calculations of a Poisson Distribution Using Excel							
2									
3		Exercises:							
4		Calculate the count rate per minute and its error.							
5		Calculate the probability of 13 counts being recorded in a random 1 min interval.							
6		Calculate the probability that the safety system will trip.							
7									
8		Time / hours	10		Count limit	13			
9		Time / mins	600		Probability of reaching the count limit	=POISSON.DIST(F8,C12,0)			
10		Total Counts / counts	1980		Probability of reaching the count limit or higher	=POISSON.DIST(x, mean, cumulative)			
11		Error in Number of Counts / counts	44.4972						
12		Mean Count Rate / counts per min	3.3						
13		Error in count rate / counts per min	0.07416						
14									

This is the mean count rate, as in the equation above.

x is the count limit we want the probability at of recording the exactly 13 counts.

Setting this to 0 calculates the probability that the variable is equal to x, not less than or equal to.

However, this is not the answer to the problem. We need to calculate the probability that the count rate would reach 13 or higher. To take this into account, we need to calculate the probability using a cumulative Poisson Distribution, by changing the 0 to a 1. This will calculate the probability that our variable is less than or equal to the inputted value.

A	B	C	D	E	F	G	H
Calculations of a Poisson Distribution Using Excel							
Exercises:							
Calculate the count rate per minute and its error.							
Calculate the probability of of 13 counts being recorded in a random 1 min interval.							
Calculate the probability that the safety system will trip.							
Time / hours		10	Count limit		13		
Time / mins		600	Probability of reaching the count limit		3.26009E-05		
Total Counts / counts		1980	Probability of reaching the count limit or higher		=(1-POISSON.DIST(F8-1, C12,1))		
Error in Number of Counts / counts		44.4972					
Mean Count Rate / counts per min		3.3					
Error in count rate / counts per min		0.07416					

Change the last number from 0 to 1 so that the probability for less than or equal to x is calculated.

To calculate the probability of exceeding 13, can do 1 – (probability of being less than 13).

The Poisson distribution includes the value for x so to be less than 13, you must calculate it for 12 or below.

Note that we were considering higher than 13 counts per minute, not less than! Hence, we must calculate the probability of the reactor reading less than 13 counts per minute and removing that from 1.