

How can I use the Exponential Distribution in Excel?

Authored by
stats writer

May 3, 2024

RECOMMENDED CITATION

stats writer (2024). *How can I use the Exponential Distribution in Excel?*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=142104>

The Exponential Distribution in Excel is a statistical tool that can be used to model the probability of a certain event occurring over a continuous period of time. This distribution is commonly used in various fields such as finance, engineering, and science. To use the Exponential Distribution in Excel, the user can input the necessary data, such as the mean or rate parameter, and the function will calculate the probability density or cumulative probability of the event. This can help in analyzing and predicting the likelihood of events happening in a given time frame. With its user-friendly interface, the Exponential Distribution in Excel provides a convenient and efficient way to perform statistical analysis and make informed decisions based on data.

Use the Exponential Distribution in Excel

The is a probability distribution that is used to model the time we must wait until a certain event occurs.

This distribution can be used to answer questions like:

How long does a shop owner need to wait until a customer enters his shop? How long will a battery continue to work before it dies? How long will a computer continue to work before it breaks down?

In each scenario, we're interested in calculating how long we'll have to wait until a certain event occurs. Thus, each scenario could be modeled using an exponential distribution.

If a X follows an exponential distribution, then the cumulative density function of X can be written as:

$$F(x; \lambda) = 1 - e^{-\lambda x}$$

where:

λ : the rate parameter (calculated as $\lambda = 1/\mu$)
e: A constant roughly equal to 2.718

To calculate probabilities related to the cumulative density function of the exponential distribution in Excel, we can use the following formula:

=EXPON.DIST(x, lambda, cumulative)

where:

x: the value of the exponentially distributed random variable
lambda: the rate parameter
cumulative: whether to use the cumulative density function or not (TRUE or FALSE)

The following examples show how to use this formula in practice.

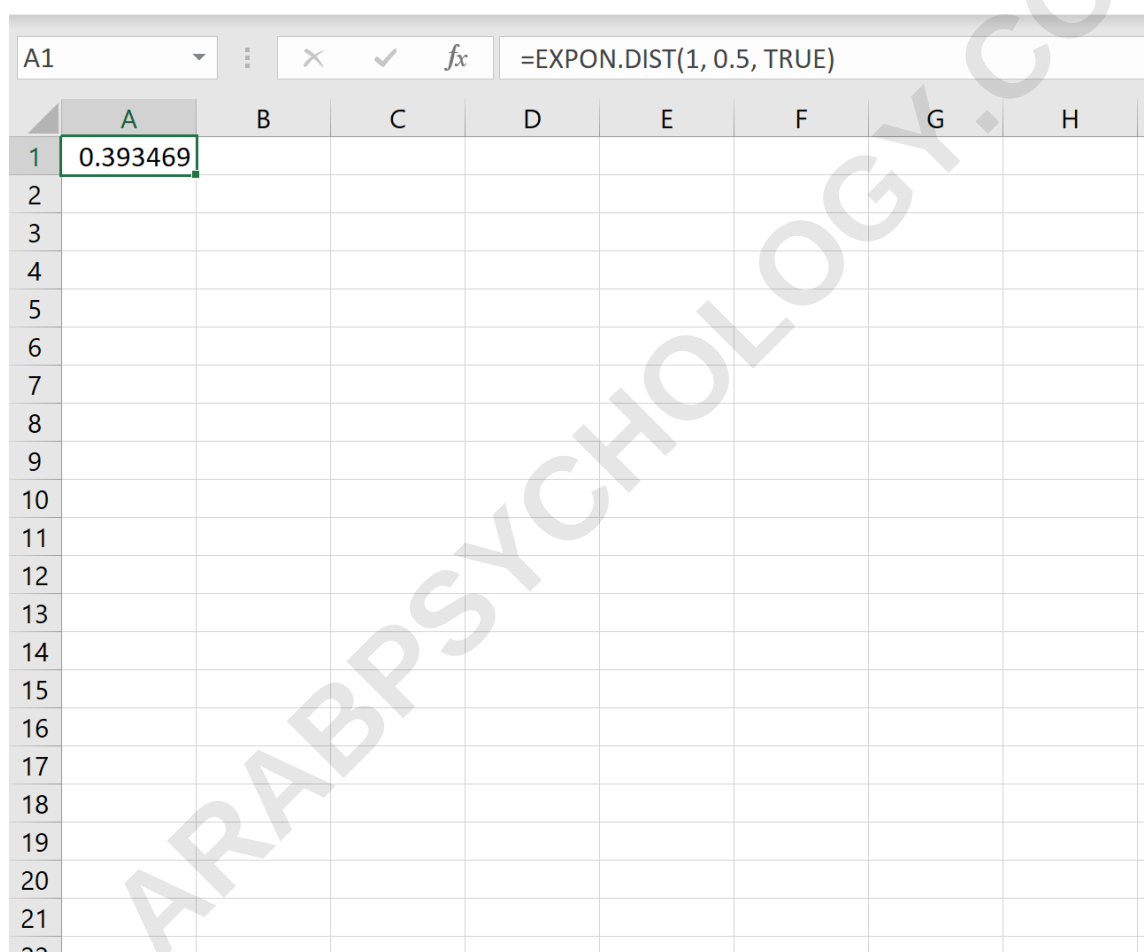
Example 1: Time Until Next Customer Arrives

A new customer enters a shop every two minutes, on average. After a customer arrives, find the probability

that a new customer arrives in less than one minute.

Solution: The average time between customers is two minutes. Thus, the rate can be calculated as:

$$\lambda = 1/\mu\lambda = 1/2\lambda = 0.5$$



The image shows an Excel spreadsheet with the formula bar at the top displaying `=EXPON.DIST(1, 0.5, TRUE)`. The spreadsheet grid shows column headers A through H and row numbers 1 through 22. Cell A1 contains the value 0.393469, which is the result of the formula. A large diagonal watermark reading 'ARABPSYCHOLOGY.COM' is overlaid on the spreadsheet.

	A	B	C	D	E	F	G	H
1	0.393469							
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

The probability that we'll have to wait less than one minute for the next customer to arrive is 0.393469.

Example 2: Time Until Next Earthquake

Suppose an earthquake occurs every 400 days in a certain region, on average. After an earthquake occurs, find the probability that it will take more than 500 days for the next earthquake to occur.

Solution: The average time between earthquakes is 400 days. Thus, the rate can be calculated as:

$$\lambda = 1/\mu \quad \lambda = 1/400 \quad \lambda = 0.0025$$

Thus, we can use the following formula in Excel to calculate the probability that the next earthquake takes less than 500 days to occur:

A1		✕		✓	f_x	=EXPON.DIST(500, 0.0025, TRUE)			
	A	B	C	D	E	F	G	H	
1	0.7135								
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									

The probability that it will take less than 500 days for the next earthquake is 0.7135.

Thus, the probability that we'll have to wait *more* than 500 days for the next earthquake is $1 - 0.7135 = 0.2865$.

Example 3: Time Until Next Phone Call

Suppose a call center receives a new call every 10 minutes, on average. After a customer calls, find the probability that a new customer calls within 10 to 15

minutes.

Solution: The average time between calls is 10 minutes. Thus, the rate can be calculated as:

$$\lambda = 1/\mu\lambda = 1/10\lambda = 0.1$$

Thus, we can use the following formula in Excel to calculate the probability that the next customer calls within 10 to 15 minutes:

A1				fx		=EXPON.DIST(15, 0.1, TRUE) - EXPON.DIST(10, 0.1, TRUE)			
	A	B	C	D	E	F	G	H	I
1	0.1447								
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

The probability that a new customer calls within 10 to 15 minutes. is 0.1447.

ARABPSYCHOLOGY.COM