

Geometric Probability Distribution & TI

What is a geometric probability distribution?

It is a discrete probability distribution of random variable x such that

1. A trial is repeated until a success occurs.
2. The repeated trials are independent of each other.
3. The probability of success p remains the same for each trial.

Then the **probability that the first success will occur on trial number x** is

$$P(x) = p \cdot (q)^{x-1}, \text{ where } q = 1 - p$$

with $\mu = \frac{1}{p}$ and $\sigma^2 = \frac{q}{p^2}$.

Geometric Probability Distribution & TI:

When you have	Use TI command
$P(x = a)$	<code>geometpdf(p, a)</code>
$P(x \leq a)$	<code>geometcdf(p, a)</code>
$P(x \geq a)$	<code>1 - geometcdf(p, a - 1)</code>

How to find the TI Command:

`2nd` `VARS`, scroll down to `geometpdf` or `geometcdf`,
followed by pressing `ENTER` button twice.

Example:

The probability that you will make a sale on any given phone call is 0.19. Find the probability that you

1. make your first sale on the fifth call.
2. make your first sale on the first, second, or third call.
3. do not make a sale on the first three calls.
4. Find the mean and variance.

Solution:

1. make your first sale on the fifth call. $\Rightarrow P(x = 5)$

$$\begin{aligned}P(x = 5) &= .19 \cdot (.81)^{5-1} \\ &= \text{geometpdf}(.19, 5) \\ &\approx 0.0818\end{aligned}$$

2. make your first sale on the first, second, or third call. $\Rightarrow P(x = 1, x = 2, \text{ or } x = 3)$

$$\begin{aligned}P(x = 1, x = 2, \text{ or } x = 3) &= P(x \leq 3) \\ &= .19 \cdot (.81)^{1-1} + .19 \cdot (.81)^{2-1} + .19 \cdot (.81)^{3-1} \\ &= \text{geometcdf}(.19, 3) \\ &\approx 0.468\end{aligned}$$

3. do not make a sale on the first three calls. $\Rightarrow P(\overline{x = 1, x = 2, \text{ or } x = 3})$

$$\begin{aligned}P(\overline{x = 1, x = 2, \text{ or } x = 3}) &= 1 - P(x = 1, x = 2, \text{ or } x = 3) \\ &= 1 - (.19 \cdot (.81)^{1-1} + .19 \cdot (.81)^{2-1} + .19 \cdot (.81)^{3-1}) \\ &= 1 - P(x \leq 3) \\ &= 1 - \text{geometcdf}(.19, 3) \\ &\approx 0.531\end{aligned}$$

4. Find the mean and variance.

$$\mu = \frac{1}{p} = \frac{1}{.19} \approx 5.263$$

$$\sigma^2 = \frac{q}{p^2} = \frac{1 - .19}{.19^2} \approx 22.438$$
