Negative binomial random variables

What they are NOT is the negative of a Binomial(n,p) !!

Instead, they are a generalization of Geometric(p) random variables.

Idea: Geometric(p)

F F F F F F S

$X = 7$

Where X is our Geometric(p) random variable i.e. number of trials until 1st success

F F F S | F F F F F S | F S | F F F F F S

1ST | 2nd | 3rd | 4th

Geom | Geom | Geom | Geom

the total number of flips until the 4th success, assuming each trial has probability of success p, and independent trials, is a Negative Binomial random variable with parameters r=4 and p.

In general, a Negative Binomial (r, p) random variable is the number of trials needed until the rth success occurs.

Equivalently, a Negative Binomial (r,p) random variable is the sum of r independent Geometric(p) random variables

F F F S | F F F F F S | F S | F F F F F S

X_1 | X_2 | X_3 | X_4

$X = 18$

$= X_1 + X_2 + X_3 + X_4$

$= 4 + 6 + 2 + 6$