

Technology Insight 7 - Calculating Binomial Probabilities

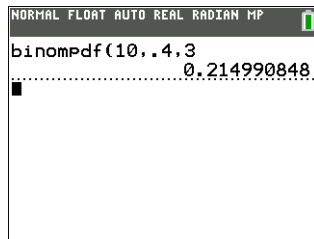
Suppose we're given a binomial distribution $B(10, 0.4)$, meaning 10 fixed trials, with a probability of success. Let's look at four different types of probability calculations:

- a) $P(x = 3)$ *The probability of exactly 3 successes.*
- b) $P(x \leq 2)$ *The probability of at most 2 successes.*
- c) $P(x \geq 7)$ *The probability of at least 7 successes.*
- d) $P(4 \leq x \leq 8)$ *The probability of 4 to 8 successes.*

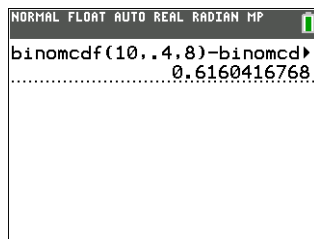
TI-84

All of the various types of distributions are found by pressing **2nd** **vars** (dist). Scroll down to find **binomialpdf** for a single probability, or **binomialcdf** for a range of probabilities. The binomialcdf will only calculate *left-tail* probabilities.

- a) $P(x = 3)$ $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
binompdf(10, 0.4, 3) = 0.215



- b) $P(x \leq 2)$ $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (left-tail)
binomcdf(10, 0.4, 2) = 0.167
- c) $P(x \geq 7)$ $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (left-tail)
1 - binomcdf(10, 0.4, 6) = 0.0548
- d) $P(4 \leq x \leq 8)$ $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (left-tail)
binomcdf(10, 0.4, 8) - binomcdf(10, 0.4, 3) = 0.616



EasyStats

OpenEasyStats and click on the 2-Distributions page. The Binomial box will calculate all of the types of binomial probabilities as well as the mean and standard deviation of the distribution. Here are the solutions to the same examples from above, using 10 trials and $p = 0.4$ for success:

- a) $P(x = 3)$ *The probability of exactly 3 successes.*

Discrete Distributions	
BINOMIAL	
n= 10	mean= 4.0000
p= 0.4	st. dev.= 1.5492
x= 3	$P(x = 3) = 0.2150$
a= 1	$P(x \leq 1) = 0.0464$
b= 9	$P(x \geq 9) = 0.0017$
	$P(1 \leq x \leq 9) = 0.9938$

- b) $P(x \leq 2)$ *The probability of at most 5 successes.*

Discrete Distributions	
BINOMIAL	
n= 10	mean= 4.0000
p= 0.4	st. dev.= 1.5492
x= 3	$P(x = 3) = 0.2150$
a= 2	$P(x \leq 2) = 0.1673$
b= 9	$P(x \geq 9) = 0.0017$
	$P(2 \leq x \leq 9) = 0.9535$

- c) $P(x \geq 7)$ *The probability of at least 7 successes.*

Discrete Distributions	
BINOMIAL	
n= 10	mean= 4.0000
p= 0.4	st. dev.= 1.5492
x= 3	$P(x = 3) = 0.2150$
a= 2	$P(x \leq 2) = 0.1673$
b= 7	$P(x \geq 7) = 0.0548$
	$P(2 \leq x \leq 7) = 0.9413$

- d) $P(4 \leq x \leq 8)$ *The probability of 4 to 8 successes.*

Discrete Distributions	
BINOMIAL	
n= 10	mean= 4.0000
p= 0.4	st. dev.= 1.5492
x= 3	$P(x = 3) = 0.2150$
a= 4	$P(x \leq 4) = 0.6331$
b= 8	$P(x \geq 8) = 0.0123$
	$P(4 \leq x \leq 8) = 0.6160$