Binomial Distribution

This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

The Binomial Distribution is a discrete probability distribution used to find the probability of an event happening if:

- *the number of observations is fixed.*
- *each observation is independent.*
- *each observation represents one of two outcomes ("success" or "failure").*
- *the probability of "success" p is the same for each outcome.*

It was derived from Bernoulli trials, experiments where an event, with probability, p of success in any given trial with a fixed number of trials. The Binomial distribution is linked to Pascal's Triangle numbers that describe the different combinations that successes and failures can happen.

The Binomial Distribution formula is given by:

$$P(X = x) = \binom{n}{x}\pi^x\left(1-\pi\right)^{n-x}$$

$$\mu = n\pi, \qquad \sigma = \sqrt{n\pi\left(1-\pi\right)}$$

where the random variable *X*, with the parameters *n (number of trials)* and *π (probability of a success)*, has the value *x (Number of successes desired)*.

On the ClassPad from the **MAIN MENU** go to the **Statistics** application and select the **Calc** dropdown menu and then tap **Distribution**. You can use the ClassPad wizard which will compute the required probabilities and also graph the distributions associated with them (which can be traced using the Left and Right arrow pads and you can read off other probability values you require).

There are a suite of distributions to select from, use the scroll bar (highlighted below) to view and tap on **Binomial PD**. Then tap on [**Next >>**].

The '**Help**' screen.
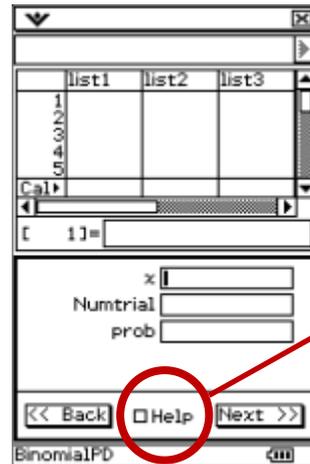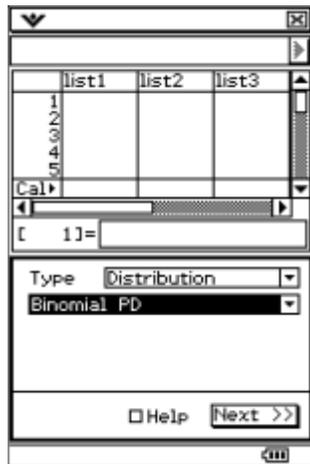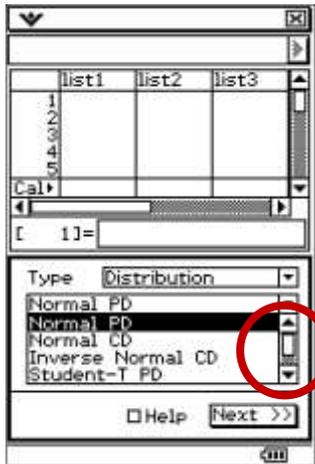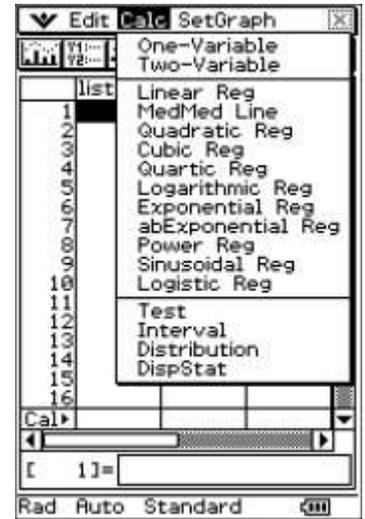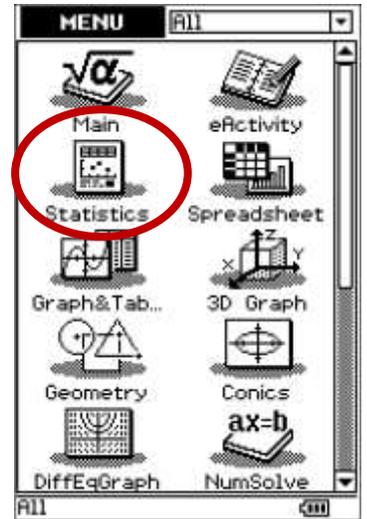
Example 1: What is the probability for flipping a fair coin (Heads, Tails) ten times and four heads are recorded.

Answer: *n* (number of trials) = 10

π (probability of a success) = 0.5

x (Number of successes desired) = 4

Enter the parameters for the distribution and tap [**Next >>**].
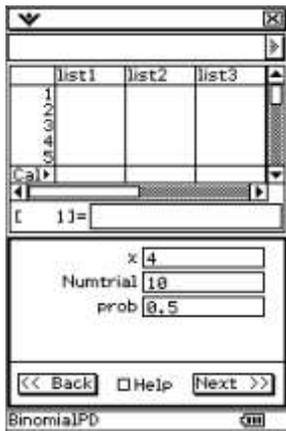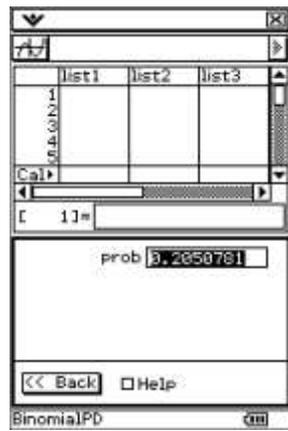
| Parameters entered. | Probability calculated | Tap on the graph icon (Top left corner, as indicated above.) | Distribution displayed |
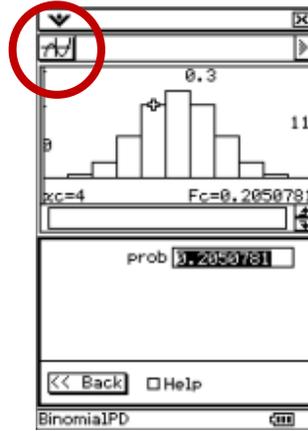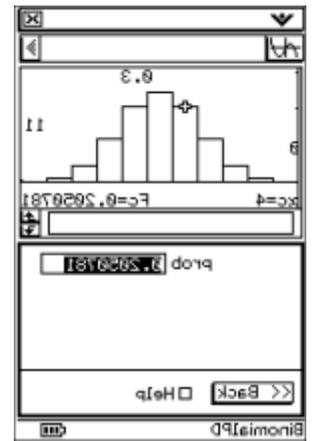
Pressing on the **Left** or **Right** arrows,

you can trace the probability distribution for:

n (number of trials) = 10
π (probability of a success) = 0.5
x (Number of successes desired) = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Example 2:   A basketball player misses 30% of her free throw shots in a typical game. During one particular game, she attempts 15 free throw shots and misses 7 of the 17. All of her free throw shots are independent and the probability that she makes a single free throw is 0.70.

(a) What is the probability that she will miss exactly 7 free throws in a game?
(b) What is the probability that she will miss 8 or more free throws in a game?
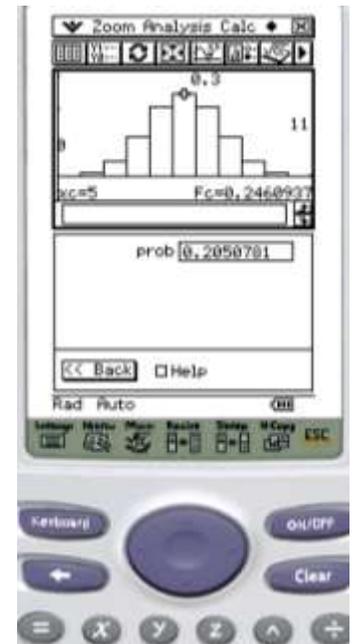
Answer:
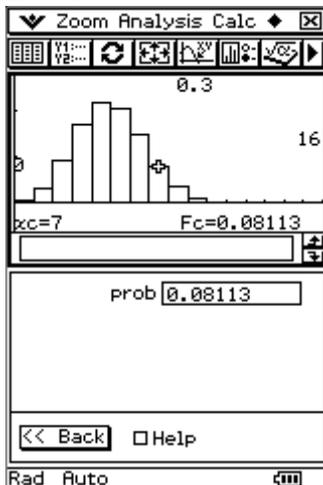
| Binomial PD selected Parameters entered Graph Distribution tapped | Binomial CD selected | Parameters entered | Graph Distribution tapped |
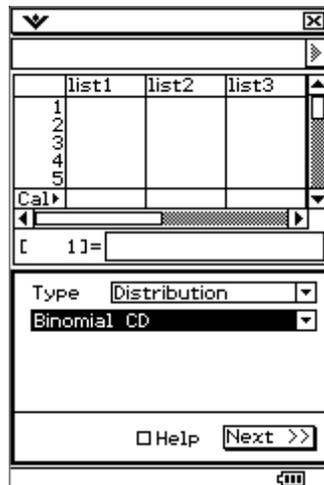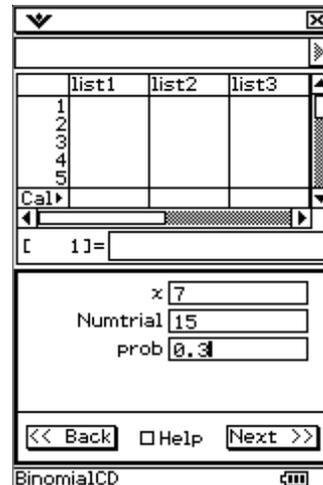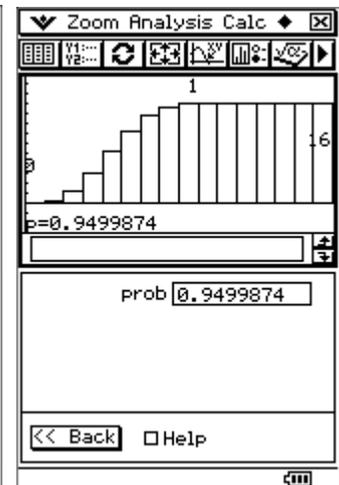
(a) Probability(exactly 7 free throws in a game) = 0.08113
(b) Probability(miss 8 or more free throws in a game) = 1 - 0.9499874 = 0.0500126