BINOMIAL DISTRIBUTION

GRAPHS OF BINOMIAL DISTRIBUTION TI Nspire

Consider the example of binomial distribution $X \sim B_i(10, 0.2)$. We will use the calculator to plot the graph of this distribution. Insert new Spreadsheet. Name two columns n and p. In the grey cell below p type=, go to Menu, Stats, Probability Distributions, binomial pdf, enter 10, 0.2 and n, when asked select variable reference (not column reference).

Insert a slider to vary *p* and animate. Watch how the mode of the distribution varies. The graph below with n=7

When n=20, vary the value of p and animate the scatterplot.

Graph. Copy the graph with the parameters to your book.

Repeat for other values of p = 0.2, 0.3, 0.5, 0.6, 0.9. Every time simply change the value of *p* and insert a new Stat Graph.

What can you conclude about the shape of the binomial distribution? Comment on the effect of the value of *p* on the shape of the distribution.

Now repeat the above for another value of *n* = 20. Remember to add values to the first column containing the values of *n* (up to 20 including 0).

CONCLUSION: Write down the conclusion about the shape of the graphs when p and *n* are varied. Discuss the symmetry and the position of the mode.

To find the Mode, we need to find the x-value with the highest probability. Either graphically or binomPdf(n,p,{0,1,2,…,n}) and select the highest probability and the corresponding value of *x*.

Notice the use of { }. It is a list, you can then obtain all values in one instruction and scroll across the screen.

It is important to distinguish between binomPdf and binomCdf.

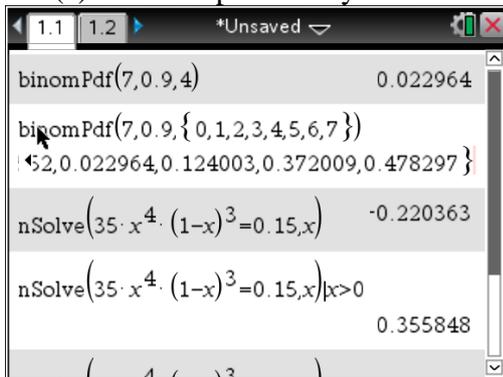binomPdf – gives single probabilities for specified discrete X values e.g. P(X=2) or P(X=4)

binomCdf – gives probabilities for X values in the given interval eg: P(1<X<5) or $P(X \geq 4)$.

Example 1

Evan likes to play two games of chance, A and B.

For game A, the probability that Evan wins is 0.9. He plays game A seven times.

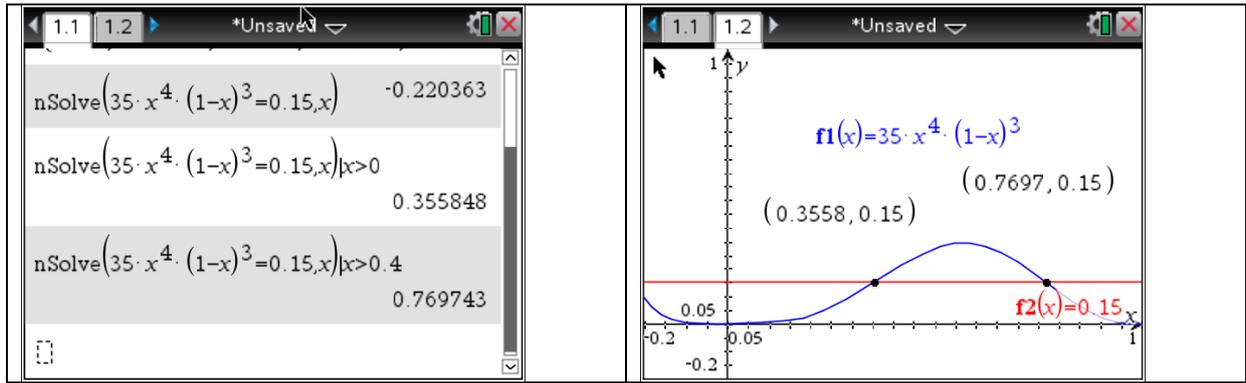   (a) Find the probability that he wins exactly four games.

For game B, the probability that Evan wins is *p*. He plays game B seven times.

(b) Write down an expression, in terms of *p,* for the probability that he wins exactly four games.

(c) Hence, find the values of *p* such that the probability that he wins exactly four games is 0.15.

(d) Find the mode of the distribution.

Example 2

X is a binomial random variable, where the number of trials is 5 and the probability of success of each trial is *p*. Find the values of *p* if P(*X* = 4) = 0.12.

If X ~ Bin (5, *p*) and P(*X* = 4) = 0.12 then

$$\binom{5}{4} p^4(1-p) = 0.12$$
$$5p^5 - 5p^4 + 0.12 = 0$$
$$p = 0.459 \text{ (3 s.f) or } 0.973 \text{ (3 s.f)}$$