4.8 Binomial distribution

Consider $X \sim \mathcal{B}(8, 0.3)$.

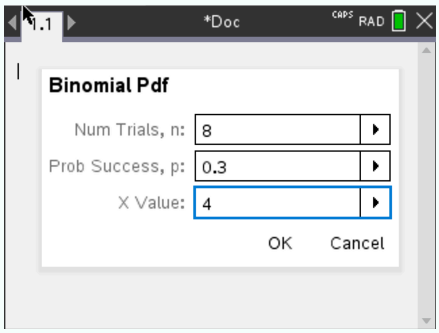
4.8.1 Compute $\mathbf{P}(X = a)$

Consider $X \sim \mathcal{B}(8, 0.3)$. Suppose you want to compute $\mathbf{P}(X = 4)$.

① Create a new document, select Add Calculator

② Press menu, select Probability > Distributions > Binomial Pdf

③ Enter the number of trials, the probability of success and the x-value.



Press OK. The result should be 0.136 (rounded).

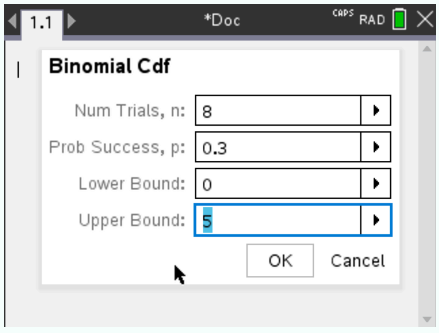
4.8.2 Compute $\mathbf{P}(X \leq a)$

Consider $X \sim \mathcal{B}(8, 0.3)$. Suppose you want to compute $\mathbf{P}(X \leq 5)$.

① Create a new document, select Add Calculator

② Press menu, select Probability > Distributions > Binomial Cdf

③ Enter the number of trials, the probability of success, the lower bound and the upper bound.



④ Press enter and the result is displayed. The result should be 0.988708.

NB: If you wanted to compute $\mathbf{P}(X < 5)$ instead, you would calculate $\mathbf{P}(X \leq 4)$ (since the binomial distribution is discrete).

4.8.3 Find x when $\mathbf{P}(X \leq x) \geq c$

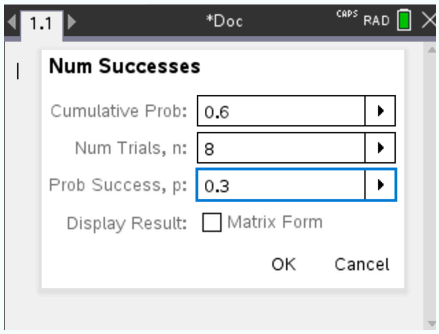
Some calculators may not have this functionality

Consider $X \sim \mathcal{B}(8, 0.3)$. Suppose you want to find **the smallest** x for which $\mathbf{P}(X \leq x) \geq 0.6$.

① Create a new document, select Add Calculator

② Press menu, select Probability > Distributions > Inverse Binomial

③ Enter the cumulative probability, the number of trials and the probability of success.



④ Press enter and the result is displayed. The result should be 3.

Note that **Binomial Cdf(8,0.3,3)=0.806**, which is **not** 0.6. But since **Binomial Cdf(8,0.3,2)=0.552** is smaller than 0.6, **Inverse Binomial** gives us 3 (even though 2 gives an area closer to 0.6, the calculator gives the first integer that gives an area bigger or equal to 0.6)

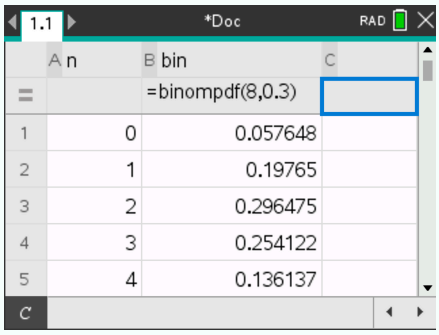
4.8.4 Plot a binomial distribution

To plot a binomial distribution, we will create two lists, one being the possible amount of successful trials, and the other their probability, and then plot it.

① Create a new document, select Add List & Spreadsheets

② In the first column: type n as the column name and fill the cell with numbers from 0 to n (n=8 in our case). In the second column: type bin as the column name and type **binompdf(8,0.3)** in the cell at the line ′ =′

③ Type enter and the probability of success for each number of trials is displayed.



④ Now we need to plot the graph. Type ctrl and +page doc, select Add Data & Statistics.

⑤ Select Click to add variable on the x-axis, choose n. Select Click to add variable on the y-axis, choose bin.

⑥ To connect data points: press menu, select Plot Properties > Connect Data Points. The following plot should be displayed: