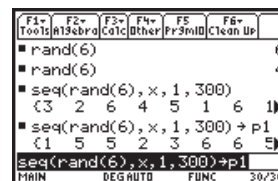


CHAPTER 12 Calculator Notes for the TI-89, TI-92 Plus, and Voyage 200

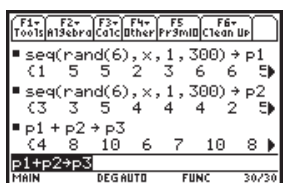
Note 12A • Dice Simulation

Recall that you can simulate the throw of a die using the random integer command, `rand(6)`. By pressing `ENTER` repeatedly, you simulate more and more throws. Or, by combining the random integer command and the sequence command, you can simulate many throws of a die at once. For example, to simulate 300 rolls, press `2nd` `[MATH]` `3:List 1:seq(`, then press `2nd` `[MATH]` `7:Probability 4:rand(`, enter `6),X,1,300)`, and press `ENTER`. To store the outcomes into a list, say list `p1`, press `STO>` `[alpha]` `[p]` `1`. See **Note 1L** for help with the `rand(` command.

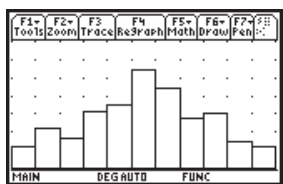


Follow these steps to simulate the sums for 300 throws of a pair of dice:

- Store 300 throws of a die into list `p1`, `seq(rand(6),x,1,300)→p1`.
- Store 300 throws of a die into list `p2`, `seq(rand(6),x,1,300)→p2`.
- Define list `p3` as the sum of lists `p1` and `p2`, `p1+p2→p3`.



- You can display a histogram to show the distribution of the sums in list `p3`. See **Note 2D** for help with histograms.



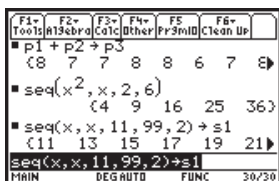
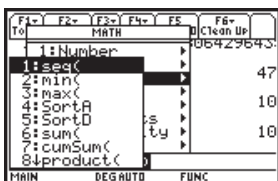
[2, 13, 1, 0, 70, 10]

Note 12B • Sequences into Lists

With the calculator in any mode you can use the `seq(` command to generate a nonrecursive sequence. To find the `seq(` command, press `2nd` `[MATH]` `3:List 1:seq(`.

The `seq(` command requires four arguments: an expression, a variable counter, the starting value of the counter, and the ending value of the counter. The counter increases in increments of 1 unless an optional fifth argument specifies a different increment.

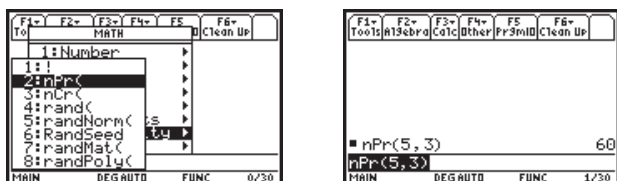
For example, `seq(x2,x,2,6)` generates the sequence of perfect squares 2^2 through 6^2 . As another example, `seq(x,x,11,99,2)` generates the odd integers from 11 to 99. To store the sequence into a list, you can use the store key, `STO>`, followed by the name of a valid list.



Note 12C • Permutations

To find numbers of permutations, use the nPr (command. To find the nPr (command, press $\boxed{2nd}$ [MATH] 7:Probability 2:nPr(. Enter the command in the form $nPr(n, r)$, where n is the number of objects and r is the number of objects chosen.

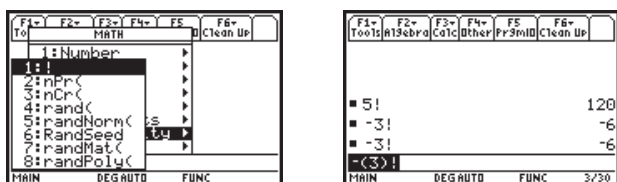
For example, to find the number of arrangements of 5 objects chosen 3 at a time, enter $nPr(5,3)$. The answer shows that there are 60 arrangements.



Note 12D • Factorials

To find the factorial command, press $\boxed{2nd}$ [MATH] 7:Probability 1:!. For example, to find $5!$: press 5 $\boxed{2nd}$ [MATH] 7:Probability 1:! \boxed{ENTER} .

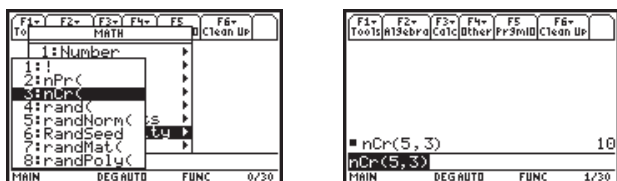
In the order of operations, factorial has higher precedence than negation, so $-3!$ is equivalent to $-(3!)$. Notice that after entering $-(3!)$ and pressing \boxed{ENTER} the parentheses don't even appear on the Home screen.



Note 12E • Combinations

To find numbers of combinations, use the nCr (command. To find the nCr (command, press $\boxed{2nd}$ [MATH] 7:Probability 3:nCr(. Enter the command in the form $nCr(n, r)$, where n is the number of objects and r is the number of objects chosen.

For example, to find the number of groupings of 5 items chosen 3 at a time, enter $nCr(5,3)$. The answer shows that there are 10 different groupings.



Note 12F • Binomial Probability

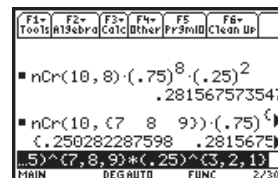
Single Probability

To calculate the probability of any number of successes in a probability experiment, you must calculate the value of one term of a binomial expansion.

(continued)

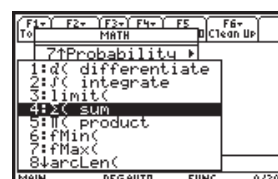
For example, to find the probability of 8 successes out of 10 trials where the probability of each success is .75, enter $nCr(10,8) \cdot (.75)^8 \cdot (.25)^2$.

You can calculate more than one probability at the same time by entering the number of successes and failures into lists. For example, to find the probabilities of 7, 8, and 9 successes out of 10 trials where the probability of each success is .75, enter $nCr(10, \{7,8,9\}) \cdot (.75)^{\{7,8,9\}} \cdot (.25)^{\{3,2,1\}}$.

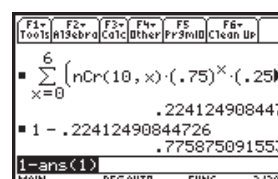


Cumulative Probability

You can also calculate a range of successes with the summation command, $\Sigma()$, to sum the appropriate terms of a binomial expansion. To find the $\Sigma()$ command, press 2^{nd} [MATH] B:Calculus 4: $\Sigma()$. (If you have operating system 2.05 or earlier, press 2^{nd} [MATH] A:Calculus 4: $\Sigma()$.) The summation command requires four arguments: an expression, a variable, the least variable value, and the greatest variable value.



For example, to find the probability of 6 or fewer successes out of 10 trials where the probability of each success is .75, enter $\Sigma(nCr(10,x) \cdot (.75)^x \cdot (.25)^{(10-x)}, x, 0, 6)$. To find the probability of more than 6 success, subtract the previous answer from 1 or edit the entry line to $\Sigma nCr(10,x) \cdot (.75)^x \cdot (.25)^{(10-x)}, x, 7, 10)$.



Binomial Probability with the Stats/List Editor

If your calculator has the Stats/List Editor application, you can use built-in functions that calculate binomial probabilities. To run the Stats/List Editor, press \square [APPS] 1:FlashApps and select Stats/List Editor.

The binomial probability distribution function, Binomial Pdf, calculates the probability of any number of successes in a probability experiment. The binomial cumulative distribution function, Binomial Cdf, sums the binomial probabilities between (and including) two specified values. You find either command by pressing $F5$ (Distr).



For Binomial Pdf, enter the number of trials, the probability of success, and the number of successes (called the X Value). For Binomial Cdf, enter the number of trials, the probability of success, the Lower Value, and the Upper Value.

