hp calculators

HP 10BII Statistics – Rearranging Items

Statistics on the HP 10BII

Rearranging items

Practice solving problems involving rearranging items

Statistics on the HP 10BII

The HP 10BII has many built-in statistics functions that apply to finding averages and standard deviations as well as linear regression, correlation and rearranging items.

Rearranging items

There are a great number of applications that involve determining the number of ways a group of items can be rearranged. The factorial function, accessed by pressing yellow shift ⬛ $n!$ on the HP 10BII, will determine the number of ways you can rearrange the total number of items in a group.

To determine the number of ways you can select a subgroup of a specified number of items from a larger group, where the order of each of the items in the subgroup is important, the permutation formula is used, as shown in figure 1 below. The formula indicates the permutations of n items taken r at a time.

$$Permutation = \frac{n!}{(n-r)!} \qquad \text{Figure 1}$$

To determine the number of ways you can select a subgroup of a specified number of items from a larger group, where the order of each of the items in the subgroup is not important, the combination formula is used, as shown in figure 2 below. The formula indicates the combinations of n items taken r at a time.

$$Combination = \frac{n!}{r!(n-r)!} \qquad \text{Figure 2}$$

To see the difference between permutations and combinations, consider the set of three items A, B, and C. If we select a subgroup of 2 items, we could select AC and CA as two possible subgroups. These would be counted as different subgroups if computing the number of permutations, but only as one subgroup if computing the number of combinations.

Factorials show up throughout mathematics and statistics. Permutations and combinations show up in many discrete probability distribution calculations, such as the binomial and hypergeometric distributions.

Practice solving problems involving rearranging items

<u>Example 1:</u>   How many different ways could 4 people be seated at a table?

<u>Solution:</u>   [4] ⬛ [$n!$]

<u>Answer:</u>   24.

<u>Example 2:</u>   How many different hands of 5 cards could be dealt from a standard deck of 52 cards? Assume the order of the cards in the hand does not matter.

<u>Solution:</u>   Since the order of the cards in the hand does not matter, the problem is solved as a combination.

[5] [2] ⬛ [$n!$] [÷] ⬛ [(] [5] ⬛ [$n!$] [×] ⬛ [(] [5] [2] [−] [5] ⬛ [)] ⬛ [$n!$] ⬛ [)] [=]

Answer: 2,598,960 different hands.

Example 3: John has had a difficult week at work and is standing in front of the doughnut display at the local grocery store. He is trying to determine the number of ways he can fill his bag with his 5 doughnuts from the 20 varieties in the display case. He considers the order in which the doughnuts are placed into the bag to be unimportant. How many different ways can he put them in his bag?

Solution: Since the order in which the doughnuts are placed in the bag does not matter, the problem is solved as a combination.

$$\boxed{2}\boxed{0}\boxed{\blacksquare}\boxed{n!}\boxed{\div}\boxed{\blacksquare}\boxed{(}\boxed{5}\boxed{\blacksquare}\boxed{n!}\boxed{\times}\boxed{\blacksquare}\boxed{(}\boxed{2}\boxed{0}\boxed{-}\boxed{5}\boxed{\blacksquare}\boxed{)}\boxed{\blacksquare}\boxed{n!}\boxed{\blacksquare}\boxed{)}\boxed{=}$$

Answer: 15,504 different ways.

Example 4: John has had a difficult week at work and is standing in front of the doughnut display at the local grocery store. He is trying to determine the number of ways he can fill his bag with his 5 doughnuts from the 20 varieties in the display case. He considers the order in which the doughnuts are placed into the bag to be quite important. How many different ways can he put them in his bag?
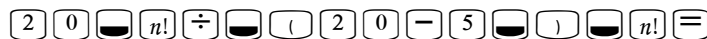
Solution: Since the order in which the doughnuts are placed in the bag matters, the problem is solved as a permutation.

$$\boxed{2}\boxed{0}\boxed{\blacksquare}\boxed{n!}\boxed{\div}\boxed{\blacksquare}\boxed{(}\boxed{2}\boxed{0}\boxed{-}\boxed{5}\boxed{\blacksquare}\boxed{)}\boxed{\blacksquare}\boxed{n!}\boxed{=}$$

Answer: 1,860,480 different ways. John may be in front of the display case for some time.
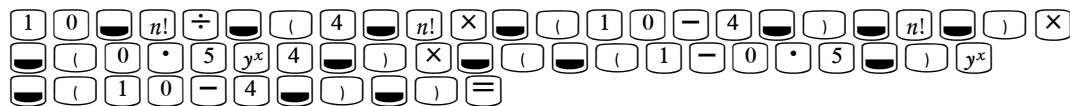
Example 5: If you flip a coin 10 times, what is the probability that it comes up tails exactly 4 times?

Solution: This is an example of the binomial probability distribution. The formula to find the answer is given by:

$$P(X) = nCx \cdot p^{X} \cdot (1-p)^{(n-X)}$$

Figure 3

where P(X) is the probability of having X successes observed, nCx is the combination of n items taken x at a time, and p is the probability of a success on each trial.

$$\boxed{1}\boxed{0}\boxed{\blacksquare}\boxed{n!}\boxed{\div}\boxed{\blacksquare}\boxed{(}\boxed{4}\boxed{\blacksquare}\boxed{n!}\boxed{\times}\boxed{\blacksquare}\boxed{(}\boxed{1}\boxed{0}\boxed{-}\boxed{4}\boxed{\blacksquare}\boxed{)}\boxed{\blacksquare}\boxed{n!}\boxed{\blacksquare}\boxed{)}\boxed{\times}$$
$$\boxed{\blacksquare}\boxed{(}\boxed{0}\boxed{.}\boxed{5}\boxed{y^x}\boxed{4}\boxed{\blacksquare}\boxed{)}\boxed{\times}\boxed{\blacksquare}\boxed{(}\boxed{\blacksquare}\boxed{(}\boxed{1}\boxed{-}\boxed{0}\boxed{.}\boxed{5}\boxed{\blacksquare}\boxed{)}\boxed{y^x}$$
$$\boxed{\blacksquare}\boxed{(}\boxed{1}\boxed{0}\boxed{-}\boxed{4}\boxed{\blacksquare}\boxed{)}\boxed{\blacksquare}\boxed{)}\boxed{=}$$

Answer: 0.21. If you flip a coin 10 times, there is a 20.51% chance of seeing heads 4 times.