Stars and bars

MTH 225 -- Module 9A
4 November 2020

Consider the problem of counting the number of ways to distribute 5 identical lollipops to 6 different children. In a stars-and-bars diagram, the stars would represent

- The lollipops
- The kids
- A switch from one kid to another

To 0

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The number of ways to distribute 5 identical lollipops to 6 different kids is

- $\binom{6}{5}$
- $\binom{10}{5}$
- $\binom{10}{6}$
- $\binom{11}{5}$
- None of the above

To 0

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You just found some more lollipops, so now you have 10 to give away. The number of ways to distribute 10 identical lollipops to 6 different kids is

- $\binom{11}{5}$
- $\binom{15}{5}$
-
- $\binom{16}{10}$
- None of the above

To 0

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You don't want to leave any of the kids out, so you decide that each kid should get at least one lollipop. The number of ways to distribute 10 identical lollipops to 6 different kids so that each kid gets at least one is

$\binom{10}{5}$	**A**
$\binom{11}{5}$	**B**
$\binom{16}{5}$	**C**
$\binom{16}{10}$	**D**
None of the above	**E**

To 0

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Counting Yahtzee rolls (on Jamboard)

Integer solutions to equations

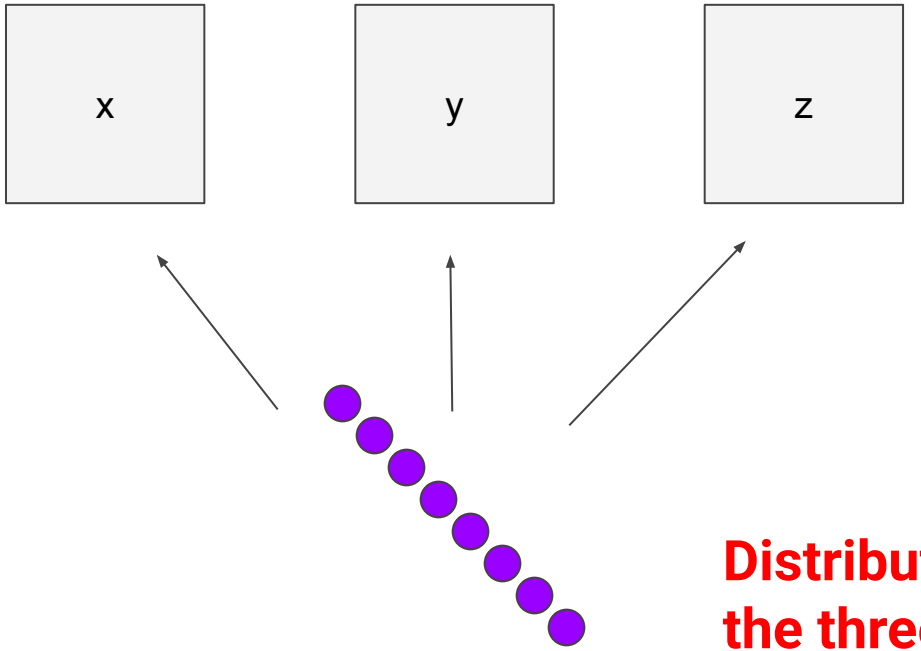
$$x + y + z = 8$$

One solution: x = 11, y = 0, z = -3. Another: x = 2.5, y = 3.5, z = 2.

How many solutions to this equation are there? → Infinitely many unless we place restrictions on the variables

How many **natural number solutions** are there?

Using stars and bars



x = 2, y = 1, y = 5

|*|***

Distribute these 8 objects to the three bins. Each bin has to get at least one.

How many integer solutions to x + y + z = 8 are there if 0 is allowed as a variable value?

- $\binom{9}{2}$
- $\binom{10}{2}$
- $\binom{11}{2}$
- $\binom{12}{2}$

To 0

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How many integer solutions to x + y + z = 8 are there if 0 is allowed as a variable value?

- $\binom{9}{2}$
- $\binom{10}{2}$
- $\binom{11}{2}$
- $\binom{12}{2}$

To 0

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