

How high is the probability of at least

two 3's when tossing 4 dices?

We consider "variation" and we number 4 dices.

"At least two 3's", so we can use sum rule:

"two 3's" + "three 3's" + "four 3's"

▣ Calculating number of events for "two 3's" is done by multiplying the result of ~~the~~ following substeps:

1. substep: "find the position of two 3's"

→ choose 2 from the position set of $\{1, 2, 3, 4\}$

→ Combination w/o-rep $\binom{4}{2} = 6$

2. substep: fill the rest of position arbitrarily (no 3)

→ variation w-rep $5^2 = 25$

▣ Calculating number of events for "three 3's":

1. substep: "find the position of three 3's"

→ choose 3 from the position set of $\{1, 2, 3, 4\}$

→ Combination w/o-rep $\binom{4}{3} = 4$

2. substep:

→ the only left position can have 5 different values

→ Variation w-rep $5^1 = 5$

☐ "four 3's"

→ Here, there is only one possibility

Total number of accepted events:

$$N(\text{two } 3\text{'s}) + N(\text{three } 3\text{'s}) + N(\text{four } 3\text{'s}) = 6.25 + 4.5 + 1 \\ = 171$$

All possible events: $6^4 = 1296$

$$\text{Laplace} \quad ; \quad P(\text{"at least two } 3\text{'s"}) = \frac{171}{1296} = 13.194\%$$