

Probability Distributions

Examples and key information

1) PASCAL'S TRIANGLE

Pascal's triangle starts with 1 in row 0 and has 1s down both sides. All the other numbers are found by **adding the two numbers directly above**. E.g. in row 2, the 2 comes from 1+1. The triangle gives you the **numbers** that go **in front** of p and q — e.g. to expand $(p + q)^4$, use **row 4** to get $(p + q)^4 = 1p^4 + 4p^3q + 6p^2q^2 + 4pq^3 + 1q^4$.

row 0	1
row 1	1 + 1
row 2	1 = 2 1
row 3	1 3 3 1
row 4	1 4 6 4 1

2) YOUR CALCULATOR'S nCr BUTTON

The **nCr button** on your calculator gives the numbers in Pascal's triangle. The probability of **r successes** from **n trials** is $nCr p^r q^{n-r}$. E.g. for 4 trials with 3 successes, type '4', 'nCr', '3', '=' and you'll get 4 — and the probability is $4p^3q$. (The powers of p and q always **add up to n**.)

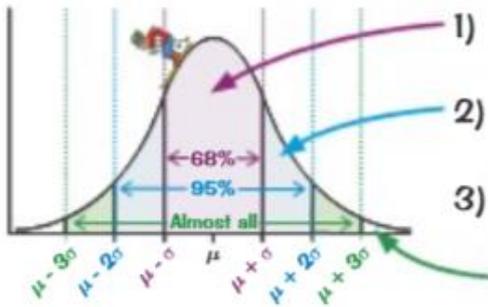
You might see nCr written nC_r or $\binom{n}{r}$.

3) CALCULATOR FUNCTIONS

Some calculators can find the **probability** you want **directly**. All you have to do is find the **binomial probability function** and enter the number of **successes** (x), number of **trials** (n) and probability of **success** (p) — make sure you know how to find probabilities on **your** calculator.

Key words

- event
- outcome
- percentage
- decimal
- normal distribution,
- binomial distribution
- standard deviation
- symmetrical
- frequencies

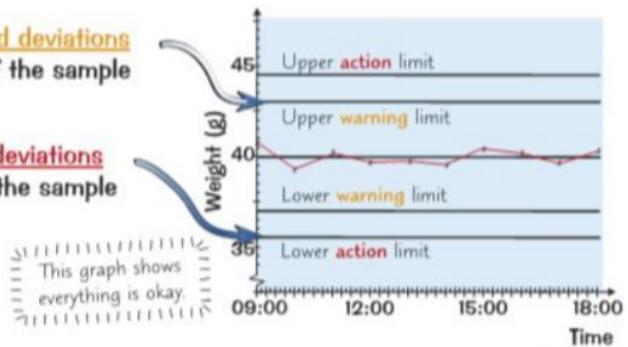


- 1) Approximately **68%** (just over two thirds) of values are within **one standard deviation** of the **mean** ($\mu \pm \sigma$).
- 2) Approximately **95%** of values are within **two standard deviations** of the **mean** ($\mu \pm 2\sigma$).
- 3) Values more than **three standard deviations** from the **mean** ($\mu \pm 3\sigma$) are **very uncommon** — these are considered **outliers** (see page 60).

Approximately 99.7% of the data values lie within 3 standard deviations of the mean.

WARNING LIMITS — these are set at **2 standard deviations** above and below the target value. Only **1 in 20** of the sample averages or ranges should fall outside them.

ACTION LIMITS — these are set at **3 standard deviations** above and below the target value. Almost **ALL** of the sample averages or ranges should fall within them.



This graph shows everything is okay.

Success Criteria: Probability Distributions

I can...

Write down one condition so that the binomial distribution is a suitable model.

Calculate binomial probabilities for a given n and p.

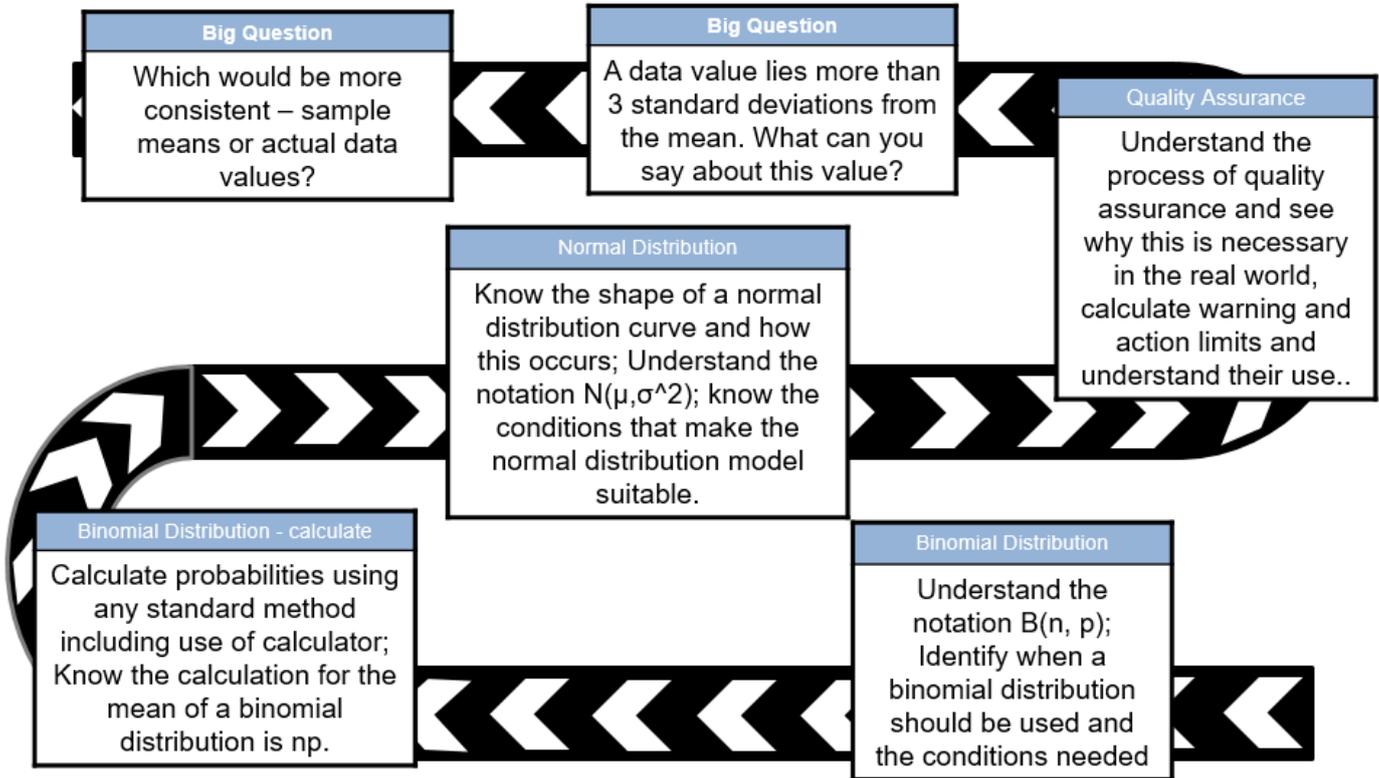
Work out the mean if given a standardised score and the standard deviation.

Draw action lines and warning lines on a control chart when given the mean and standard deviation.

Determine what action to take on a control chart when given a sample mean.

Think big.
Chase dreams.
Succeed together.

Mathematics Learning Journey: Probability Distributions



Achievement resilience
 Community PERSEVERANCE Pride

SHUTTLEWORTH COLLEGE

<p>DEFINITION</p> <p>ETYMOLOGY/MORPHOLOGY</p>	<p>CHARACTERISTICS</p>
<p>EXAMPLES</p>	<p>NON-EXAMPLES</p>