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Fundamentals of Hypothesis Testing

Given one point





Two points

Lot's of points



How do you use
hypothesis testing?

What is hypothesis testing?



Comparison

What is hypothesis testing?

A method to determine if there is sufficient evidence to support a hypothesis.

Samples of a population of interest

Meeting specification

Checking a solution

Detecting a difference



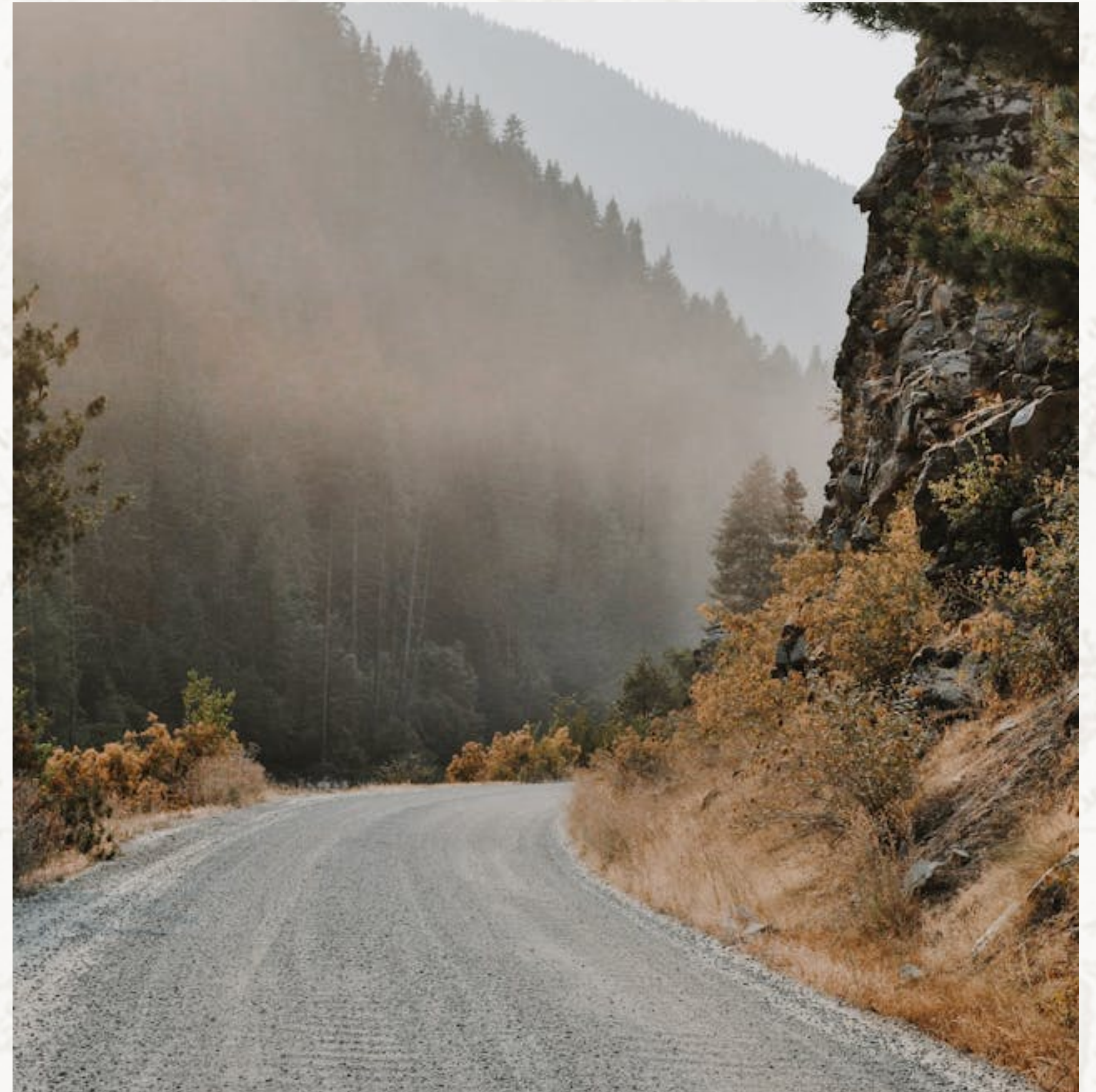
Randomness

What is hypothesis testing?

If the world had no randomness –
making one measurement would be
sufficient...

Alas, there is plenty of randomness

What is a random sample?



Differences

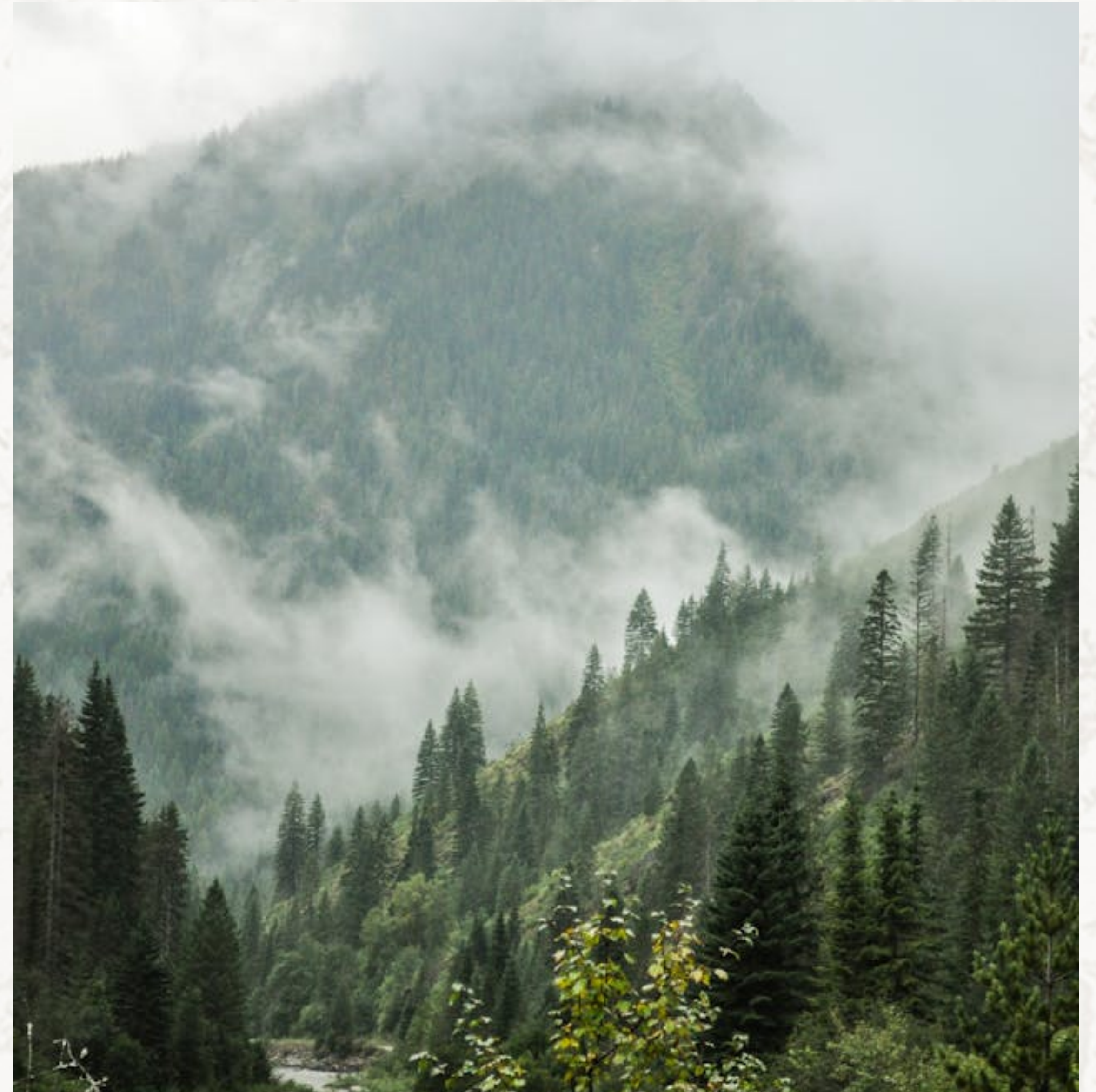
What is hypothesis testing?

A useful method when making a comparison of two things.

A sample of measurements to a specification

Two samples from different processes

A before and after a design change



Which type(s)

do you use?

Basic Process



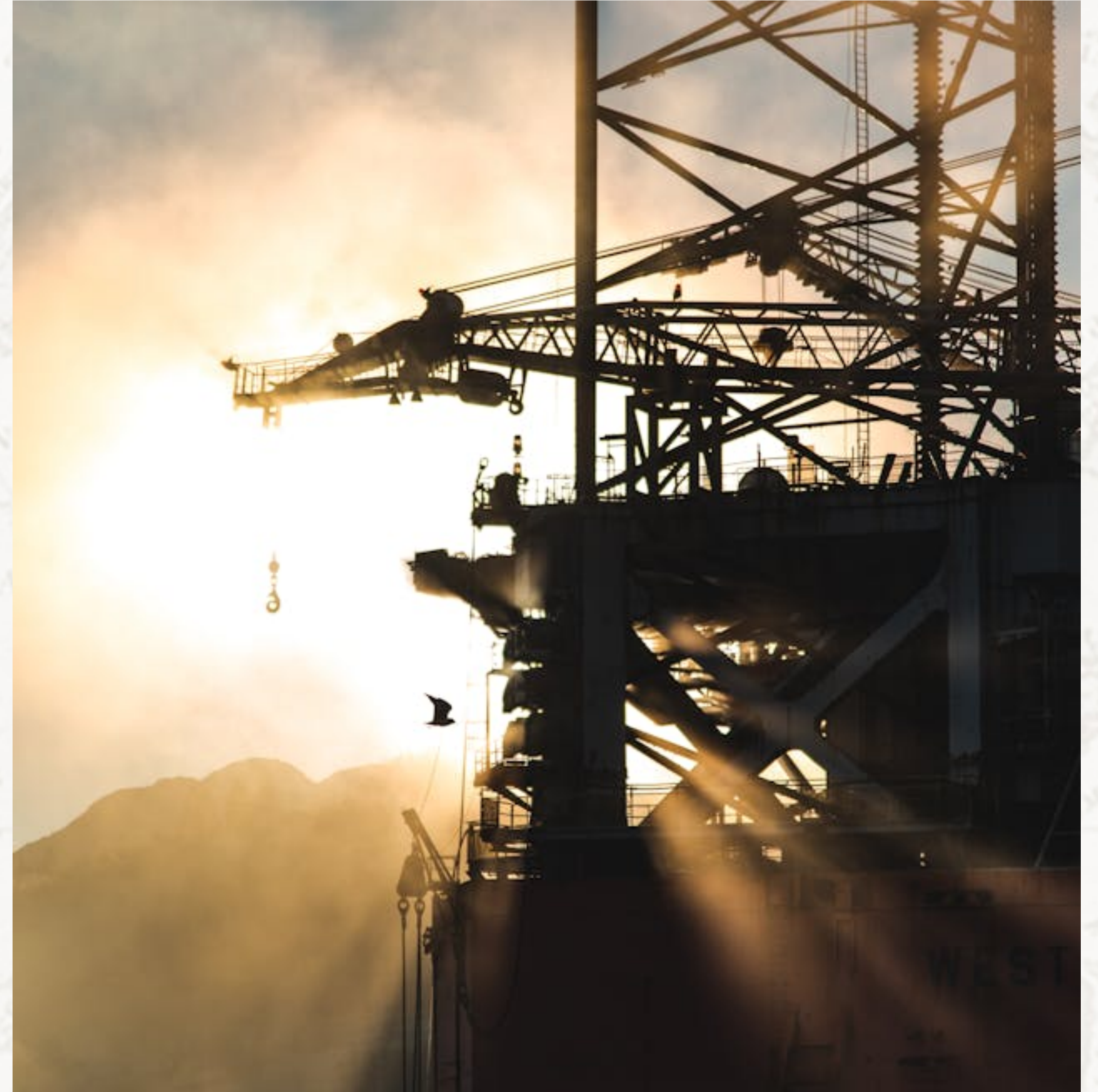
Hypothesis

Basic Process

A process change – did this result in a lower weight?

Null hypothesis – no change

Alternate hypothesis – new process results in a lower weight



Data

Basic Process

Plot the data – box plots, histograms, etc.

The test statistic is calculated based on the sample measurements.

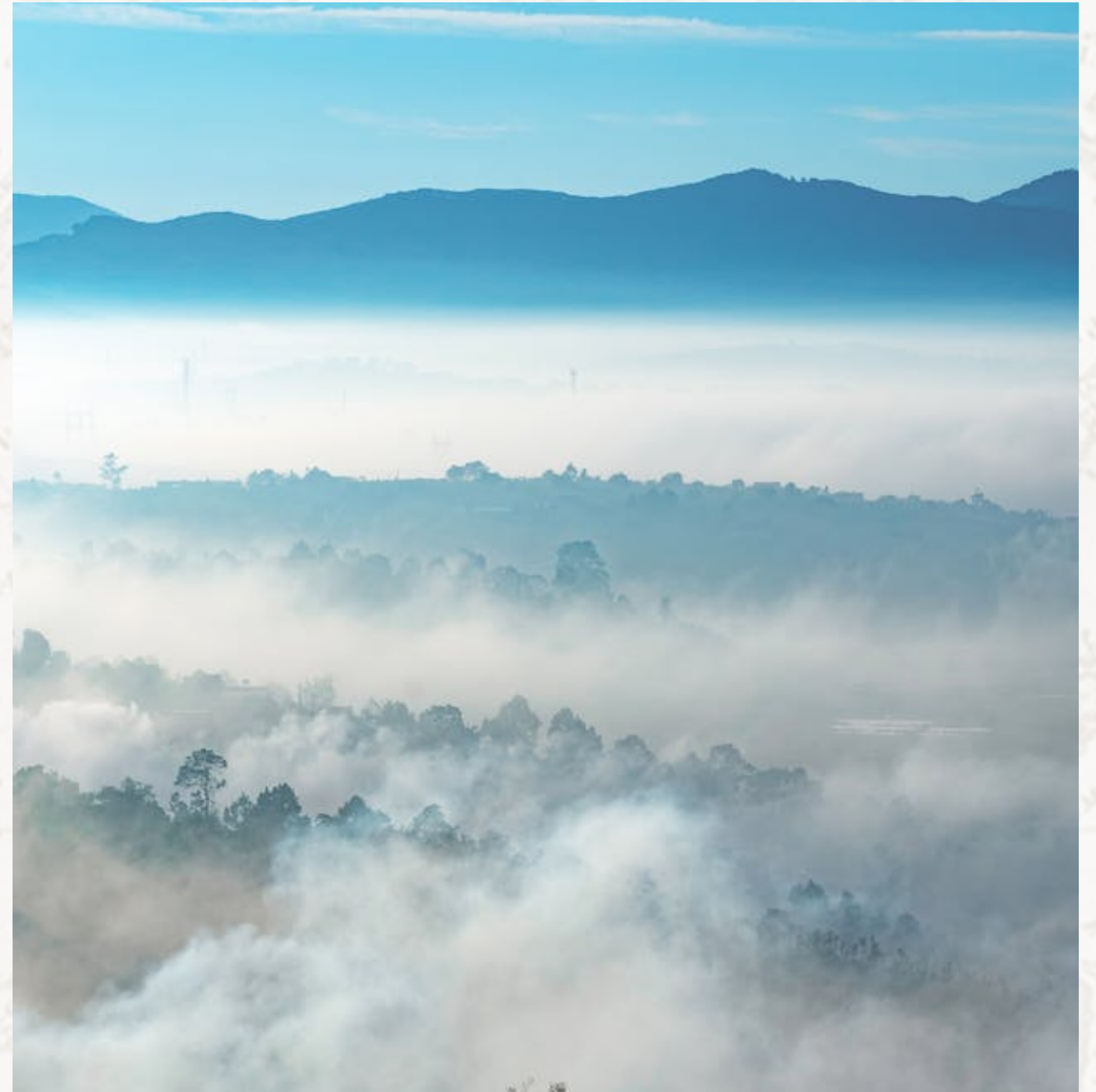
Sample size calculation to minimize type I and II errors

Assumptions to check:

measurement error acceptable

random sample from the population

underlying distribution



Calculation

Basic Process

The test statistic is a measure of the shift in the parameter

For a z-test

$$z = \frac{\bar{y} - \mu_0}{\sigma_{\bar{y}}}, \text{ where } \sigma_{\bar{y}} = \frac{\sigma}{\sqrt{n}}$$

Compare z to the critical value



How do you

check your work?

A few issues



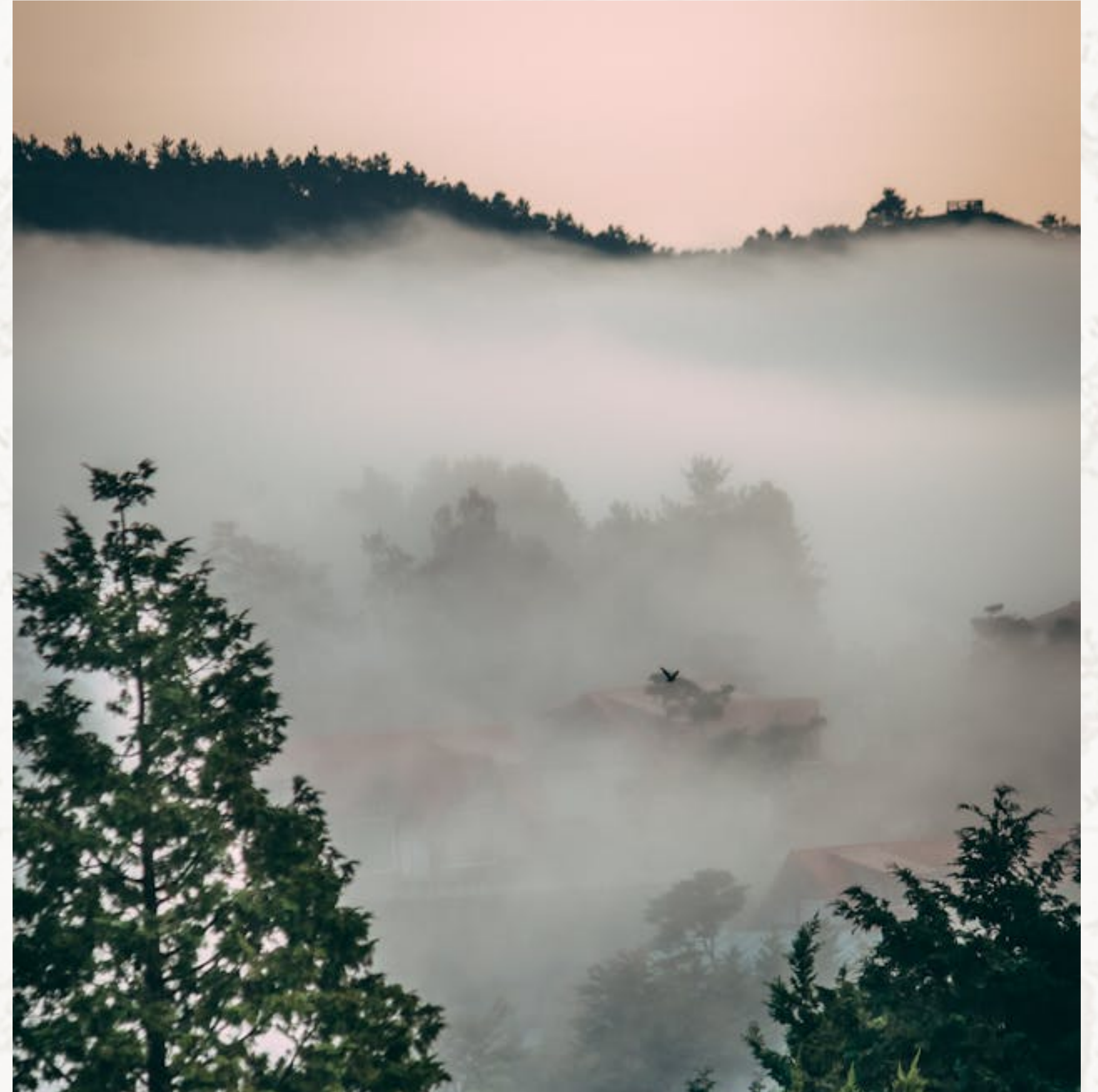
Measurement error

A few issues

Some portion of the variation of the sample measurements is due to measurement error.

So, check it!

Large measurement error will lead to faulty conclusions.



Multiple comparisons

A few issues

There are other comparison tools

Design of Experiments

Analysis of Variance

Control Charting

Nonparametric methods



Statistical vs Practical

A few issues

Statistical significant

Practical importance

The effect of sample size

Use statistical intervals instead

(graphical methods should always be
a part of the analysis)



When was the last

you did a comparison?

Additional Comments and Questions

Thanks

see more at AccendoReliability.com