



Fundamentals of Sample Size Determination

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How Many
Samples?

Consider
the
Decision



Constraints



Why Do We Use

Samples?

Why Sample?



Feasibility



Destructive Testing



Cost

Feasibility



Does every item in the population even exist?

Sample vs Population

Cost

Testing Time

Pre-production

Decision support

Destructive Testing



Consumed during testing or measurement

Hard to sell destroyed items

Cost



Sample cost

Testing cost

Measurement cost

Analysis cost

The results have to be
worth the expense

Do You Use Standard

Sample Sizes?

Statistical Considerations



Population Variability



Discrimination



Confidence

Population Variability



Important and Difficult

We often do not know the population variance – so, what do you do then?

More variability= more samples

Less variability = less samples

Discrimination



What difference do you want to detect?

How small of a change matters?

How much of a difference matters?

Confidence



This not just feeling good by
doing some testing

Type I sample error

The probability that the sample provides results that are similar to the actual population values

Nearly always assumes a random sample from the entire population

What does 50%

Confidence Mean?

Business Considerations



Cost per Sample

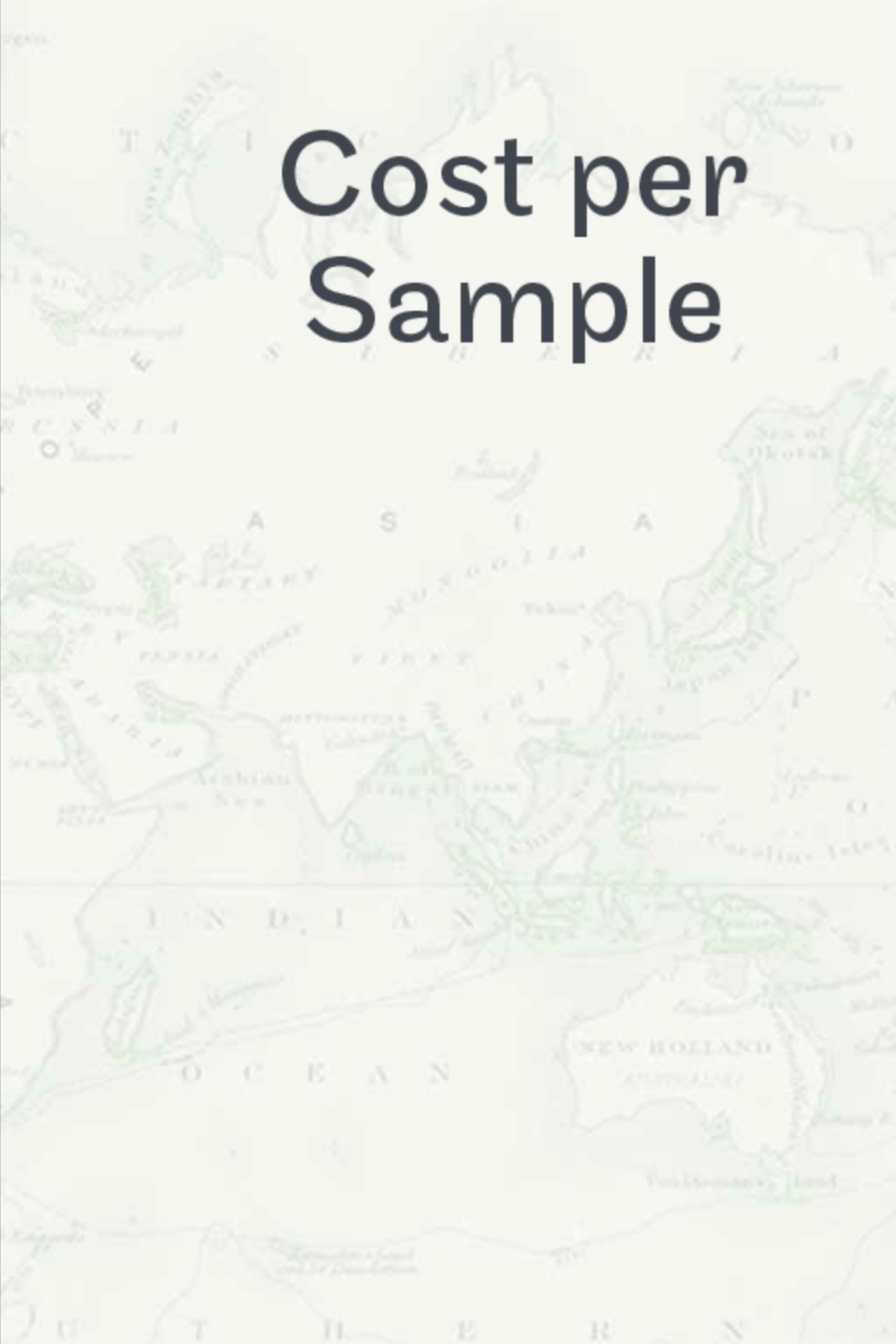


Decision Importance



Purpose

Cost per Sample



Decision Importance



Purpose of the Experiment



Can any sample

have no risk?

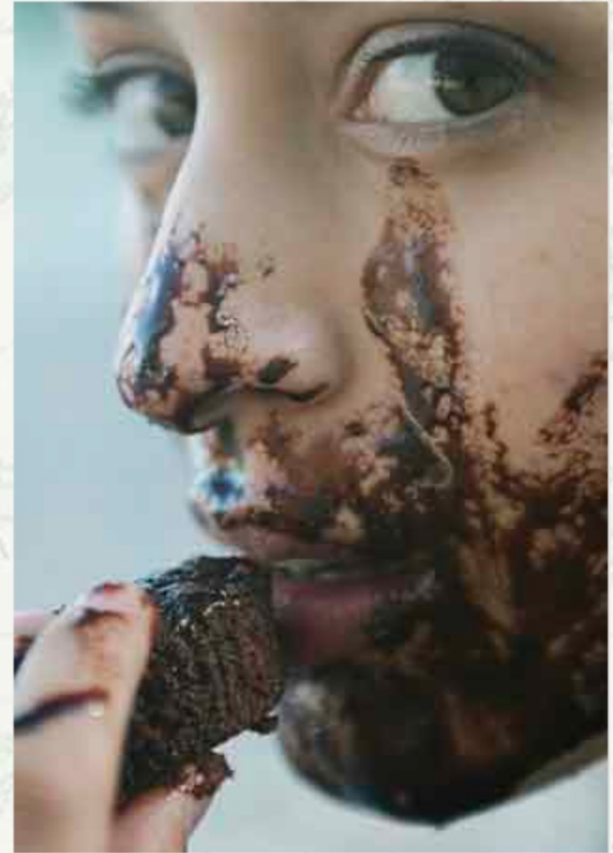
Sample Size Formulas



Comparing Means



Success Testing



ALT

Comparing Means

Hypothesis Testing

$$H_o : \mu = \mu_o$$

$$H_a : \mu > \mu_o$$

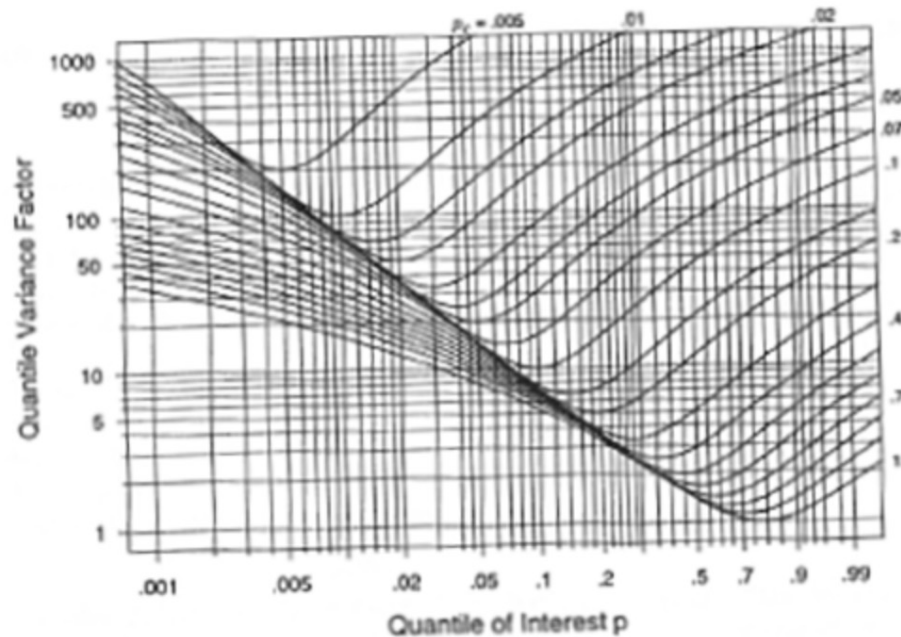
$$n = \sigma^2 \frac{(z_\alpha + z_\beta)^2}{\Delta^2}$$

Success Testing

$$n = \frac{\ln(1 - C)}{m \bullet \ln R_L}$$

ALT w/ Weibull

$$n = \frac{z_{(1-\alpha/2)}^2 V_{\log(\hat{t}_p)}}{[\log(R_T)]^2}$$



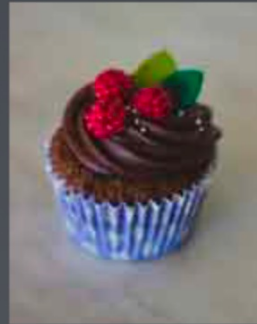
Meeker, William Q and Luis A Escobar. 1998. Statistical Methods for Reliability Data. New York: Wiley.

What are the Best
Ways to Reduce

Sample Size?

In Summary

Questions & Life Data



Fit and Plot



Analysis



Ask better questions



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