NATIONAL RESEARCH UNIVERSITY

School of Data Analysis and Artificial Intelligence Department of Computer Science

DATA SCIENCE FOR BUSINESS

Lecture 8. Design of experiments

Moscow, June 3rd, 2022.

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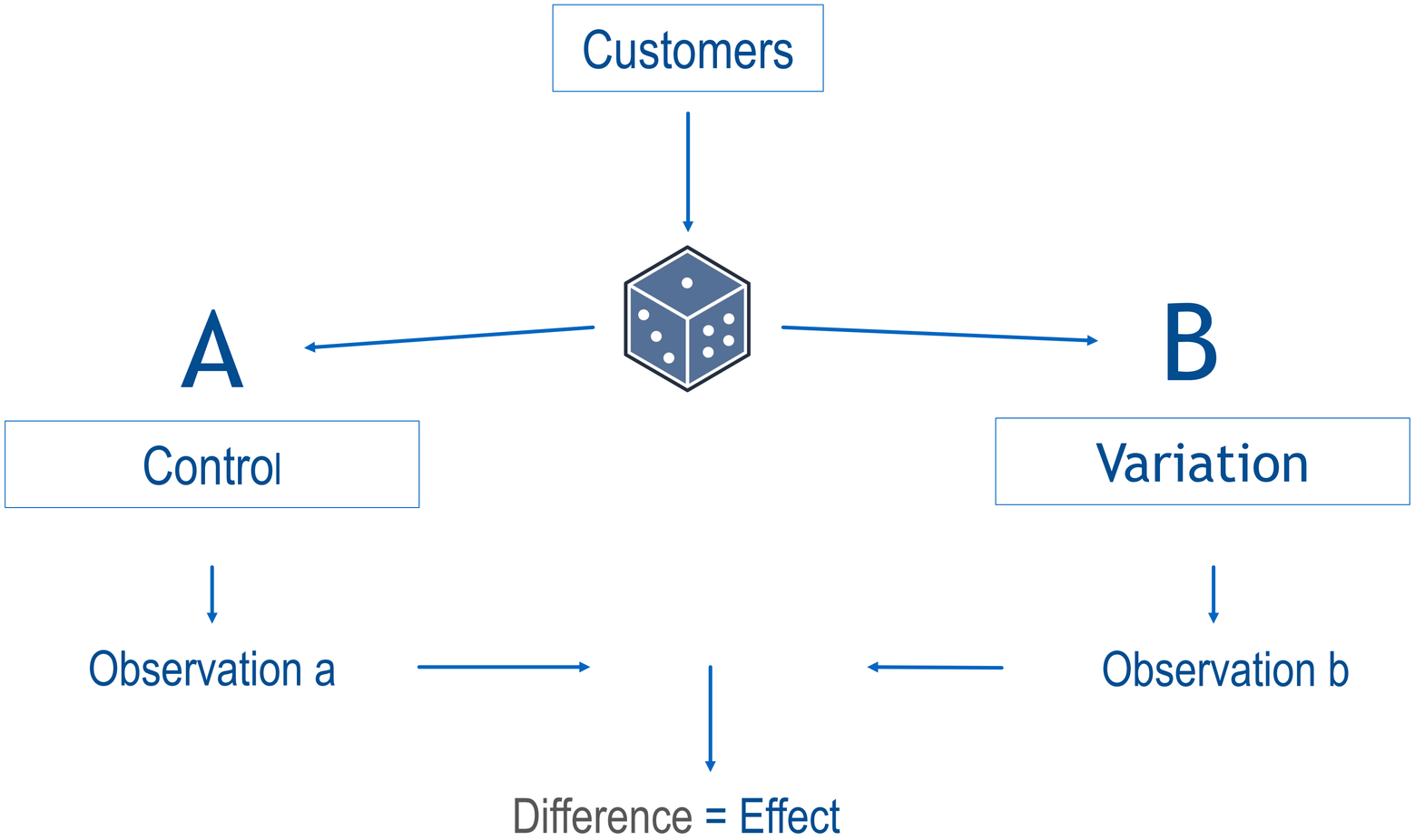
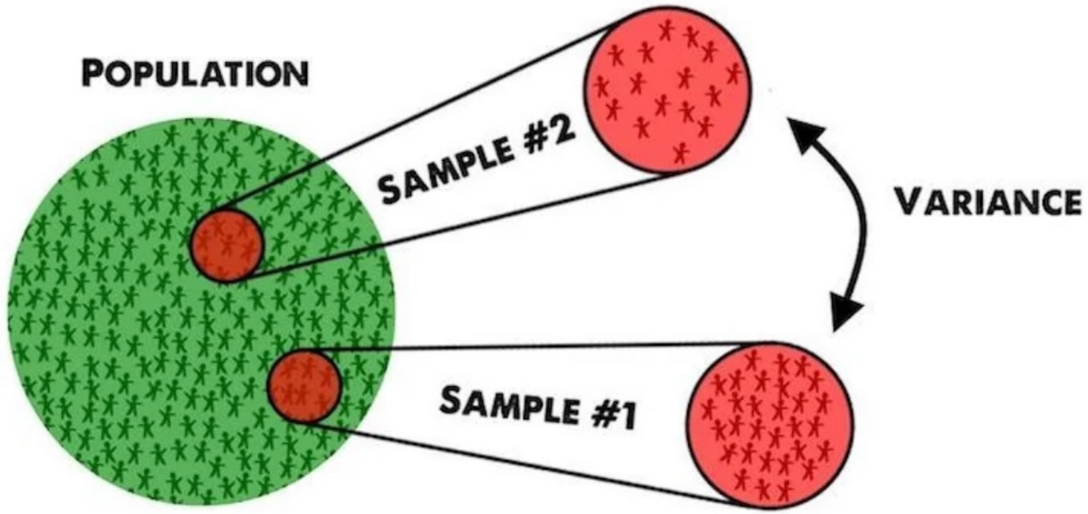
DESIGN OF EXPERIMENTS

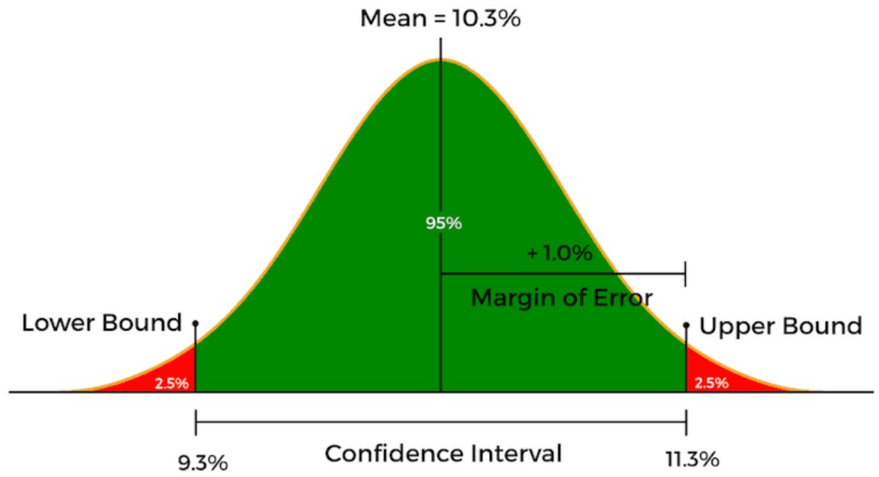
Randomized experiments allows us to measure the true effect of proposed solutions



STATISTICAL SAMPLING

A/B testing set up





The “**population**” is the group we want information about**.**

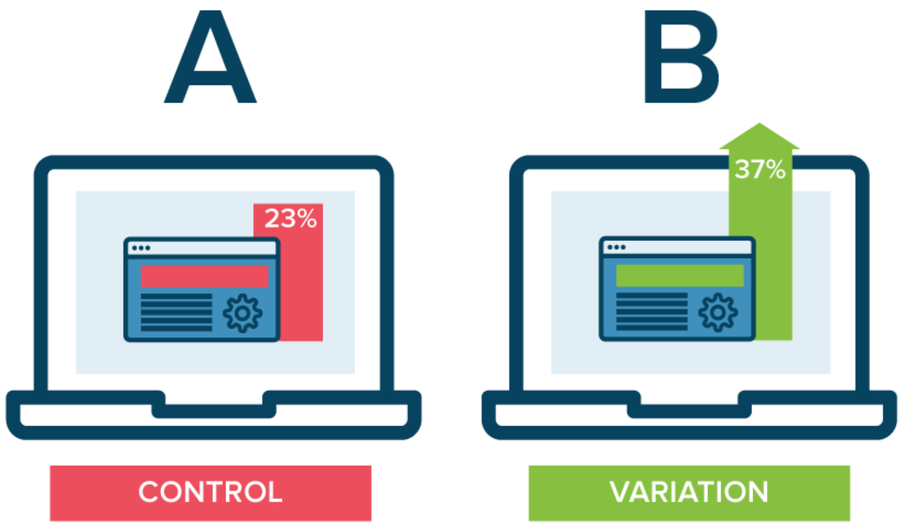
The “**sample**” is a small portion of the larger population.

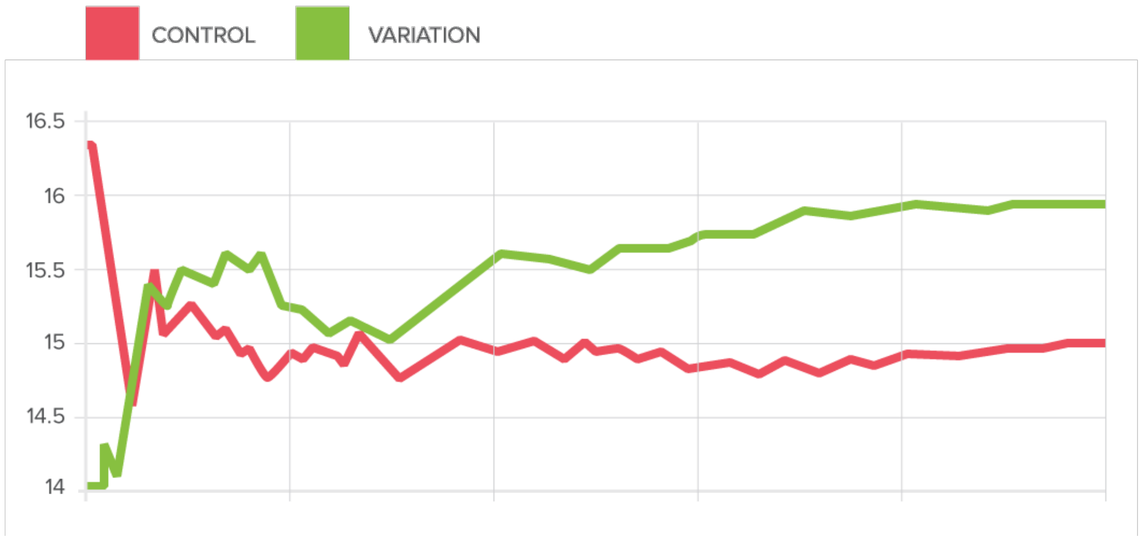
The variability across samples is expressed as a unit called the “**variance**”,

The higher the variance, the more variable the mean will be across samples

DESIGN OF EXPERIMENTS – A/B TESTING

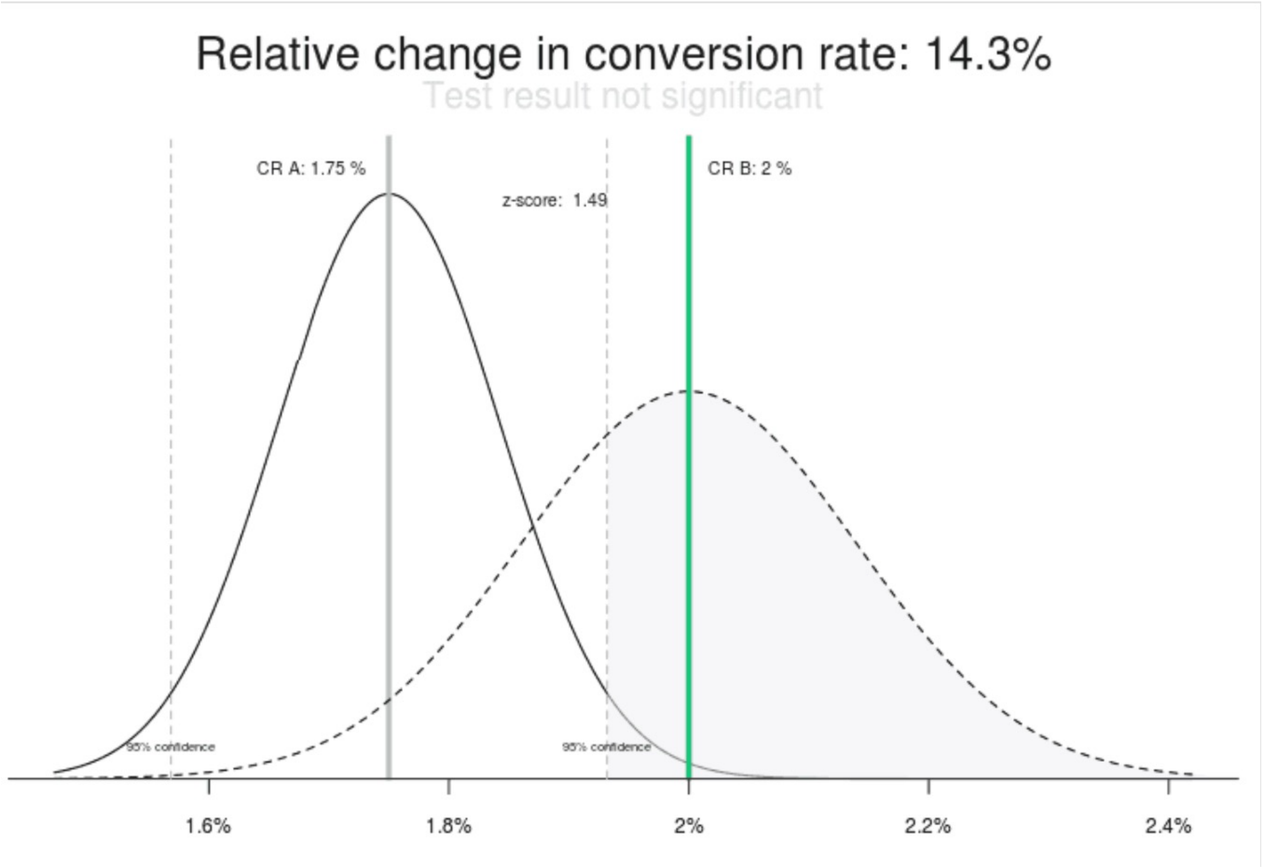
A/B testing set up





INTERPRETING THE RESULTS

A/B testing set up



INTERPRETING THE RESULTS

	Participants	Conversions
Variation A	500	200
Variation B	500	220

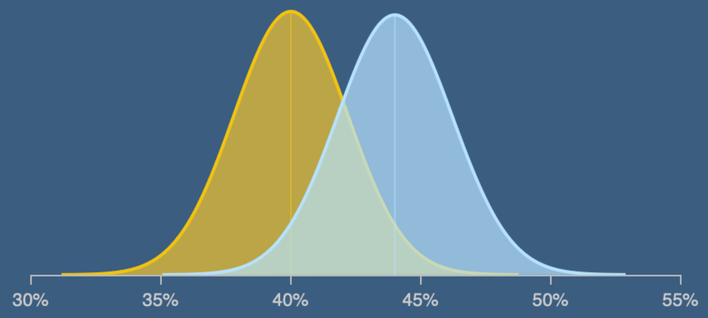
reset form

Copy Results URL

Executive Summary

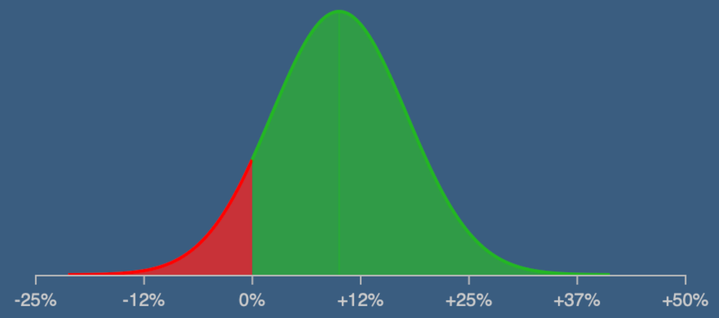
Variation B's observed conversion rate (44%) was 10% higher than Variation A's conversion rate (40%).
There is a 90% chance that Variation B has a higher conversion rate.
You can be confident that this result is a consequence of the changes you made and not a result of random chance.

Conversion Rate Distributions



the true conversion rates (the numbers you would get if you ran the test forever) for Variation A and Variation B fall somewhere within their respective bell curves above

Improvement Distribution



if you change from Variation A to Variation B the improvement you will see in the long run falls somewhere within this bell curve

INTERPRETING THE RESULTS

	Participants	Conversions
Variation A	500	200
Variation B	500	210

reset form

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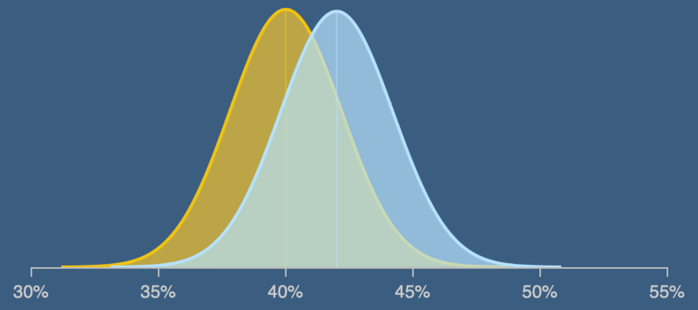
Executive Summary

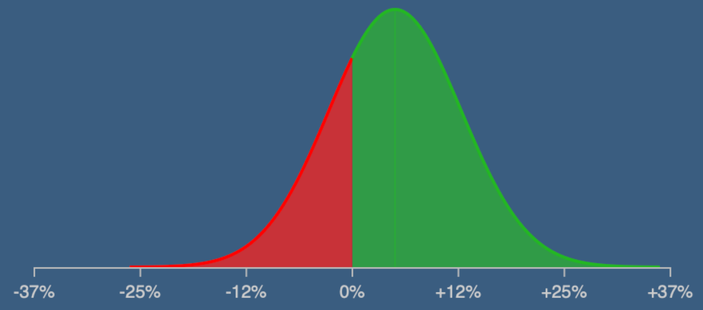
Variation B's observed conversion rate (42%) was 5% higher than Variation A's conversion rate (40%).
There is only a 74% chance that Variation B has a higher conversion rate.
You cannot be confident that this result is a consequence of the changes you made and not a result of random chance.

Conversion Rate Distributions



the true conversion rates (the numbers you would get if you ran the test forever) for Variation A and Variation B fall somewhere within their respective bell curves above

Improvement Distribution

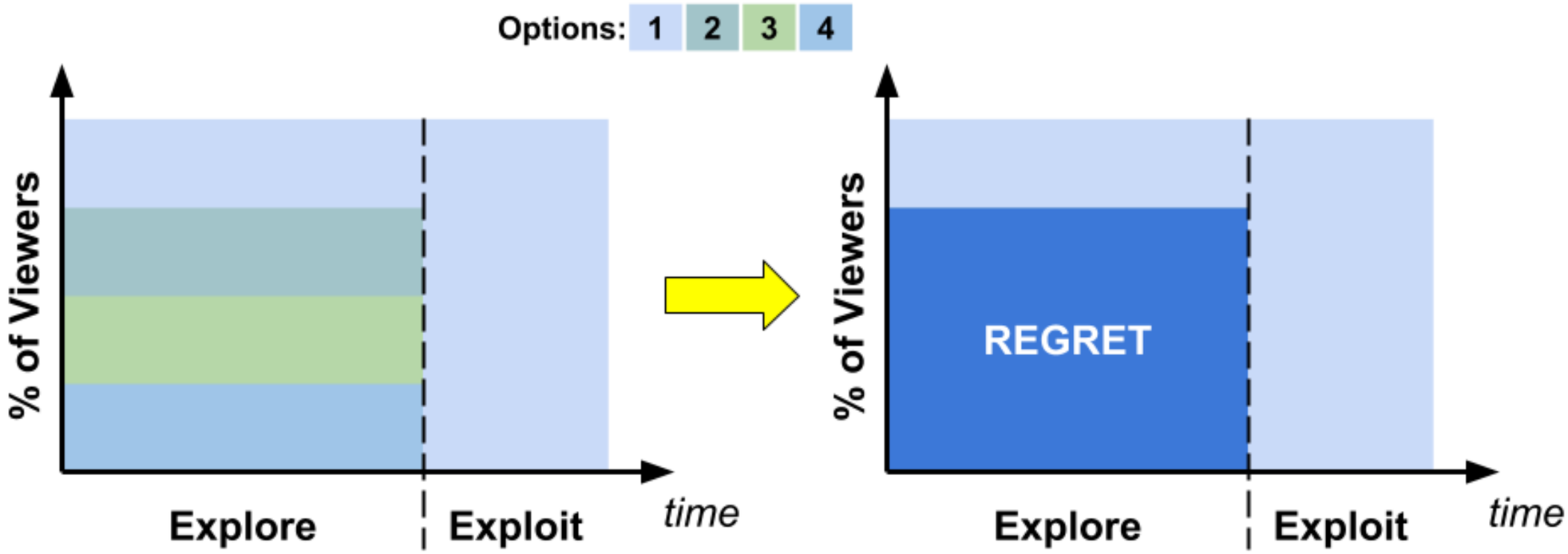


if you change from Variation A to Variation B the improvement you will see in the long run falls somewhere within this bell curve

INTERPRETING THE RESULTS

EXPLORE–EXPLOIT DILEMMA

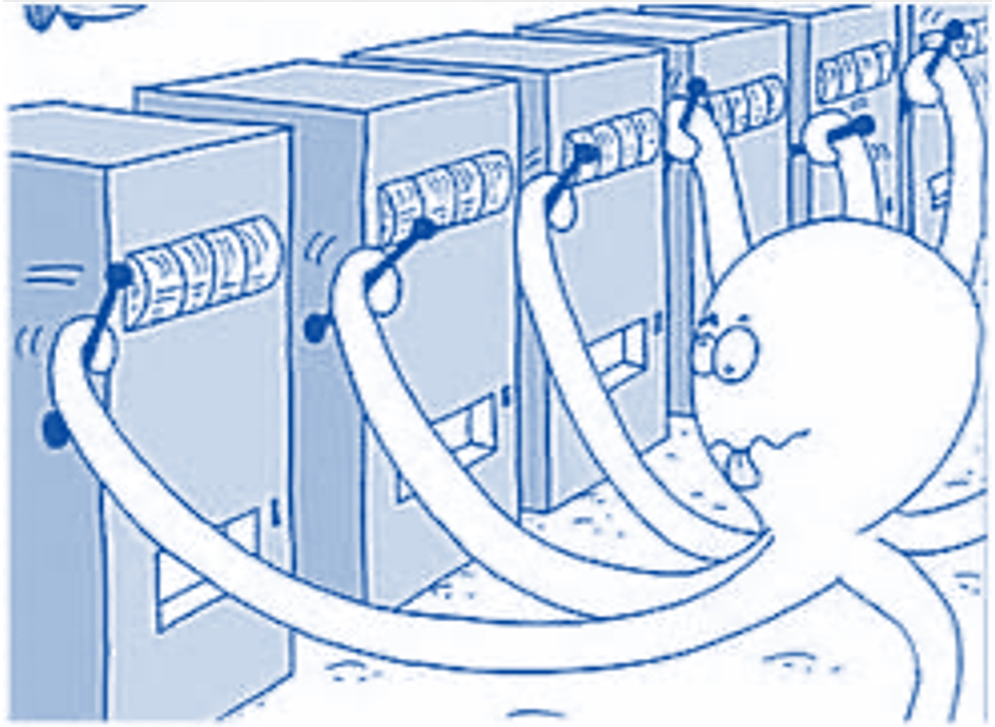
A/B/C… testing



MULTI-ARMED BANDITS (MAB)

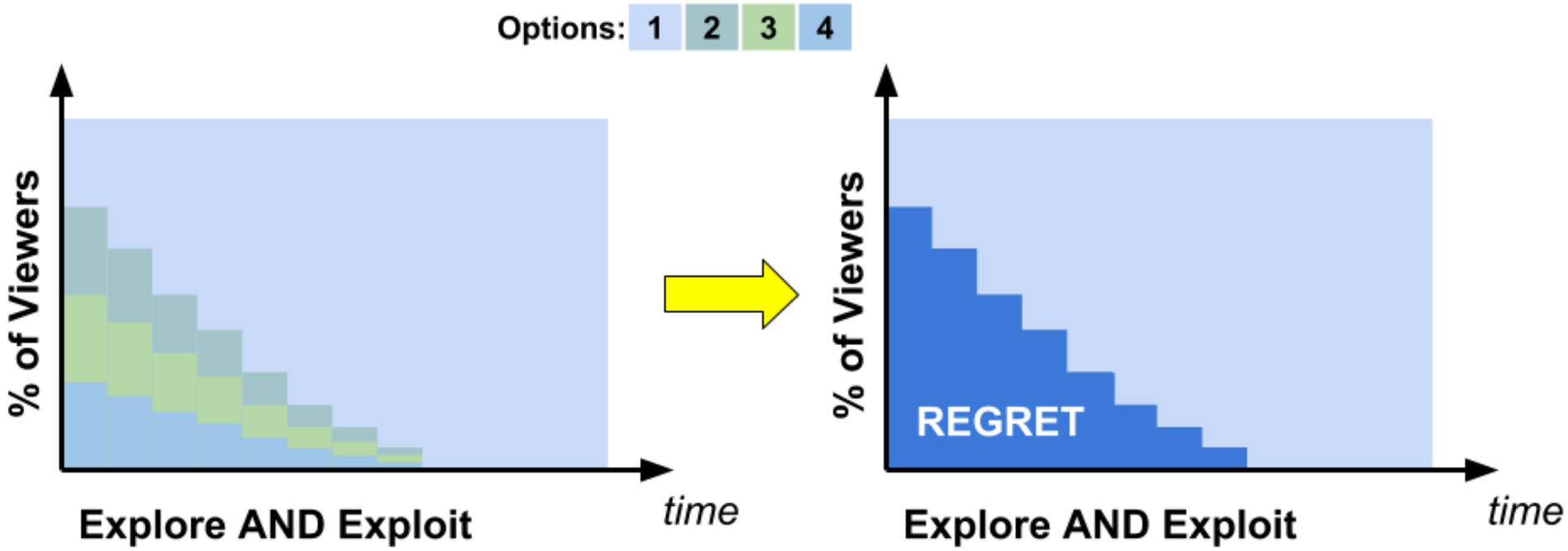
Dynamically adjust the allocation

”Multi-armed bandit" - a hypothetical experiment where a person must choose between multiple actions – which slot machine to pull, in which order and how many times, each with an unknown payout. The goal is to obtain the most profitable outcome through a series of improving choices.



EXPLORE–EXPLOIT DILEMMA

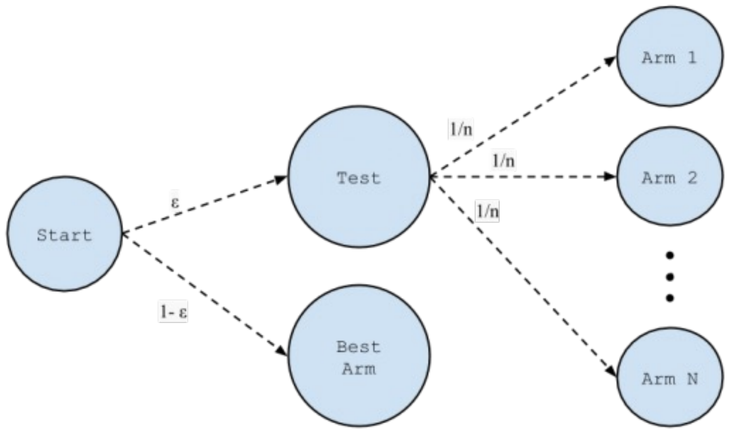
Multi-arm bandits



MULTI-ARMED BANDITS

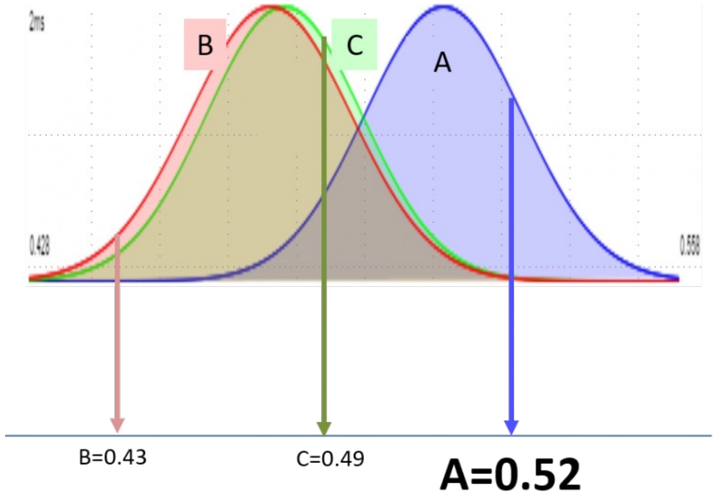
Solution strategies

Epsilon-greedy algorithm



- On every step select the higher expected mean reward option with probability 1- eps (exploit) and others with eps/n, eps –probability of explore
- Update mean rewards
- Most time exploiting

Thompson sampling

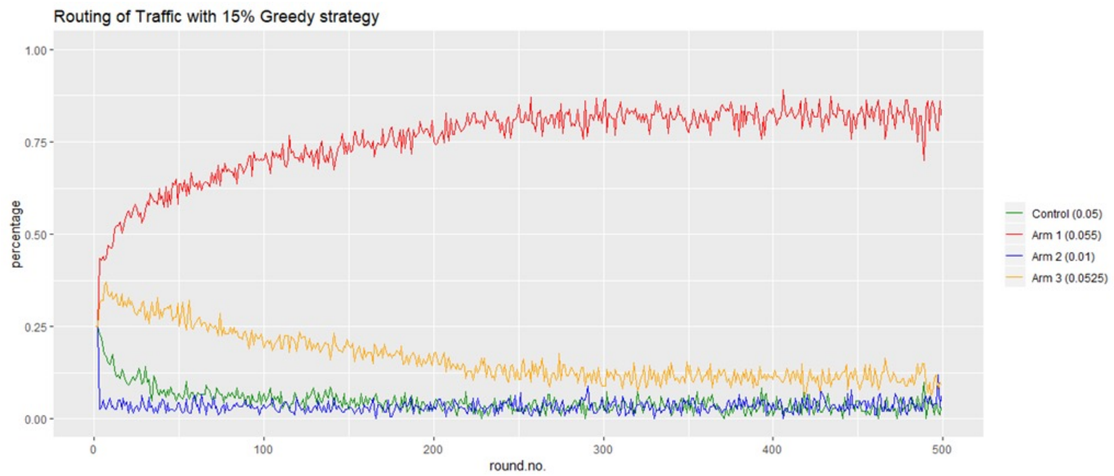


- On every step sample from the distribution of expected rewards and choose one with largest sample.
- Update posterior distributions

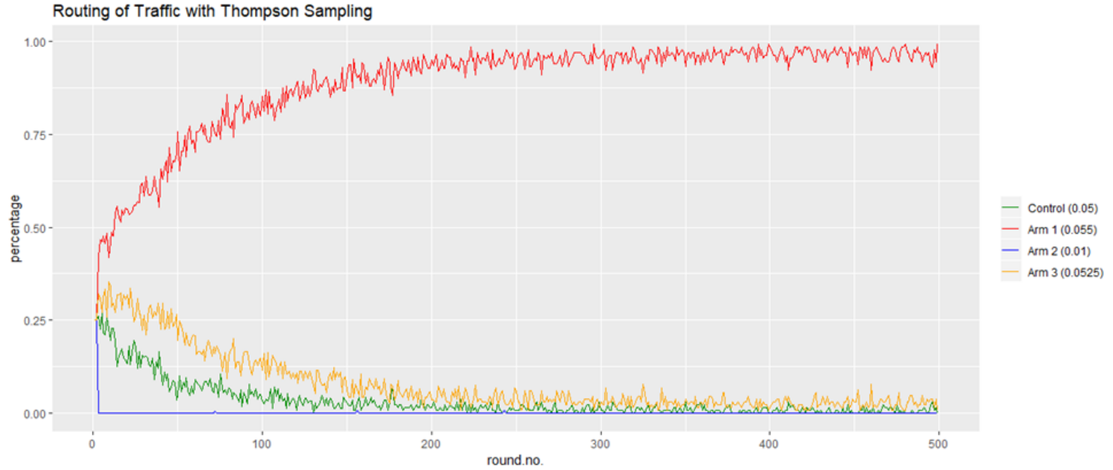
MULTI-ARMED BANDITS

Solution strategies

Epsilon-greedy algorithm

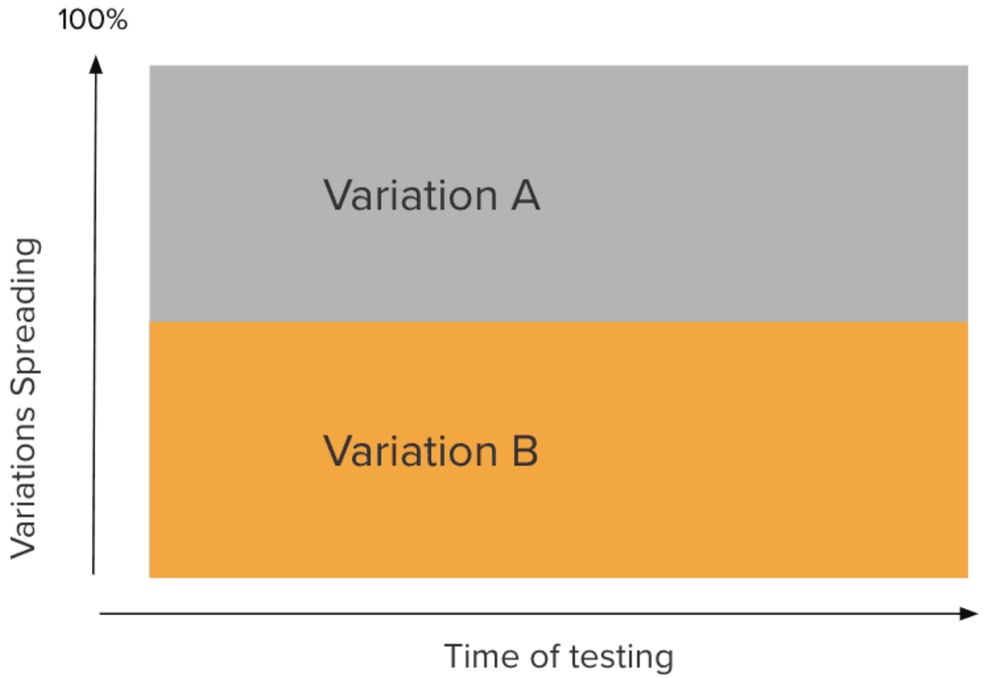


Thompson sampling

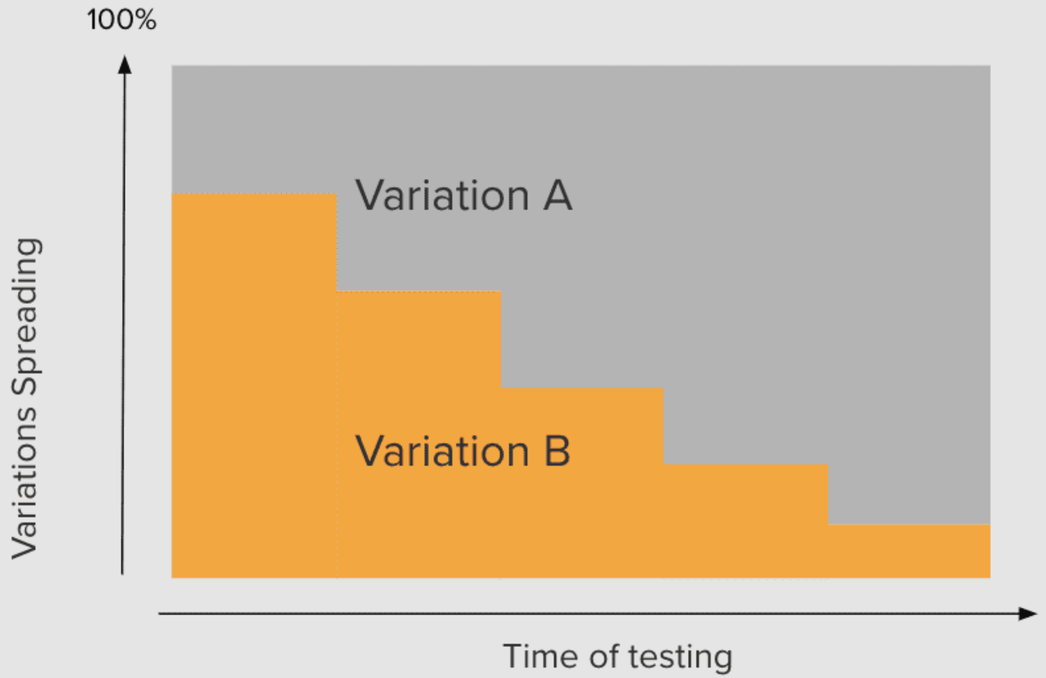


DESIGN OF EXPERIMENTS

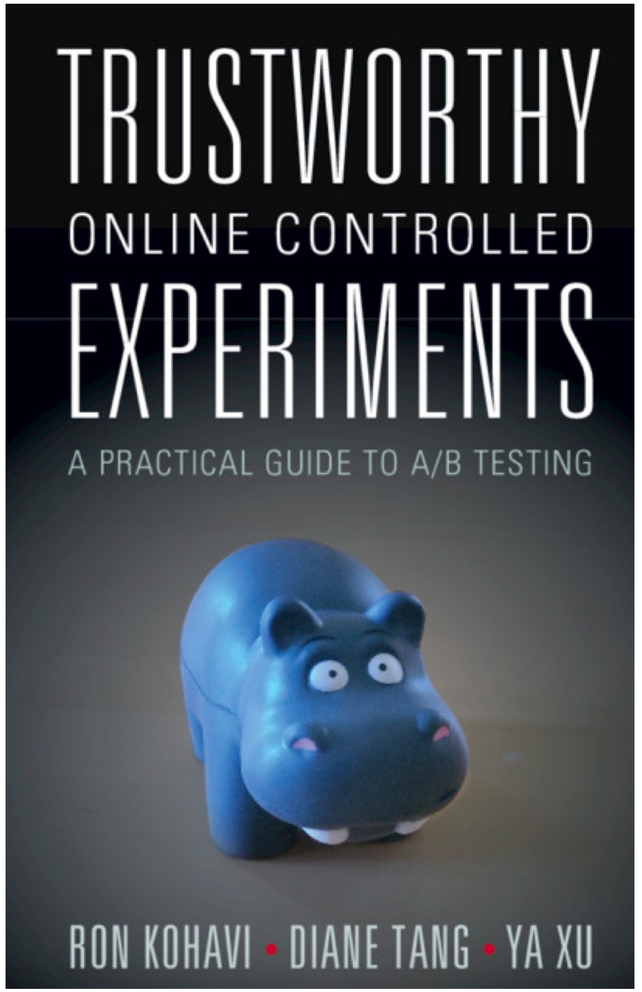
A/B testing



Multi-armed bandits



MORE READING



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