

# Research Questions

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# Research Questions

Guidelines of formulating RQ and structure research

# Research Questions

## What is a research question?

- Clear statement of what to research
  - Novel
  - Quantifiable
  - Interesting
  - Relevant
  - Non-trivial
  - Precise

### Example

Is method  $\mathcal{X}$  suited to solve problem  $\mathcal{Y}$ ?

# Research Questions

## Why start with a research questions?

- Guides your research
- Strategy of how to conduct the research
  - Helps to remain focused
- Communication device
- Blueprint for papers

## Alternative Approaches

Problem statement, hypothesis

# Research Questions

## Granularity of research questions

- Too general (solve everything)
- Too specific (solve small detail)
- Typically one research question equates one contribution
- Unsure → ask your supervisor!

# Research Questions

## Examples of critical research questions

- What is the **optimal** way so solve  $\mathcal{X}$ ?
  - $\rightarrow$  prove required
- Is is **possible** to solve  $\mathcal{X}$ ?
  - Might be trivial (e.g., via manual work)
  - e.g., Can we apply Naive Bayes for spam detection?
- Does  $\mathcal{X}$  **maximise**  $\mathcal{Y}$  and **minimise**  $\mathcal{Z}$ ?
  - Requires logic to combine different targets (e.g., trade-offs)

# Research Questions

## Types of research questions

- Depend of the type of research
- Hypothesis driven or exploratory?
- Type of study design (prospective, interventional, ...)

# Research Questions

## Exploratory research questions

- Existence questions
  - Does  $\mathcal{X}$  exist?
  - Is  $\mathcal{X}$  actually a problem?
  - Is there a useful applications for solution of  $\mathcal{X}$ ?
- Description question
  - What is  $\mathcal{X}$  like?
  - How can  $\mathcal{X}$  be measured?
  - What are the parts of  $\mathcal{X}$  (and how do they relate to each other)?



# Research Questions

## Exploratory research questions

- Classification question
  - What types of  $\mathcal{X}$  are there?
- Descriptive-comparative questions
  - How does  $\mathcal{X}$  differ from  $\mathcal{Y}$ ?

# Research Questions

## Base-rate questions

- Frequency question
  - How often does  $\mathcal{X}$  occur?
  - What is the average amount of  $\mathcal{X}$ ?
- Distribution questions
  - What distribution best describes  $\mathcal{X}$ ?
- Descriptive-Process questions
  - How does  $\mathcal{X}$  normally work?
  - What triggers  $\mathcal{X}$ ? How does the process look like?
  - In what sequence of events does  $\mathcal{X}$  happen?
  - How does  $\mathcal{X}$  achieve its purpose?

# Research Questions

## Relationship questions

- Relationship question
  - Are  $\mathcal{X}$  and  $\mathcal{Y}$  related?
  - Do  $\mathcal{X}$  and  $\mathcal{Y}$  correlate?
- Causality questions
  - Is there a causal relationship between  $\mathcal{X}$  and  $\mathcal{Y}$ ?
  - Does  $\mathcal{X}$  cause  $\mathcal{Y}$ ? Does  $\mathcal{X}$  prevent  $\mathcal{Y}$ ?
  - What are the factors for  $\mathcal{X}$  to cause  $\mathcal{Y}$ ?
  - Does solution  $\mathcal{X}$  cause problem  $\mathcal{Y}$  to be solved?
- Causality-Comparative questions
  - Does  $\mathcal{X}$  cause  $\mathcal{Y}$  more than does  $\mathcal{Z}$ ?

# Research Questions

## **Knowledge questions** (non-empirical approach)

- Design question
  - What is an effective way to achieve  $\mathcal{X}$ ?
  - What strategies are helpful to solve  $\mathcal{X}$ ?

# Research Questions

## **Approach to research questions**

- Start with a single RQ
- Split into smaller (research) questions

# Research Questions

## Workflow of writing a RQ driven paper/thesis

- Start with a single RQ
- Split into smaller (research) questions

**Introduction** Does the problem exist? How relevant is it? What would be possible (impact)?

**Related work** How well is it solved already? How has it been approached?

**Method** How have you approached it? Why did you do it this way?

**Evaluation** How can it be measured? How well is it solved?

**Future Work** What is still missing?

# Research Questions

## Literature

- Easterbrook, S., Singer, J., Storey, M. A., & Damian, D. (2008). Selecting empirical methods for software engineering research. In *Guide to advanced empirical software engineering* (pp. 285-311). Springer, London.

# Thank You

For your attention!