April 2023

2IMP40 Empirical Methods in Software Engineering 22/23 · 4 exercises · 100.0 points

1   Part 1 (20 points)

20.0 points · 5 questions

The first part of the exam consists of **five** multiple choice questions. Each question has four answer options and exactly one is correct. Each correctly answered question gives four points. We estimate that "an average student" will not spend more than 18 minutes answering these questions.

Text

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a   Field studies are appropriate when the researchers aim at

4.0 points · Multiple choice · 4 alternatives

○   building a new theory based on the existing ones   0.0

○   performing precise measurements   0.0

○   generalizing the findings across populations   0.0

◉   **understanding the phenomenon under study in the most realistic context**   4.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

b In the study discussed during the lecture Luca Pascarella and his co-authors wanted to compare the answers provided by video-game developers and software developers that are not game developers. They have asked fourteen questions on the scale Strongly disagree… Strongly agree and compute fourteen p-values corresponding to the Wilcoxon test comparing distributions of two groups of answers (game developers vs non-game developers) for each one of the questions. Then they adjusted these p-values to control for the false discovery rate.

Please select the right statement from the four statements below.

4.0 points · Multiple choice · 4 alternatives

○   the adjustment procedure would not have been necessary if the 0..10 scale has been used instead of Strongly disagree… Strongly agree   0.0

○   after the adjustment procedure, some of the p-values have decreased   0.0

◉   **after the adjustment procedure, some of the p-values have increased**   4.0

○   the adjustment procedure would not have been necessary if the Student's t-test has been used instead of the Wilcoxon test   0.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

c To conduct a series of interviews with visually-impaired software developers researchers have decided to perform a respondent-driven sampling. As an expert on empirical methods you would recommend them to …

4.0 points · Multiple choice · 4 alternatives

◉ **start with well-connected (in terms of professional contacts) developers from different continents to ensure that the initial set of participants is diverse enough**　　4.0

○ ask the interviewees to identify prospective participants rather than recruit them such that the researchers can select the most promising participants for the next interview round　　0.0

○ use traditional statistical methods to analyze the data obtained after conducting interviews.　0.0

○ encourage the interviewees to provide as many names as possible such that the researchers can reach many people in a short amount of time　　0.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

d Several perils of mining GitHub repositories have been discussed by Kalliamvakou et al. To filter out inactive, personal, or projects with low activity the authors of a study investigating the influence of Continuous Integration on code reviews choose to only focus on GitHub projects with more than 5,000 stars. What risk is most relevant for this sampling strategy?

4.0 points · Multiple choice · 4 alternatives

◉ **the results of the study are biased towards larger software projects**　　4.0

○ there could still be many personal projects in this dataset　　0.0

○ JavaScript projects might be systematically excluded　　0.0

○ the researchers might not be able to identify all git merges in the repositories　　0.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

e   A research team is interested in exploring the problems newcomers experience when joining open-source software projects. They decide to run an interview study where they talk to people that recently joined an open-source project. To this end, they recruit people by approaching contacts of the researchers on LinkedIn that are active in open-source.

What sampling strategy is used by the researchers?

4.0 points · Multiple choice · 4 alternatives

◯   purposive sampling   0.0

◯   snowball sampling   0.0

◯   simple random sampling   0.0

◉   **convenience sampling**   4.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

2 Part 2 (40 points)
40.0 points · 8 questions

The italic text included below is a summary of an introduction of a recent empirical paper. This summary concludes with a research question. For this part of the exam, we ask you to sketch an empirical study that answers the listed research question. This part is divided over several sub-questions which ask you to indicate your choice for research strategy and to describe the data collection, and data analysis methods. In particular, for your data collection we ask you to explicitly describe and discuss your sampling. In addition to sketching your study design, we also ask you to motivate each part.

To grade your submissions we will consider the alignment between your chosen strategy and sampling, data collection and data analysis methods. Secondly, we are looking for detailed and succinct descriptions of your proposed data collection, sampling and data analysis that sketch a study that can be used to address the listed research question. In addition to that, we will also consider whether your motivation contains enough details to argue that the chosen solution is appropriate for the research question.

We estimate that "an average student" will not spend more than 36 minutes answering these questions.

Context and Research Question:

A team of researchers studied bots involved in pull-request discussions. They conducted interviews with open-source developers to investigate the characteristics that influence developers' perceptions of those bots. The researchers found that developers believe persona to be a crucial characteristic that affects how developers perceive bot behavior. Persona refers to the bot's language, and can be either factual and concise or informal and chatty.

The researchers formulated the following follow-up research question: **How does a bot's persona affect a developer's preference for the bot's behavior during a pull request discussion***?*

Text

Research Strategies
Text

a   Please indicate your choice for research strategy used to answer the research question.
This is merely an indicative question, answering this question is mandatory but it does not grant points.

Multiple choice · 8 alternatives

○   Sample Study   0.0

○   Judgement Study   0.0

○   Lab Experiment   0.0

○   Experimental Simulation   0.0

○   Field Experiment   0.0

○   Field Study   0.0

○   Computer Simulation   0.0

○   Formal theory   0.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

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b   Motivate your choice for the research strategy indicated in your answer to Question 2a.
Explain why your choice is appropriate for the research question stated above.

10.0 points · Open · 3/10 Page

+5 points
The answer gives a convincing argument on why the chosen research strategy is appropriate for the research question.

+5 points
The arguments are based on specific properties of the chosen research strategy. Showcasing that there is a detailed understanding of the research strategy.

Data Collection
Text

c Please describe a data collection method that can be used to answer the research question, given your research strategy.

5.0 points · Open · 2/5 Page

+2.5 points

The chosen data collection method is described in sufficient detail to understand the proposed study.

+1 point

The chosen data collection method is described in general terms only.

+2.5 points

The chosen data collection method uses the best practices as discussed during the course.

0 points

The chosen data collection method does not adhere to the best practices or it is not clear whether it adheres to the best practices.

d Motivate your choice of data collection method and explain how it aligns with your research strategy and the research question.

5.0 points · Open · 2/5 Page

+2.5 points

The data collection method described aligns with the chosen research strategy.

+2.5 points

The motivation puts forward a strong argument as to why the data collection method is appropriate for the research question.

Sampling

Text

e Describe, where needed in your data collection process, how you plan to sample.

5.0 points · Open · 2/5 Page

+4 points

The sampling strategy is described in sufficient detail to be reproduced by an independent researcher.

+2 points

The main idea of the sampling strategy is clear and valid but the description is not detailed enough to be reproduced.

0 points

The sampling strategy is invalid or unclear

+1 point

It is clear where the sampling strategy fits in the data collection process.

f Motivate your sampling choice(s) and explain why they are appropriate for your chosen research strategy, data collection method and the research question.

5.0 points · Open · 2/5 Page

+2 points
The sampling choice is well-motivated

+1 point
The sampling choices are clearly aligned with the research strategy chosen.

+1 point
The sampling choices are clearly aligned with the data collection method chosen.

+1 point
The sampling choices are clearly aligned with the research question.

Data Analysis
Text

g Describe a data analysis method that you propose to use to answer the research question, given your data collection method and sampling strategy(s).

5.0 points · Open · 2/5 Page

+5 points
Data analysis method is described in sufficient detail to be reproduced by an independent researcher

+2.5 points
The main idea of the data analysis method is clear and valid but the description is not detailed enough to be reproduced.

h Motivate your choice of data analysis method and explain how it aligns with your data collection, sampling, research strategy and the research question.

5.0 points · Open · 2/5 Page

+1 point
The data analysis method can be used to answer the research question.

+1 point
The data analysis method is aligned with the research strategy.

+0.5 points
The data analysis method is aligned with the data collection method.

+0.5 points
The data analysis method is aligned with the sampling strategy.

+2 points
The choice of the data analysis method is well-motivated.

3 Part 3 (40 points)
40.0 points · 6 questions

For the third part we ask you to read the accompanying paper. Please read the paper and come-up with two viable and distinct threats to validity. For each threat to validity please use the answer fields below to describe and classify it. The threats you describe should describe **two different types of threats to validity** (So if the first threat to validity you describe belongs to the category external, the second threat you describe cannot belong to the category external).

You should describe your first threat to validity in 3.a, describe the conclusion it invalidates in 3.b and classify it in 3.c, and you should describe your second threat to validity in 3.d, describe the conclusion it invalidates in 3.e and classify it in 3.f. We estimate that "an average student" will not spend more than 36 minutes answering these questions.

Text

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a Describe your first threat to validity
9.0 points · Open · 1/2 Page

+9 points
The answer describes a threat to validity that could indeed threaten the validity of the study

+4.5 points
The answer describes a viable threat to validity that could indeed threaten the validity of the study. However, the description is not detailed or specific enough, or the threat is not completely realistic given the design of the study.

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b Explain which conclusions of the study would be invalidated by the threat and how
9.0 points · Open · 1/2 Page

+9 points
The answer points to a specific conclusion of the study that might be impacted by the threat to validity.

+4.5 points
The answer points to conclusion(s) that are not fully impacted by the described threat to validity.

c Classify your first described threat as

2.0 points · Multiple choice · 4 alternatives

⦿ Conclusion validity	2.0
⦿ Construct validity	2.0
⦿ External validity	2.0
⦿ Internal validity	2.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

d Describe your second threat to validity

9.0 points · Open · 1/2 Page

+9 points

The answer describes a threat to validity that could indeed threaten the validity of the study

+4.5 points

The answer describes a viable threat to validity that could indeed threaten the validity of the study. However, the description is not detailed or specific enough, or the threat is not completely realistic given the design of the study.

e Explain which conclusions of the study would be invalidated and how

9.0 points · Open · 1/2 Page

+9 points

The answer points to a specific conclusion of the study that might be impacted by the threat to validity.

+4.5 points

The answer points to conclusion(s) that are not fully impacted by the described threat to validity.

f Classify your second described threat as

2.0 points · Multiple choice · 4 alternatives

◉ Conclusion validity   2.0

◉ Construct validity   2.0

◉ External validity   2.0

◉ Internal validity   2.0

Feedback

Feedback when the question is answered correctly

Feedback when the question is answered partially correctly

Feedback when the question is answered incorrectly

4 Extra page

0.0 points · 1 question

Extra space for answers. Please indicate what question each answer belongs to.

Open · 1 1/2 Page