Study the relationship of time needed to fix bugs by heroes and non-heroes

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**Abstract**

The purpose of this document is to show how the project of the course “Empirical Software Measurement” has been conducted by us and what the adopted experimental procedure was.

The purpose of this project is to identify heroes among developers, based on their commit on the version control system and then the amount of time spent by them to fix a bug compared the amount required by non-heroes.

The focus was on the Project KUSER, subproject of KDE.

# Problem

A hero is a developer that alone maintains most of a software system. Thus a hero is the only developer with a high knowledge the code he/she maintains exclusively. So when a hero is requested to fix a bug, it should take a short to fix very familiar code. However, the hero could be overloaded, as he/she is the only able to work on a large portion of code.

So what the main topic of the project will be is to compare the amount of time spent by heroes to fix a bug with the amount required by non-heroes.

RQ: do heroes take a shorter or a longer time to fix a bug than non-heroes?

# Experimental definition and planning / Considerations taken

In order to get needed information in order to get heroes for the project we had to connect to the SVN repository using a library called SVNKit. We fetched all historical changes for each file currently (IMPORTANT) in the project and added counters for modifications by other users and the original author.

Authors where flagged as heroes taking into consideration the original definition given in the slides provided during the course:

*Hero= Developer that EXCLUSIVELY edits/commits a number of files >=α%*

Then the bug search had to be planned now and since there is much possible kind of resolutions for bugs, we have taken into consideration only those who affect the code.

## Hypothesis formulation and variable selection

Based on the study definition the subsequent hypotheses can be formulated:

H0: there is not difference in the amount of time required by heroes and non-hero developers to fix bugs

H1: there is a difference in the amount of time required by heroes and non-hero developers to fix a bug

These two hypotheses are two-tailed because there is no a-priory knowledge on the expected trend that should favor heroes versus non heroes to fix bugs. On the one hand heroes know better the code so, probably, they require less time to fix. On the other hand, we cannot be sure that a hero knows exactly where to find the bug in prior.

The dependent variable is the fix time. It is computed by summing up time needed to fix a bugs taking into consideration whether it has been fixed by a hero or not.

The independent variable (the main factor of the experiment) is the property of being hero or not.

## Experimental design

We have chosen to collect only those files actually in the project in order to get only does heroes continuously working on it.

All bug severity and priority types where taken, but only those bugs resolved by actually making changes in the code where selected.

## Experimental material and procedure

To perform data collection, connection tools for the SVN and Bugzilla repositories where used. We developed our software in Java and used an external library for the connection called SVNKit and for Bugzilla just connected and parsed the Xmls.

## Analysis method

We do not make any assumption on the normal distribution of experimental data, so we use a non-parametric statistical test to check the total fix time (H0). As we collect two measurements, one for bugs fixed by heroes and one for non-heroes, data are paired, so we use the Wilcoxon to check the hypothesis.

We fix the confidence level at 95%, which means that we reject the null hypothesis when p-value is lover that 0.05.

# Results

## Analysis of main factor

Data: Fix time by Hero

t = 2.6355, df = 81.146, p-value = 0.01006

alternative hypothesis: true difference in means is not equal to 0

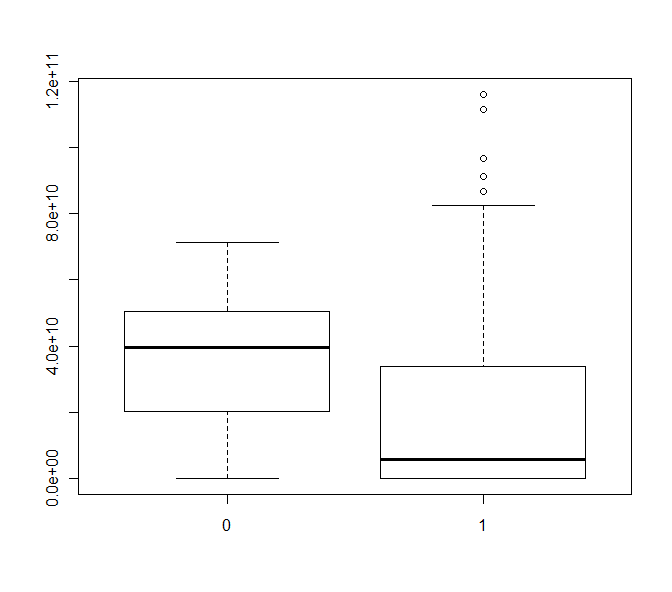
95 percent confidence interval:

3433384655 24586496042

sample estimates:

mean in group 0 mean in group 1

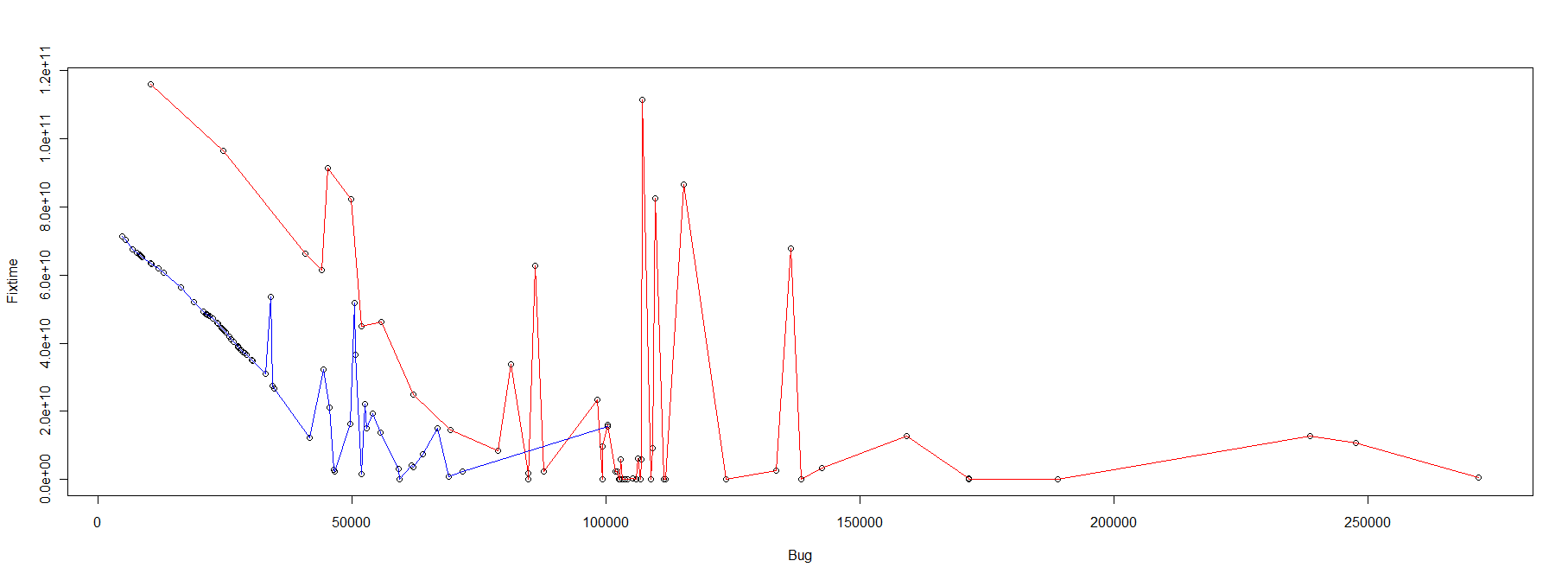
37346110235 23336169887



## Analysis of co-factor

# Conclusion

The key result of this experiment is that heroes need less time to fix bugs than non-heroes



In red, fixed by heroes, in blue fixed by non heroes.