



The University of Arizona Consent to Participate in Research

Study Title: Building Attack Trees: The Best Tools for Reverse Engineering

Principal Investigator: Clark Taylor

Sponsor: National Science Foundation

Summary of the Research

The researchers here seek to understand better the process by which humans reverse engineer computer code, particularly when that code has been obfuscated. Specifically, the researchers are interested in what the best reverse engineering practices are for given obfuscation types and how effective those strategies (and the opposing obfuscations) are. To do that, the researchers are hosting obfuscated code challenges which participants reverse engineer while using data collection software. That data is then to be analyzed in order to answer the research questions.

The researchers intend this study to be an ongoing effort, with participants investing time as they see fit. As participants solve difficult challenges, they can earn monetary rewards for their participation. There is little associated risk, as participants simply work on problems from their computer or device at their convenience.

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

Why is this study being done?

This study focuses on how professionals reverse engineer computer code. Data collected from the subjects of the study will be aggregated in order to build attack trees, which may serve as guides in solving reverse engineering problems.

What will happen if I take part in this study?

The first step for subjects is to sign up on the web application and download a virtual machine. The sign up procedure will allow participants to enter their names and email addresses as well as demographic information including education level, professional/employment position, experience with binary reverse engineering, race, and gender. Then, on the virtual machine, log onto the web application and select a problem you wish to solve. Download the problem script and execute it, selecting the options you wish, and begin solving the problem. Once the problem is complete, use the upload script to turn it back into the web application.



During the survey, data will be collected from you while you solve the reverse engineering problems provided by the investigators on their website. The data will be collected on the virtual machine provided on that website using software preinstalled on the virtual machine. The software will only be collected once activated by scripts, as detailed on the site. The data will only be uploaded upon submission of a problem solution, using the submission script. You will be prompted with the option to submit the data at that time.

How long will I be in the study?

You will be in the study as long as you wish to continue solving the problems on the website while collecting and submitting data. All data collected and submitted will be done by you through the provided scripts. Thus, you are in the study only as long as you wish to be in the study and simply refusing to collect and/or upload data will cease your participation in the study. Data already collected before ceasing activity will remain in the study. You have the option to solve problems without collecting data as well.

How many people will take part in this study?

100 computer security professionals will take part in this study.

Can I stop being in the study?

Your participation is voluntary. You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. Data will only be collected upon your running and activating it in the provided script; data will only be uploaded to the investigators when you choose to do so in the submission script. No matter what decision you make, there will be no penalty to you and you will not lose any of your usual benefits. Your decision will not affect your future relationship with The University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

What risks or benefits can I expect from being in the study?

There are few risks associated with this study. The investigators have taken reasonable security measures on the infrastructure (the web application and virtual machine provided) but cannot guarantee that the data collected will be completely secure; a security breach may possibly render it vulnerable. This information includes email addresses and names, though you are free to provide fake email addresses and/or fake names if desired. Passwords will be salted and hashed, but please do not use a password that you use in other applications.

Will I receive compensation for being in the study?

There is no general compensation for solely participating in this study. However, there may be compensation for solving certain types of reverse engineering problems. Throughout the course of this study, the investigators will continually update problems listed on the web application with the amount of compensation for solving a given problem. Compensation offerings will reflect whether the problem has been solved adequately. If a problem has not yet been solved, the investigators will offer compensation for being able to solve that problem in



accordance with the perceived difficulty of the problem and post that onto the problem's web page. Receiving compensation is subject to several restrictions.

You will be eligible for such compensation if you meet the following conditions: (1) you solve a problem which the researchers have deemed "medium" or "hard" and listed the problem as such on the study website and which has been solved no more than 3 times thus far as determined by problem submission dates, (2) you solve the problem with a novel method, (3) you consent to and complete any additional activity required by the study to generate data, including (a) using the data recording software provided by the study properly, and (b) answering and supplemental questions aimed at determining exact methodology used to solve the problem provided by the researchers to the satisfaction of the researchers.

The investigators understand that, in many circumstances, you may not be able to disclose the particular details regarding how you solve a particular problem. However, simply knowing that you have solved a problem is also useful data, and, as such, the investigators offer a smaller amount of compensation for solving a problem as defined in (1) above with only a limited, written statement regarding your methods as best as you are able to describe them. You consent to having this description data and your submission used in the study here. The description must be formed in accordance with (3)(b) above. Compensation for a limited submission (as described in this paragraph) is only available if you are the first person to solve a particular problem. In order to use this option, use the "Agree to Limited Submission" option in the download script.

The table below summarizes the compensation offered for particular problems. "Full" submission denotes the complete submission including data collection, as described above. "Limited" submissions consist of a correct solution with a written description, as described above. Compensation offerings are ordered by the order in which the problem is solved. To illustrate, the first offering (\$500 for medium, \$1000 for hard) is available for the first person to submit a solution, while the second (\$200 for medium, \$400 for hard) is available for the second person to do so, etc. Difficulty is determined by the investigators and labeled on the website.

Besides difficulty-based categories, there exists a "Beta" category. The purpose of this category is (1) to test the system/software used in this study, and (2) to gauge difficulty for future problems. As shown in the table, the first to solve a "Beta" problem while using the data collection software is eligible for \$100 in compensation.

Submission	Easy	Medium	Hard	Beta
Full	\$0	\$500, \$200, \$100	\$1000, \$400, \$200	\$100
Limited	\$0	\$50	\$100	

Each award (except for limited submissions) is available only for a new novel approach to solve the problem. That is, you may submit an unlimited number of submissions but may only receive compensation for those which (in addition to the criteria above) show a different method to solve the problem, as determined by the investigators. Additionally, a valid Limited submission made



before any others will count as the first submission generally, which means that subsequent Full submissions will be considered 2nd, 3rd, ... nth submissions and thus will not be eligible for Full compensation as a first submission.

In addition to these categories on the main RevEngE Competition application, there will be periodic capture-the-flag style competitions with prizes up to \$10,000 max. Those prizes will be listed on the RevEngE CTF application.

Those who earn compensation will be able to receive that compensation through a check or ech transfer. Those requiring other forms of payment should contact the investigators through their web site prior to participating in the study; other forms of payment may be allowed if the investigators and the University of Arizona determine the form reasonable.

Will my data or specimens be stored for future research?

The data submitted to the web application will be kept for an indefinite period of time (at least 6 years) on the web application's database.

Will my data or specimens be sold for commercial profit?

No.

Will I hear back on results that directly impact me?

No.

Will whole genome sequencing be done with my specimen?

No.

Will my study-related information be kept confidential?

Efforts will be made to keep your study-related information confidential; reasonable security measures including password salting and hashing and HTTPS will be employed on the web application. However, there may be circumstances where this information must be released. Should the investigators publish any study data, they will anonymize that data by removing names, emails, and any other identifying information (except a provided username) beforehand.

Also, your records may be reviewed by the following groups:

- *The University of Arizona Institutional Review Board*
- *The sponsor supporting the study, their agents or study monitors*

Who can answer my questions about the study?

For questions, concerns, or complaints about the study you may contact **Clark Taylor** or **Christian Collberg**.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact



the Human Subjects Protection Program at 520-626-6721 or online at <http://rgw.arizona.edu/compliance/human-subjects-protection-program>.

An Institutional Review Board responsible for human subjects research at The University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

By taking part in this study, you are allowing your responses to be used for research purposes.