**Lab Assignment 04**

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CSC-803-DT1, Introduction to Cybersecurity Research

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October 11, 2022

**What is a hypothesis? Illustrate the functions of a hypothesis.**

A hypothesis is the verification of an assumption or assertion, which are the basis of enquiry. The goal of hypotheses is to bring focus to the research problem in quantitative research. Another way to word it might be, a hypothesis is a statement of expectation or prediction that will later be tested by research.

To formulate a hypothesis, we need to have a solid research background behind whatever the topic is. Because it will further aid the functions of the hypothesis by bringing the specificity and clarity needed to construct it by ensuring only the information required is collected. This will help validate and legitimize the study as well by not overextending the scope of what is measured and improving the focus as well. By doing so we can conclude what is true or what is false, which is an important part of the theory formulation.

**Illustrate type I and type II errors in testing a hypothesis, give an example each.**

Type I and II errors are a type of inference error regarding the original hypothesis. A type I error occurs when there is an association when there is none. Whereas the type II error occurs when we conclude that is no association when there should be one. An example of the type I error would be, if we were to conclude that the hypothesis, “there are green skittles in a Skittles bag”, is false despite that being true within the sample population/data. And an example of the type II error would be, if we concluded that the hypothesis, “nobody likes Reese’s cups”, was false but we failed to reject it despite the contrary being evident within the population.

**Illustrate the concept and function of research design.**

The function of a research design is like the idea of a research methodology. Except, instead of the methodology describing the process of collecting, grading, or manipulating data within the study, we are conceptualizing a process to complete the various other procedures and tasks needed to finish it.

By ensuring that these procedures are adequate to obtain valid, objective, and accurate answers to the research questions; something which is called the control of variance. The objective is to guarantee that any independent variable exercises the maximum opportunity to affect the dependent variable(s) while the effect of extraneous and changing variables is minimized to a cause-effect relationship.

**Illustrate the meaning of “Changes in the dependent variable may be attributed to three types of variables” and give an example.**

The meaning of the statement describes the affects any independent variable in addition to any extraneous variable or chance might ultimately have over the dependent variable. For instance, if you were trying to measure the subjective taste of certain types of food, you might try to limit the effect of nearby smells or a previous palate as they could completely alter experiences not solely limited to a single type of food. Especially if you were to test multiple different types of food, the type of palate cleanser used in-between food could have untold effects on the next measurements made.

**What are the principles of generating research ideas? Please illustrate each principle.**

There are eight useful principles described that a good researcher can use.

1. Being patient
   1. By not immediately tossing old ideas aside and keeping them in mind as you continue researching, you might stumble upon new ideas.
2. Quick ideas
   1. Between projects, conferences, events, keeps notes of what we are working on. By doing so we might reach a new perspective on the topic.
3. Take an opposite view
   1. If a topic has already been presented and researched from one view, approach it from the opposite. Like, a previous researcher already looked into the efficiency of round wheels– maybe you look into square wheels.
4. Collect thoughts that can be joined together later
   1. Read other’s research studies and papers, especially sections that specific future work or their literature reviews and try to join their ideas together to inspire a new research problem.
5. Get ideas from conferences, books, and papers
   1. By attending conferences like Black Hat, WWHF, DEFCON, or others, and seeing what ideas other researchers have presented or by participating in workshops we can learn new skills or general knowledge that will fuel new ideas and help solve current ones.
6. Connect thoughts with those of others
   1. After having thoroughly analyzed something, take your conclusions or questions and compare them to those of others. Perhaps you might have the knowledge that can fill someone elses gaps, or vice versa. An example could be something like the reversal of a network stack or specific piece of hardware, there are any number of approaches that could have been taken and an equally large number of more questions or knowledge gained.
7. Good ideas come from diverse minds
   1. Having a diverse background of researchers or even within your own knowledge base can be useful. Assume that you might want to reverse a family of malware whose language you’re unfamiliar with, but you have solid reverse engineering skills, partnering with someone experienced with that language would be immensely helpful.
8. Make space for ideas to incubate
   1. It is easy to become consumed with completing research, but it is important to take breaks and not become narrow minded with our approaches towards gathering and studying information. If you are stuck studying a group of malware, take breaks from reversing those specific samples and look at others collected or review previous work that is related. Or, it could even be reading what others might have done – tools they may have developed before or related malware families. Maybe sharing your ideas and progress with colleagues and then taking an actual break would be fruitful as well.