

# COP 3515 – Fall 2020

## Homework #4

### Title: Testing The Vaccine



Finally! Vaccines have started to roll out of the research labs and human trials are underway! This is great news for everyone. However, what we all need to realize is that just because a vaccine worked well in the controlled environment of the lab, this does not mean that it's going to be effective in humans in the real world. These trials are going to be very important and we need them to be successful so that we'll know which vaccines we can move forward with.

In the Tampa Bay area there are four different vaccine trials that will be conducted: (1) AstraZeneca, (2) Johnson & Johnson, (3) Moderna, and (4) Novavax. There will be four phases to the trials:

**Phase 0:** Phase 0 of a clinical trial is done with a very small number of people, usually fewer than 15. Investigators use a very small dose of medication to make sure it isn't harmful to humans before they start using it in higher doses for later phases. If the medication acts differently than expected, the investigators will likely do some additional preclinical research before deciding whether to continue the trial.

**Phase I:** During phase I of a clinical trial, investigators look at the effects of the medication on about 20 to 80 people who have no underlying health conditions. This phase aims to figure out the highest dose humans can take without serious side effects. According to the FDA, approximately 70 percent of medications move on to phase II.

**Phase II:** Phase II of a clinical trial involves several hundred participants who are living with the condition that the new medication is meant to treat. They're usually given the same dose that was found to be safe in the previous phase. Investigators monitor participants to see how effective the medication is and to gather more information about any side effects it might cause. The FDA estimates that about 33 percent of medications move on to phase III.

**Phase III:** Phase III of a clinical trial usually involves up to 3,000 participants who have the condition that the new medication is meant to treat. The purpose of phase III is to evaluate how the new medication works in comparison to existing medications for the same condition. To move forward with the trial, investigators need to demonstrate that the medication is at least as safe and effective as existing treatment options. Roughly 25 to 30 percent of medications move on to phase IV (public availability).

You have been asked to create a Python program that will process the results of the vaccine trials that have been conducted for each of the phases. The goal of your program is to determine which vaccines should be given to the general public.

You will start by processing four sets of data from the phase 0 trials of all four vaccines. Based on what you discover, only some of the vaccines may be permitted to proceed to Phase 1. As you process each phase, based on your results only the vaccines that meet the success criteria are permitted to proceed to the next phase of testing.

**Note:** The vaccine testing data is considered to be very valuable to the pharmaceutical companies that have developed them. Because of this, the data has been encrypted using the Caesar Cypher Algorithm. While encrypting the given string, 3 is added to the ASCII value of the characters. Similarly, for decrypting the string, 3 is subtracted from the ASCII value of the characters. In order to ensure that your decryption code is working correctly, check to ensure that the encrypted string:

DEFHGIJKLMNOPQRS3456789::<

Is decrypted as:

ABCDEFGHIJKLMNP0123456789

When decrypting the data file, remember that every line will have an end of line character that may get decrypted by accident also. [ASCII character 10]

## Phase 0 Testing Results

The phase 0 data set will consist of four sets of 15 records. Each record will have the following format:

*sex, age, T-Cell Count*

You will process this data. The normal T-Cell count for a patient should be in the range of 500-1200. If any patient has a T-cell count that exceeds this range, then there is a problem with this vaccine. If more than 10 patients out of the 15 patients who were tested have a T-Cell count greater than 1200, then that vaccine cannot move on to the next phase of testing.

## Phase I Testing Results:

The phase I data set will consist of three sets of 20 records. Each record will have the following format:

*sex, age, Pain / swelling, Mild fever, Chills, Feeling tired, Headache, Muscle and joint aches*

Outside of the sex and age data, all other data will be 0/1 to indicate if the symptom was present in the testing subject. In order to move to the next phase, the vaccine needs to cause any side effect in less than 30% of the test subjects.

## **Phase II Testing Results:**

The phase II data set will consist of two sets of 100 records. Each record will have the following format:

*sex, age, days of immunity*

The results of this phase of the testing will show how long a subject remained immune to the Covid-19 virus after receiving the vaccine. The goal is to have the protection last for the longest amount of time. If the protection lasts for less than 60 days, then it is considered to have failed. A vaccine that cannot protect at least half of the subjects for this amount of time will not be permitted to move to the next phase.

## **Phase III Testing Results:**

The phase III data set will consist of one set of 500 records. Each record will have the following format:

*sex, age, got sick*

The "got sick" data item will be either 0/1. In order for a vaccine to be approved for use by the general public, less than 20% of the people who take the vaccine can get sick after having been vaccinated.

**Based on the data that has been collected on the four vaccines, which one (or ones) should be approved for use by the general public?**

## **Assignment Requirements:**

1. You will be given a data file with all of the data that has been collected from the various phase trials in it:  
Phase 0: 4 sets of 15  
Phase 1: 3 sets of 20  
Phase 2: 2 sets of 100  
Phase 3: 1 set of 500

2. Your code must contain the following comment header:

```
#  
# COP 3515 – Fall, 2020  
#  
# Homework #4: Testing The Vaccine  
#  
# (Your Name)  
#  
#
```

3. **Note:** You are only permitted to use the C commands that we have covered in class so far. Yes, there are many more, but no, you can't use them in solving this homework!
4. This homework is due at the start of class on **Tuesday, 11/24/20.**