**Applied Algorithms: Benchmarking and Determining Functions**

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# Message to Grader

In the code section of this submission/document all of the code has been uploaded to a public GitHub Repository on 2024-02-10. All screenshots have been uploaded to the same repository in a subfolder. The Excel file in the GitHub repository will contain a converted table and the tables in this file will be the converted values. When using the trendline within Excel and calculating the prediction value. The values seem EXTREMELY off. I am absolutely lost at the values I am getting as the trendline of where it is and the actual value when calculated have no correlation and are extremely off. All the data gathered has been averaged out when running the routines 20 times. I will say this now. NONE of my data and trendlines have ANY correlation. For a lack of better terms the trendline equation is fucked up(sorry not sorry). Also Tables didn’t fit so I am uploading an Excel File with the data. Please refer to the Excel file for all data. I’m sorry for making it like that but I couldn’t fit it and I was just done with the data cause none of it correlated even after running and testing so many times. I will be honest I do not expect a grade above 10 due to such disparities in the prediction and ratio data in the Excel file and probably because I am providing a GitHub link to such info so maybe less cause it’s a pain in the ass. I’m fully expecting that I did this wrong and would like to talk in person or something regarding it.

# Analysis

## Routine 1

When comparing the asymptotic complexity (or basically the trend line) for Routine 1 the data visually on the graph matches fairly close. Between the trend line/asymptotic complexity there seems to be some level of correlation and similarity between the two. However, from calculating the predictions all the numbers start to jump all over the place and are no where near what the graph shows. Routine 1s Asymptotic is the only one of the routines that seemed to be somewhat close and by somewhat it is really NONE at all.   
Personal Prediction for 1 Week of Compute:   
Given my system specs I would bet/predict that within 168hrs of execution my system SHOULD be able to safely execute a single sample size of perhaps between 10k-50k given it is not looping multiple times. This is also a very low ball as from testing a 20x loop on up to 2000 it was fairly quick.

## Routine 2

With Routine 2 the complexity more represents a Polynomial function as the data fluctuates. As mentioned in the “Message to Grader” the data predictions are extremely off and have no correlation. Furthermore just basing off the trend line ONLY the data is relatively close to what it would/should be eventually… However this also resembles logarithmic as with further data and estimation the line seems to plateau after a while.

Personal Prediction for 1 Week of Compute

## Routine 3

Routine 3 given the trendline/asymptotic is also fairly close to polynomial while also being similar to an exponential however not an extremely large one. The time it took to run Routine 3 was fairly short so I scratched the idea of it being a large exponential.

Personal Prediction for 1 Week of Compute

## Routine 4

Routine 4 is shown to be an exponential complexity. In the graphical data utilized with Excel the data would be shown to utilize Eulers function due to the scale of the data.

Personal Prediction for 1 Week of Compute:

At most I would put my system capable of computing only up to 100 at best as even up 70 took more then 24hr and it didn’t compute that far.

## Routine 5

Routine 5 from matching trend data seems to be more of an exponential. The data tested is jumping each test case. While using Excel the trendline matches near 1:1 as a polynomial however the actual correspondence and data more closely matches with an exponential function such as y = a \* b­x.

# Code

I chose to not attach code per routine in the document and at my own discretion created a GitHub repository that contains the modified routines and terminal outputs for each routine all named.

<https://github.com/HawkOverHK/Applied-Algo-Assignment-1>

# Terminal Output(s)

Please note that all Terminal Outputs/Results are displaying the “Mean Runtime” in Nanoseconds. Results, Data and Graphs will be rounded up to be in Milliseconds

## Routine 1

A screen shot of a computer

Description automatically generated

## Routine 2

A screen shot of a computer

Description automatically generated

## Routine 3

A screen shot of a computer program

Description automatically generated

## Routine 4

Note that Routine 4 will have 2 sets of data and graphs. The Routine was executed twice

A screen shot of a computer

Description automatically generated

A screen shot of a computer

Description automatically generated

## Routine 5 A screenshot of a computer screen Description automatically generated