SE 2XB3 Group 4 Report 2

Huang, Kehao
400235182
huangk53@mcmaster.ca
L01

Jiao, Anhao
400251837
jiaoa3@mcmaster.ca
L01

Ye, Xunzhou
400268576
yex33@mcmaster.ca
L01

January 29, 2021

1 Timeing Data

1.1 Analysis of $f(n)$

$f(n)$ is determined to be growing in the order of $\mathcal{O}(n)$. We started by plotting $f(n)$ on a x-y plane and observed a graph similar to that of a linear function. We formed our speculation on $f(n)$ being linear. A linear regression on the data set was then attempted to further investigate. The resulting coefficient of determination is 0.9992, indicating that there is a high chance that $f(n)$ is indeed a linear function. To confirm our guesses, we plotted a log-log graph for $f(n)$ and performed linear regression on the plot. Both the slope of the trend line and the R^2 value were approximately 0.9994. This is strong evidence that $f(n)$ grows in the order of $\mathcal{O}(n)$.

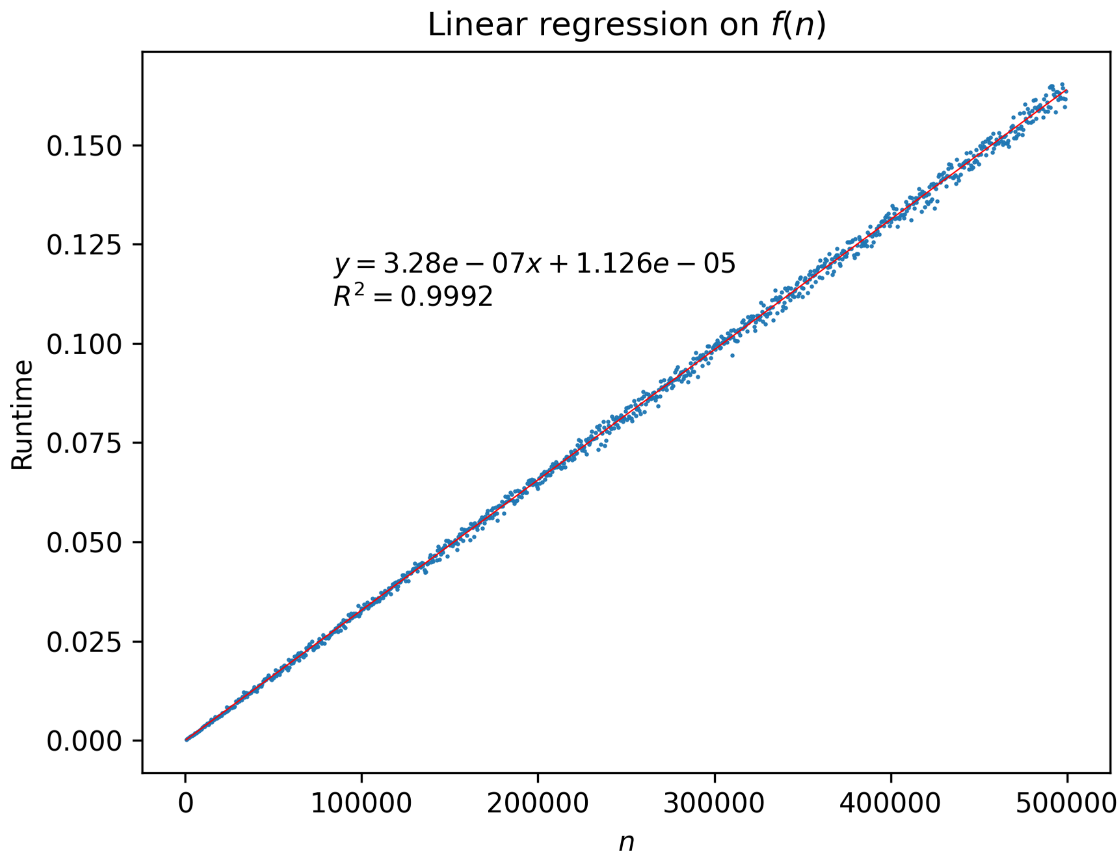

Figure 1: f(n) fitting line

1.2 Analysis of $g(n)$

By observing the graph of $g(n)$, our guess on the order of growth was polynomial or power. After applying the fitting line and constructed R^2 value, we found that the polynomial

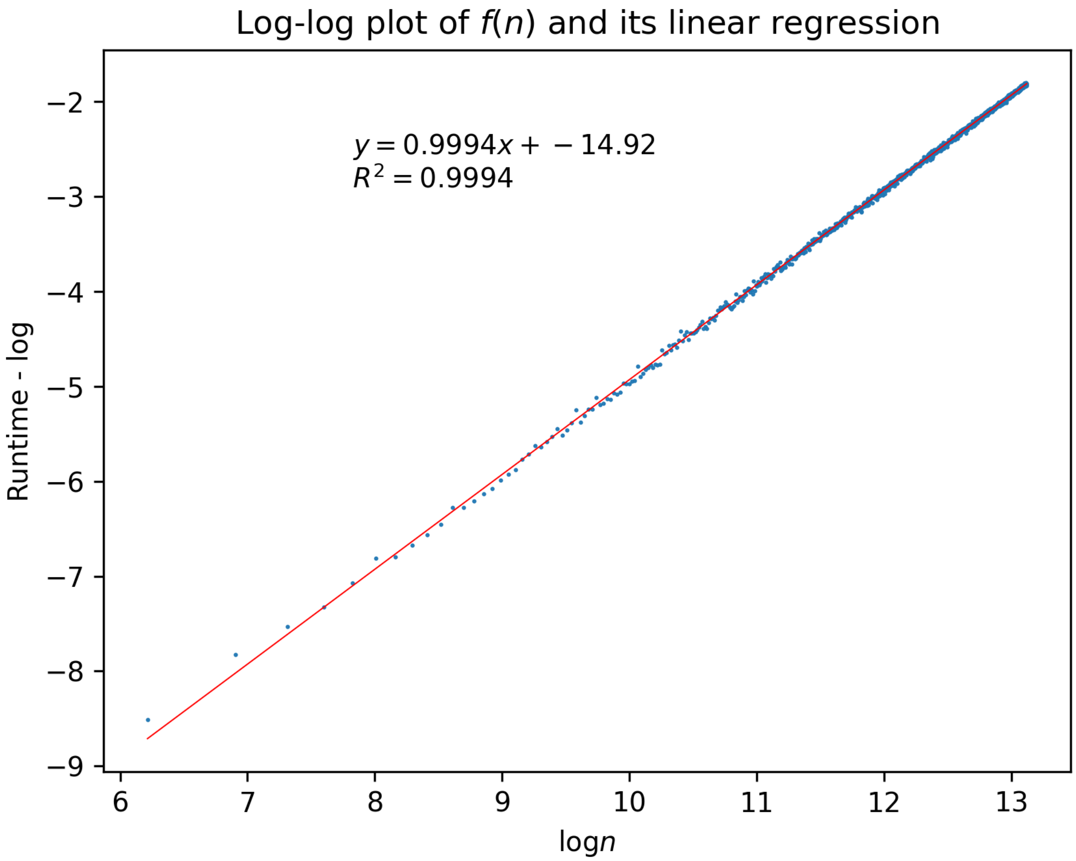

Figure 2: f(n) log regression

function with power of 3 fit the dots the most. However, the coefficient of x^3 is relatively smaller than the coefficient of x^2. To confirm our hypothesis on the growth order, we plotted the log graph and resulted in a linear regression with 2.8548 as the coefficient of x. Because there were nly 43 pairs of data were given for $g(n)$, so the insufficient amount of data ould cause the difference between 2.8548 and 3(the expected growth rate). Overall, with the finite given date set, we concluded that $g(n)$ has a growth order of $\mathcal{O}(x^3)$

1.3 Analysis of $h(n)$

After plotting the $h(n)$ data set into the graph, our first intuition about the type of growth was linear. However, by the visual contrast with the $h(n)$ (figure5), we all thought that the fitting line bended too much as a linear function. Therefore, we made the second graph which plotted with $log(n)$ and $log(runtime)$ (figure6), as the x-axis and the y-axis respectively. Then, we analyzed the coefficient of the term that has the highest power(x). Compared to 1, the oefficient 1.1069 is off by quite a bit. At this point we were uncertain about the intuition we had at the beginning. Because the coefficient is larger than 1 which means it grows faster than linear, however, not as much as polynomial, exponential or power functions. At

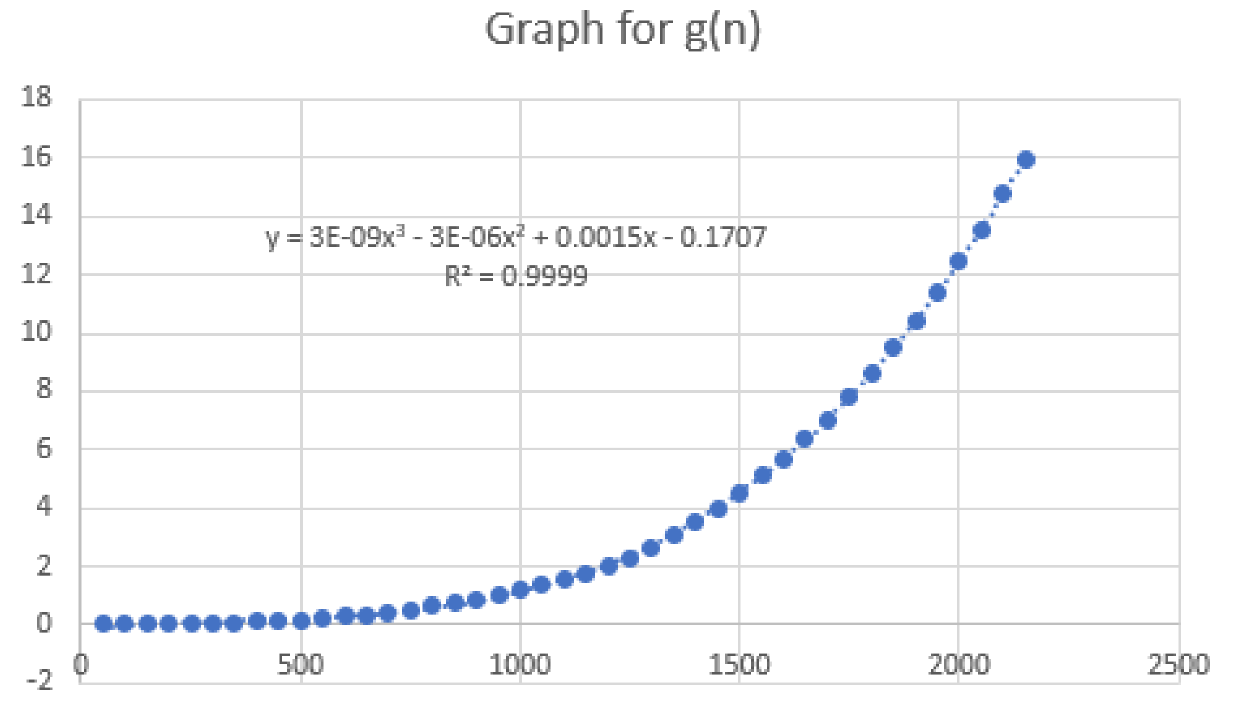

Figure 3: g(n) fitting line

this point, we doubted that it could be $nlog(n)$ form. Last but not least, we divided the runtime($nlog(n)$) by its number(n) and we got a $logn$ graph (figure7). Our assumption was right and the graph fits as a log function. In conclusion, the $h(n)$ grows in the order of $\mathcal{O}(nlog(n))$

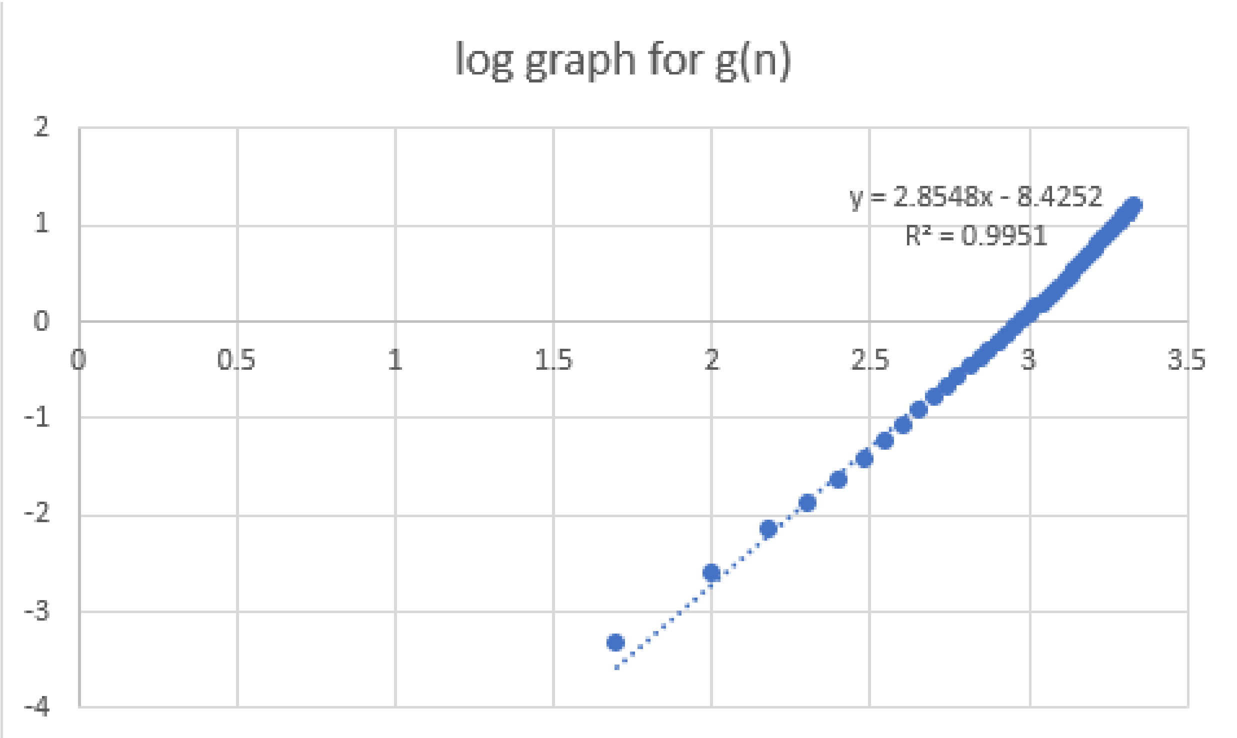

Figure 4: f(n) log regression

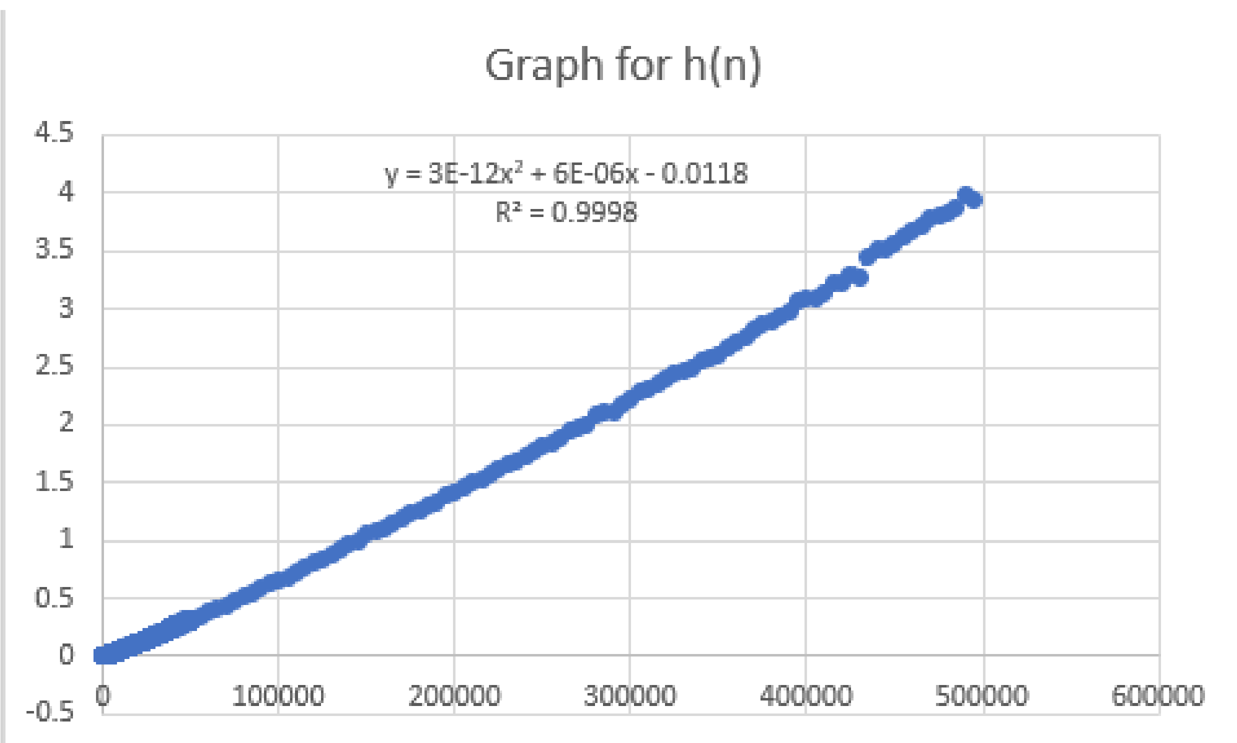

Figure 5: h(n) fitting line

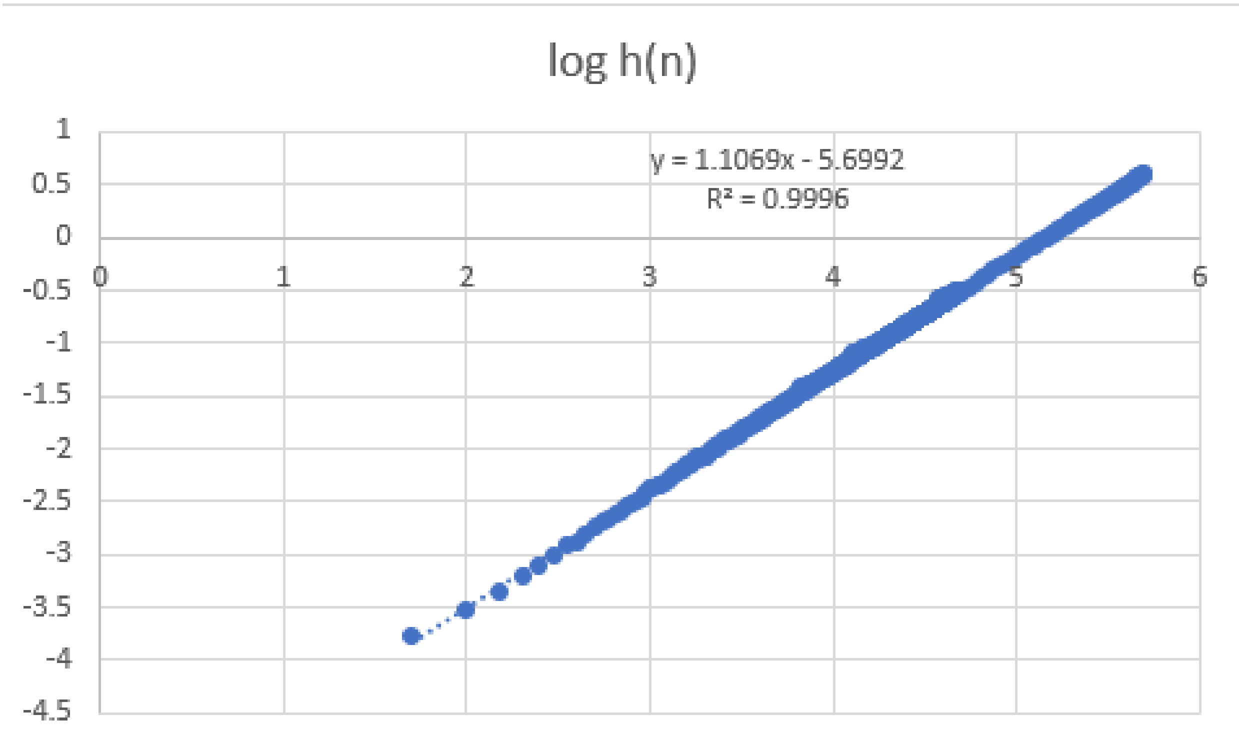

Figure 6: h(n) log regression

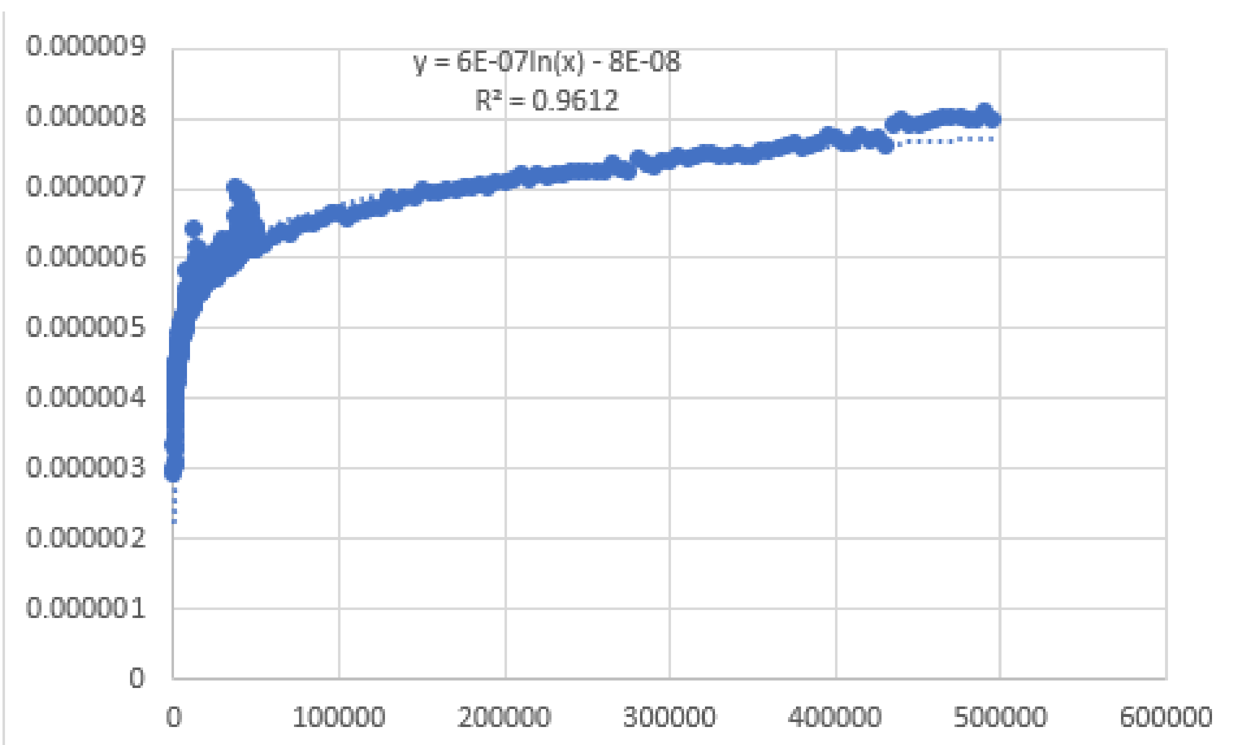

Figure 7: $g(n)/n$ graph