

Battery Life of a Laptop and How to Maximize Use Time

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ABSTRACT

Everyone in school nowadays has a laptop with the amount of school work that requires online resources. Also, almost everyone has experienced the pain of leaving their charger behind when their laptop has little to no charge left. The outcome of the 8th fractional factorial design of experiment is the duration of use of a laptop once fully charged. The overall objective expected of this experimental project is to maximize this operational duration, knowing what consumes the battery's charge and to what extent. Factors affecting the outcome of the experiments are brightness, sound, background programs, online streaming, open tabs, and the environment (outside or room temperature). The results from this design of experiment will benefit the laptop users with tips to change in settings and other ideas to conserve battery's charge life.

PROCEDURE

The first step was to set the experiment up so the factors would be tested in the most effective manner possible. An excel sheet was made to show which run tested for which of the factors. The table on excel is shown by table 1.

Table 1. *Experimental Design Run*

Run	Order of runs	Brightness	Sound	Background Program	Streaming	tabs open	environment
1	1	-1	-1	-1	1	1	1
2	2	1	-1	-1	-1	-1	1
3	3	-1	1	-1	-1	1	-1
4	4	1	1	-1	1	-1	-1
5	5	-1	-1	1	1	-1	-1
6	6	1	-1	1	-1	1	-1
7	7	-1	1	1	-1	-1	1
8	8	1	1	1	1	1	1

-1 being for the low value of the factor and 1 for a high value of the factor. There were three separate trials done with each being in a random order to make sure the trial sequence did not affect the data. The data for the three trials were then averaged and were separated into the high and lows for each of the factors. Then the factors highs and lows were averaged and subtracted from one another to find the, delta, which is the difference

between the factors. The greater the delta the greater the effect the delta has on the battery life. The deltas are then used to make a normal plot and a pareto chart which will display the most significant cause of battery usage.

RESULTS

The data collected for the experiment by trials 1, 2, 3 and the average is shown by figure 1.

Order of run	Trial 1	Trial 2	Trial 3	avg
2	1363	1663	1569	1532
5	582	663	598	614
7	728	733	781	747
1	1566	1737	1587	1630
6	616	431	554	534
4	1437	1332	1319	1363
8	510	481	477	489
3	1737	1581	1622	1647

Figure 1. *Trial Results and Averages*

The calculated values for the normal plot and the normal plot are shown by figure 2 and figure 3.

	deltas	Ascending order		Probability	Z score
Brightness	-180	-947	1	0.083333333	-1.382994127
Sound	-16	-180	2	0.25	-0.67448975
Background	-947	-91	3	0.416666667	-0.210428394
Streaming	-91	-16	4	0.583333333	0.210428394
tabs open	11	11	5	0.75	0.67448975
environmen	60	60	6	0.916666667	1.382994127

Figure 2. *Calculated Values For Normal Plot*

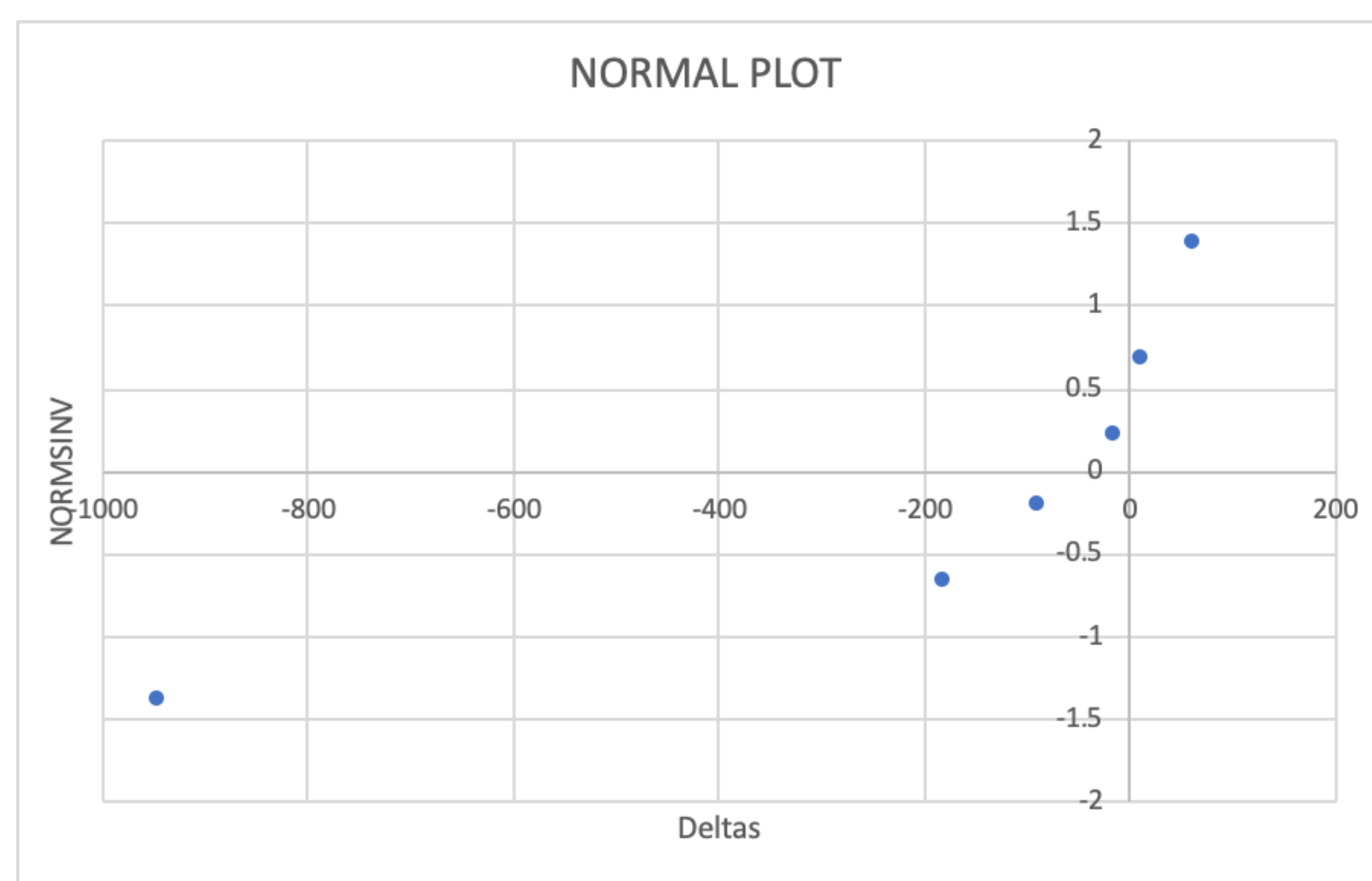


Figure 3. *Normal Plot*

The pareto chart is shown by figure 4, which shows a percentage on the right side of the chart. The percentage along with the line will tell the percentage of the time the factors left of point on the line will effect the battery life.

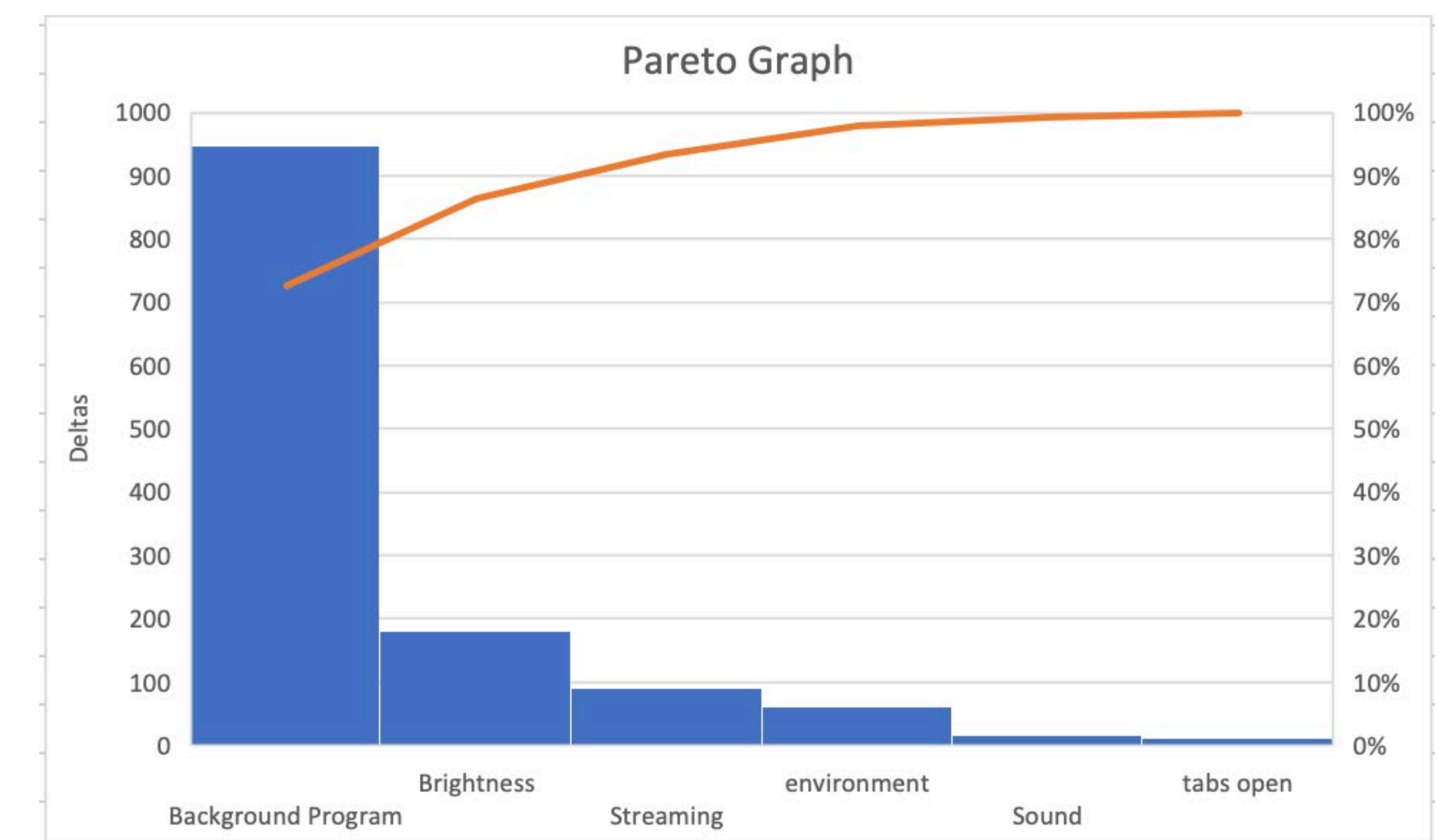


Figure 4. *Pareto Chart*

CONCLUSIONS

From the data collected the three largest deltas are Background program, brightness, and streaming. These were the three main contributors to the power consumption. From the normal plot it is seen that the factor to most consider when trying to save battery life on a laptop is to avoid having a background program running. From the pareto graph it is observed that 85% of the time the reason for battery usage comes from either background program or brightness. No real contribution to a loss in battery life was seen the environment, the tabs open, or the sound.

The best thing to do when trying to conserve battery life would be to make sure no backgrounds programs are running, turn down the brightness to the lowest level the screen can be seen, and to try and limit the amount of time spent on the internet streaming.