Descriptive Performance Analysis for Jaguar and Panther Equipment

Using Recent Performance Data

Submitted to:

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From: Geo Angelo D. Butas (Student in Engineering Data Analysis)

Subject: Performance Analysis for Jaguar and Panther Equipment

Good day, Miss Lovelace!

Attached herewith is my analysis of the recent performance data of your machines: **Jaguar** and **Panther**. As requested, I have included the step-by-step process of my manual calculations through the datasheet you have provided, and my findings have been summarized with visualizations (bar graphs and boxplots). Critical details are discussed within the report.

Regards,

Geo

I. Background

The purpose of this report is to evaluate the performance of the two (2) machine equipment: Jaguar and Panther. Their latest performance datasheet has been provided and will be used in the descriptive statistical analysis.

II. Requirements

The following have been requested and therefore will be used in the statistical analysis.

Measures of Central Tendency:

- Mean: Average of the data provided
- Median: Middle value of the data provided
- Mode: Most frequent value

Measures of Variability:

- Range: Measure of data spread
- Standard Deviation: Measure of variability
- Coefficient of Variation (CV): Ratio of standard deviation to the mean

III. Data Overview

Lot No	Jaguar	Panther	Lot No	Jaguar	Panther
1	997	1035	16	933	935
2	1153	975	17	790	1710
3	920	982	18	999	946
4	1074	1038	19	1028	1073
5	1013	891	20	976	986
6	960	907	21	1015	1078
7	890	960	22	932	969
8	910	978	23	957	1083
9	944	1041	24	936	790
10	1065	1026	25	977	1007
11	1083	590	26	1037	934
12	1820	990	27	997	999
13	859	1076	28	1730	1011
14	1043	1092	29	1046	942
15	1710	1026	30	1840	1090
N (Size)	**30**	**30**	***Sum***	**32634**	**30160**

Figure 1. Raw Datasheet of Jaguar and Panther

Lot No	Jaguar (Sorted from Lowest to Highest)		Lot No	Panther (Sorted from Lowest to Highest)
1	790		1	590
2	859		2	790
3	890		3	891
4	910		4	907
5	920		5	934
6	932		6	935
7	933		7	942
8	936		8	946
9	944		9	960
10	957		10	969
11	960		11	975
12	976		12	978
13	977		13	982
14	997		14	986
15	997		15	990
16	999		16	999
17	1013		17	1007
18	1015		18	1011
19	1028		19	1026
20	1037		20	1026
21	1043		21	1035
22	1046		22	1038
23	1065		23	1041
24	1074		24	1073
25	1083		25	1076
26	1153		26	1078
27	1710		27	1083
28	1730		28	1090
29	1820		29	1092
30	1840		30	1710
N (Total Population) = 30				

Figure 2. Sorted (Ascending) Datasheet of Jaguar and Panther

IV. Manual Calculations

A. Measures of Central Tendency

	Formula	Jaguar	Panther
Mean	$\bar{x} = \frac{\sum_{i=1}^{N} x_i}{n}$	$\bar{x} = \frac{32634}{30}$ $\bar{x} = \mathbf{1087.8}$	$\bar{x} = \frac{30160}{30}$ $\bar{x} = \mathbf{1005.33}$
Median	$M_d = \frac{n+1}{2}(th\ position)$	$M_d = \frac{30+1}{2}(th\ position)$ $M_d = 15.5(th\ position)$ $M_d = \frac{15th + 16th}{2}$ $M_d = \frac{997 + 999}{2} = 998$	$M_d = \frac{30+1}{2}(th\ position)$ $M_d = 15.5(th\ position)$ $M_d = \frac{15th + 16th}{2}$ $M_d = \frac{990 + 999}{2} = 994.5$
Mode	$M_o = most\ frequent\ value$	$M_o = 997$ **Frequency: 2**	$M_o = 1026$ **Frequency: 2**

Figure 3. Measures of Central Tendency Manual Calculations

B. Measures of Variability

Jaguar ($\bar{x} = 1087.8$)				Panther ($\bar{x} = 1005.33$)			
Lot No	x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$	**Lot No**	x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
1	997	-90.8	8244.64	1	1035	29.67	880.3089
2	1153	65.2	4251.04	2	975	-30.33	919.9089
3	920	-167.8	28156.84	3	982	-23.33	544.2889
4	1074	-13.8	190.44	4	1038	32.67	1067.3289
5	1013	-74.8	5595.04	5	891	-114.33	13071.3489
6	960	-127.8	16332.84	6	907	-98.33	9668.7889
7	890	-197.8	39124.84	7	960	-45.33	2054.8089
8	910	-177.8	31612.84	8	978	-27.33	746.9289
9	944	-143.8	20678.44	9	1041	35.67	1272.3489
10	1065	-22.8	519.84	10	1026	20.67	427.2489
11	1083	-4.8	23.04	11	590	-415.33	172499.0089
12	1820	732.2	536116.8	12	990	-15.33	235.0089
13	859	-228.8	52349.44	13	1076	70.67	4994.2489
14	1043	-44.8	2007.04	14	1092	86.67	7511.6889
15	1710	622.2	387132.8	15	1026	20.67	427.2489
16	933	-154.8	23963.04	16	935	-70.33	4946.3089
17	790	-297.8	88684.84	17	1710	704.67	496559.8089
18	999	-88.8	7885.44	18	946	-59.33	3520.0489
19	1028	-59.8	3576.04	19	1073	67.67	4579.2289
20	976	-111.8	12499.24	20	986	-19.33	373.6489
21	1015	-72.8	5299.84	21	1078	72.67	5280.9289
22	932	-155.8	24273.64	22	969	-36.33	1319.8689
23	957	-130.8	17108.64	23	1083	77.67	6032.6289
24	936	-151.8	23043.24	24	790	-215.33	46367.0089
25	977	-110.8	12276.64	25	1007	1.67	2.7889
26	1037	-50.8	2580.64	26	934	-71.33	5087.9689
27	997	-90.8	8244.64	27	999	-6.33	40.0689
28	1730	642.2	412420.8	28	1011	5.67	32.1489
29	1046	-41.8	1747.24	29	942	-63.33	4010.6889
30	1840	752.2	565804.8	30	1090	84.67	7169.0089
Total:	**2341744.80**			**Total:**	**801642.67**		
Variance:	**80749.8207**			**Variance:**	**27642.8506**		
Standard Deviation:	**284.16513**			**Standard Deviation:**	**166.26139**		

Figure 4. Variance Datasheet for Measures of Variability

	Formula	Jaguar	Panther
Range	$\boldsymbol{Range = x_{max} - x_{min}}$	$Range = 1840 - 790$ $\boldsymbol{Range = 1050}$	$Range = 1710 - 590$ $\boldsymbol{Range = 1120}$
Variance	$\boldsymbol{s^2 = \frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{n-1}}$	$\boldsymbol{s^2 = 80749.8207}$	$\boldsymbol{s^2 = 27642.8506}$
Standard Deviation	$\boldsymbol{s = \sqrt{s^2}}$	$s = \sqrt{80749.8207}$ $\boldsymbol{s = 284.16513}$	$s = \sqrt{27642.8506}$ $\boldsymbol{s = 166.26139}$
Coefficient of Variance	$\boldsymbol{\widehat{c_v} = \frac{s}{\bar{x}}}$	$\widehat{c_v} = \frac{284.16513}{1087.8}$ $\boldsymbol{\widehat{c_v} = 0.2612}$	$\widehat{c_v} = \frac{166.26139}{1005.33}$ $\boldsymbol{\widehat{c_v} = 0.1653}$

Figure 5. Measures of Variability Manual Calculations

V. Data Analysis & Interpretations

A. Mean - Panther is closer to the target value of 1k ohms (Ω) since it has a mean value of **1005.33Ω,** while Jaguar's mean is farther with a value of **1087.8Ω.**

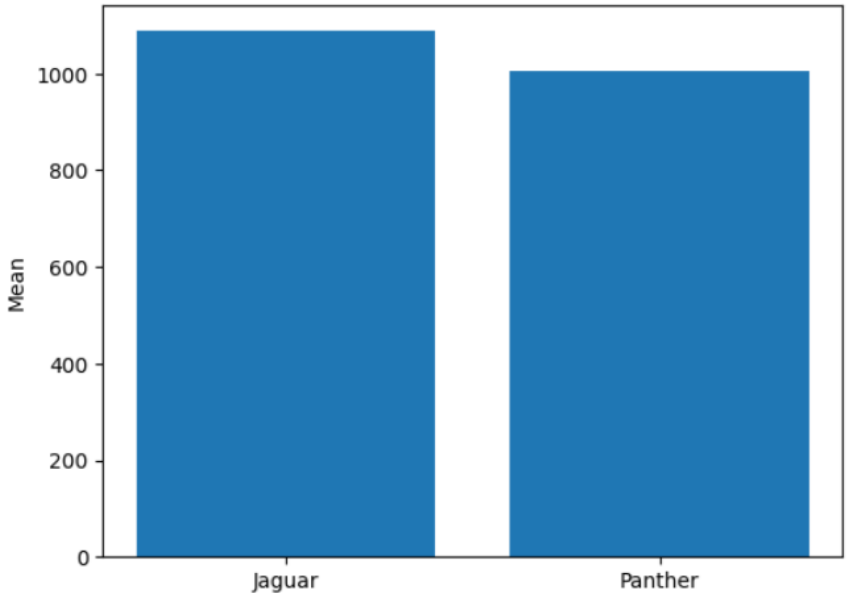

Figure 6.A. Mean of Jaguar and Panther

B. Median - Jaguar's median value of **998Ω** is closer to the target rating of 1kΩ, while Panther's median value of **994.5Ω** is farther away. This means that Jaguar is more *accurate* than Panther

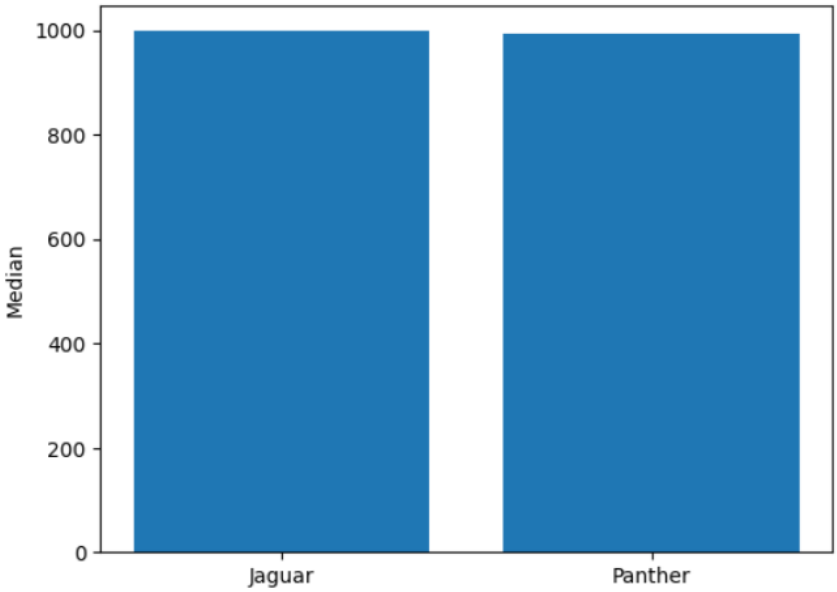

Figure 6.B. Median of Jaguar and Panther

C. **Mode -** Jaguar *frequently* produces resistors with a rating of **997Ω** which is closer to the target value than the most *frequent* resistors with ratings of **1026Ω** that Panther produces.

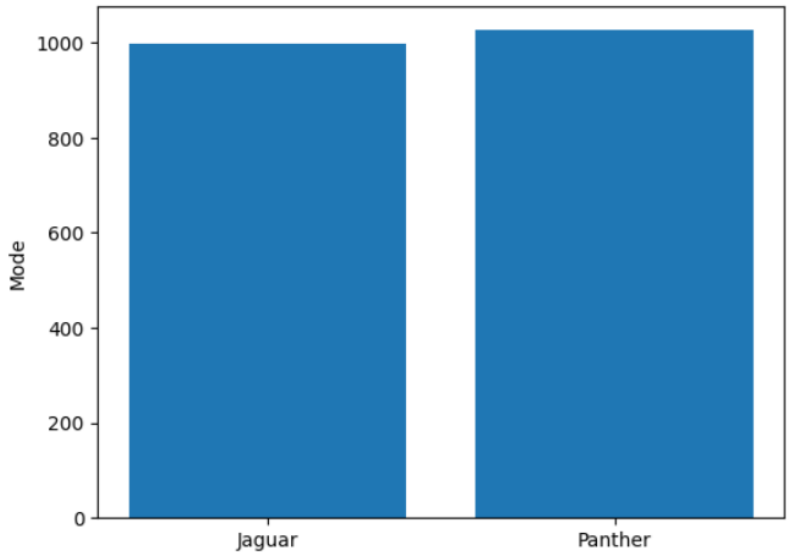

Figure 6.C. Mode of Jaguar and Panther

D. **Range -** Panther has a range of **1120Ω** while Jaguar has a range of **1050Ω,** which may indicate Panther's higher variability in production.

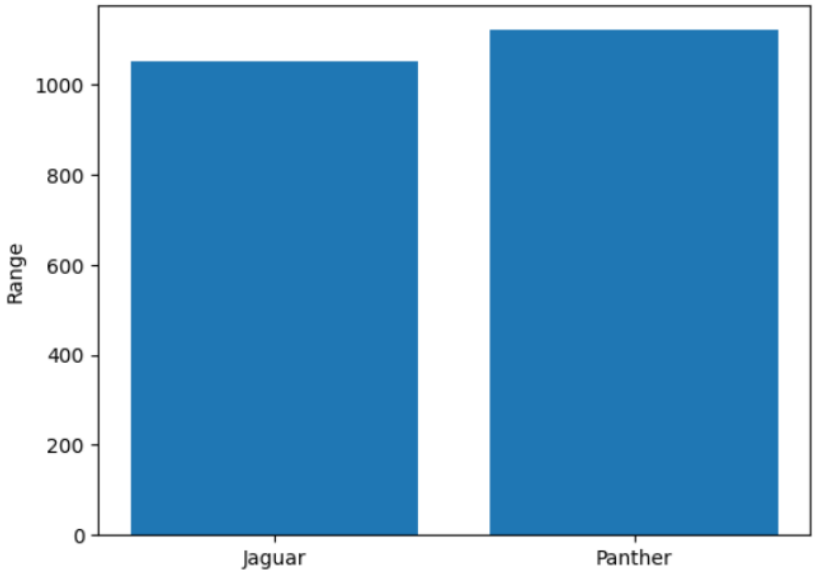

Figure 6.D. Range of Jaguar and Panther

E. Variance - Jaguar's variance of **80,749.82** is significantly higher than that of Panther's which has a value of **27,642.85**. This suggests that Panther produces resistors with great consistency in reaching the target rating compared to Jaguar.

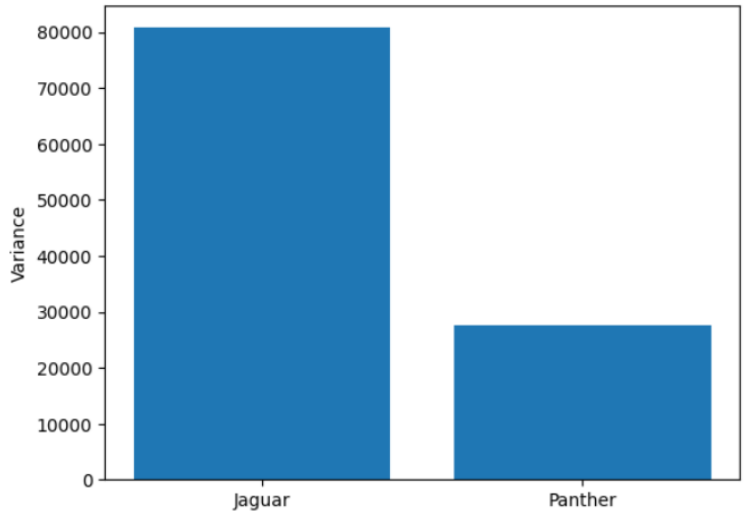

Figure 6.E. Variance of Jaguar and Panther

F. Standard Deviation - Jaguar's has a standard deviation of **284.17,** indicating higher variability in its resistor's resistance ratings than of Panther's which has a standard deviation of **166.26.**

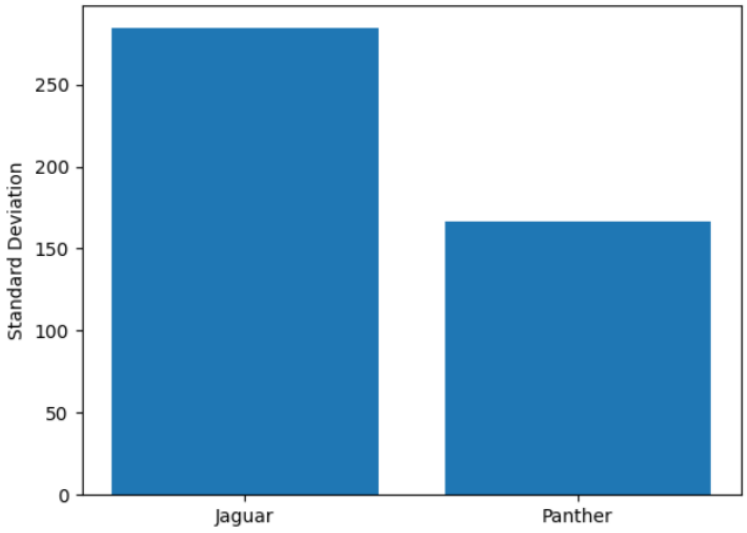

Figure 6.F. Standard Deviation of Jaguar and Panther

G. Coefficient of Variance/Variation - Jaguar has a coefficient of variation of **0.26**, while Panther has a coefficient of variation of **0.17**. This suggests that Panther is more *consistent* in production.

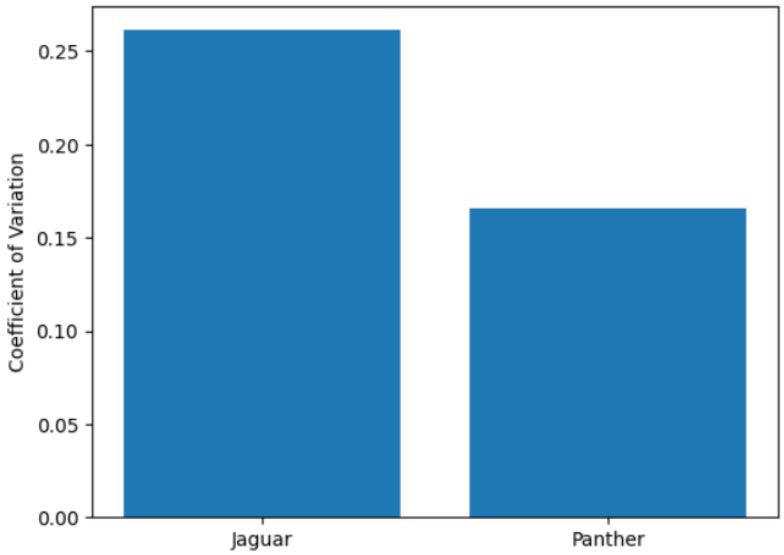

Figure 6.G. Coefficient of Variation of Jaguar and Panther

VI. Summary

- **Jaguar** has higher fluctuations in output, which could indicate operational inconsistencies or external factors influencing its performance. This fluctuation might be undesirable in production settings where consistency is essential.
- **Panther** shows much higher consistency in producing the target 1kΩ resistors, with low variability and fewer outliers.

VII. Recommendations

- **Panther** has shown to be reliable in the production of 1kΩ resistors, but it is still recommended to find the cause of its outliers to lessen errors, though it is of a lower priority.
- **Jaguar's** consistency and accuracy in production are sub-standard, which might indicate some issues with the machine itself. As such, it is highly recommended that Jaguar is checked for maintenance and/or recalibrated post-haste as to lessen any production issues it may cause.

VIII. Conclusion

In conclusion, Panther is consistent in producing 1kΩ, with minimal variance and fewer outliers. However, due to said outliers, it is still recommended that it is checked or recalibrated to further improve its performance, although this is a lower priority. Jaguar, on the other hand, shows a lot of variances in its output, making it unreliable for consistent production of 1k Ω resistors. It is of utmost priority that Jaguar is checked for maintenance and possibly recalibrating it, to improve its reliability and avoid further issues.