

Repeatability and statistics: Deliverables

ME 240: Fundamentals of Instrumentation & Measurement • D. H. Kelley and I. Mohamad • 108 points

Name: _____ Student ID: _____

Lab partners: _____

Please write the following sentence in the box below in your own handwriting and **SIGN**:
“I affirm that I have not given or received any unauthorized help on this assignment, and that this work will be my own.”

Predicting the launcher's range

1. (1 point) Mass of the metal ball: _____
2. (1 point) Spring compression distance: _____
3. (1 point) Initial position of ball: _____
4. (3 points) Predict the range and lateral displacement, showing your reasoning.



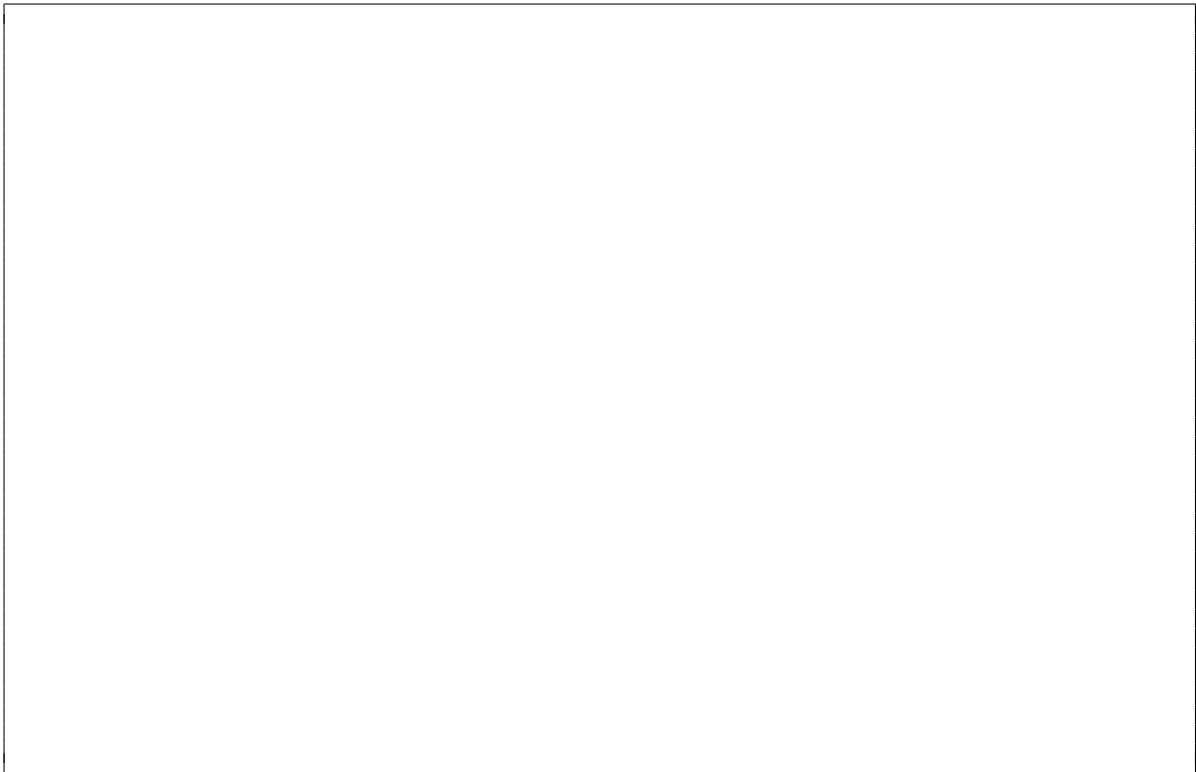
Measuring launches

5. (2 points) Attach photos of both underlying sheets of carbon-less paper, showing impact marks.
6. (2 points) Record the position of each landing in Table 1.

Analysis, statistics, and predictions

7. (2 points) Sample mean and sample standard deviation, Set 1, range x :
_____ \pm _____
8. (1 point) Percent error, versus prediction: _____
9. (2 points) Sample mean and sample standard deviation, Set 1, lateral displacement y :
_____ \pm _____
10. (2 points) Sample mean and sample standard deviation, Set 2, range x :
_____ \pm _____

11. (1 point) Percent error, versus prediction: _____
12. (2 points) Sample mean and sample standard deviation, Set 2, lateral displacement y :
_____ \pm _____
13. (4 points) Name at least three specific mechanisms that might account for the mismatch between your predictions and the mean values of your measurements. Do not use vapid terms like “human error” or “measurement error”. Which mechanism would you guess has the greatest effect? Why?



14. (4 points) Attach a plot showing the histogram and corresponding normal distribution for Set 1, range x . Axes should be labelled with proper units. Write a descriptive caption for the figure.
15. (4 points) Attach a plot showing the histogram and corresponding normal distribution for Set 1, lateral displacement y . Axes should be labelled with proper units. Write a descriptive caption for the figure.
16. (4 points) Attach a plot showing the histogram and corresponding normal distribution for Set 2, range x . Axes should be labelled with proper units. Write a descriptive caption for the figure.
17. (4 points) Attach a plot showing the histogram and corresponding normal distribution for Set 2, lateral displacement y . Axes should be labelled with proper units. Write a descriptive caption for the figure.

18. (1 point) 95% confidence interval, Set 1, range: _____ $\leq x \leq$ _____

19. (1 point) 95% confidence interval, Set 1, lateral displacement:

$$\text{_____} \leq y \leq \text{_____}$$

20. (1 point) 95% confidence interval, Set 2, range: _____ $\leq x \leq$ _____

21. (1 point) 95% confidence interval, Set 2, lateral displacement:

$$\text{_____} \leq y \leq \text{_____}$$

22. (2 points) According to the χ^2 test, are the Set 1 measurements of range x and lateral displacement y consistent with a normal distribution? Show your reasoning.

23. (2 points) According to the χ^2 test, are the Set 2 measurements of range x and lateral displacement y consistent with a normal distribution? Show your reasoning.

24. (20 points) Type and attach an abstract.

25. (20 points) Type and attach a description of the methods used.
26. (20 points) Type and attach a description of your results.