

Introduction to Statistics

(MECH261-2)StLe61f.tex

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1 Wheeler & Ganji, pp.118-179

You may pass, maybe even with a good grade, the statistics module of MECH 262 by reading these pages in the text and doing all problems assiduously. If you want to skip the lectures on Fridays; no hard feelings just be sure to show up for the mid-term on 06-03-03 at 09H30.

2 Broad Issues

Statistics about *inference* concerning *expectation* to allow us to make wise -if not lucky- *planning decisions*. There is a lot of “extra reading” for those who are interested. They appear via some of the blue hyper-links in the course outline. Do not take these seriously. These are like the appendix, a vestigial organ whose function we don’t quite understand. This is *not* the course where you can get deeply into statistics. I inherited MECH 261-262 from Dr. Martin Buehler who left for greener pastures in the Boston area.

3 Am./Can. Idol?

It's pretty safe to say if there was a TV show called "Mechanical Engineering Idol" that Sir Isaac Newton would rank pretty high, based on his contribution to dynamics and optics. But did he do statistics? Examine Fig. 1.

Meanwhile Pepys, who found his own mysteries in London's clubs and gaming tables, came to Newton for advice on a matter of recreational philosophy: "the Doctrine of determining between the true proportions of the Hazards incident to this or that given Chance or Lot." He was throwing dice for money and needed a mathematician's guidance. He asked:

- A—has 6 dice in a Box, with which he is to fling a 6.
- B—has in another Box 12 Dice, with which he is to fling 2 Sixes.
- C—has in another Box 18 Dice, with which he is to fling 3 Sixes.
- Q. whether B & C have not as easy a Taske as A, at even luck?⁹

Newton explained why A has the best odds and gave Pepys the exact expectations, on a wager of £1,000, in pounds, shillings, and pence.

Figure 1: Gleick, J. (2003) *Isaac Newton*, Vantage, ISBN 1-4000-3295-4, p.146.

4 Variability & Randomness

Measurement *variability*-controllable- and *randomness*-uncontrollable- affect conclusions drawn therefrom, hence usefulness. Statistics nevertheless permits us to *plan* experiments and *interpret* the results. Because we are lucky enough to have fairly good theoretical models, unlike the poor social “scientists”, we have fewer uncontrollable effect to contend with.

5 Models & Correlation

Correlative relation reliability will be encountered in other courses like MECH 220, 240, 331, 346. Experimental correlation occurs by comparing measurements to models - phenomenological or heuristic- to be verified. Here's a couple you may have encountered.

$$PV = mNRt, \quad Nu(h) = CRe^\alpha Pr^\beta$$

Measured data scatter about expected model predicted characteristics leads to the requirement for least squares regression to obtain parameters that best fit data to characteristics.

6 Assignment, Bins & Histograms

Go to my web-page and find and down-load the entry “MECH 262 Uniform Random Number Assignment”. It’s due 06-01-13. Study Wheeler & Ganji, pp.118-122, until section **6.2.2**

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