

Homework 1

Due January 23, 2020 at 11:59 PM

1. P. 13: 1 (5 points)

Observational study — you might be interested in assessing the job satisfaction of a large number of manufacturing workers; you could administer a survey to measure various dimensions of job satisfaction. Experimental study — you might want to compare several different job routing schemes to see which one achieves the greatest throughput in a job shop.

2. P. 13: 2 (5 points)

Qualitative data — rating the quality of batches of ice cream as either poor, fair, good, or exceptional. Quantitative data — measuring the time (in hours) it takes for each of 1000 integrated circuit chips to fail in a high-stress environment.

3. P. 14: 6 (5 points) Variables can be manipulated in an experiment. If changes in the response coincide with changes in factor levels, it is usually safe to infer the change in the factor caused the changes in the response (as long as other factors have been controlled and there is no source of bias). There is no control or manipulation in an observational study. Changes in the response may coincide with changes in another variable, but there is always the possibility that a third variable is causing the correlation. It is therefore risky to infer a cause-and-effect relationship between any variable and the response in an observational study.

(Or one can just say there is no treatment variable in an observational study.)

4. P. 19: 1 (5 points) Even if a measurement system is accurate and precise, if it is not truly measuring the desired dimension or characteristic, then the measurements are useless. If a measurement system is valid and accurate, but imprecise, it may be useless because it produces too much variability (and cannot be corrected by calibration). If a measurement system is valid and precise, but inaccurate, it might be easy to make it accurate (and then useful) by calibrating it to a standard.

5. P. 24: 8 (5+5 points)

- (a) Rockwell hardness: multivariate (bivariate), repeated measures (paired), quantitative data. Flatness: univariate, qualitative data.
- (b) There are many possibilities. Possible factors are Vendor, Material, Heating Time, Heating Temperature, Cooling Method, and Furnace Atmosphere Condition. You could choose any number of levels for each factor. If you choose Vendor (1 vs 2), Heating Time (short vs long), and Cooling Method (1 vs 2), the factor-level combinations are given below.

Vendor	Heating Time	Cooling Method
1	short	1
2	short	1
1	long	1
2	long	1
1	short	2
2	short	2
1	long	2
2	long	2

6. (a)
 - Population: All Type I Diabetes-afflicted rats.
 - Sample: the 18 diabetes-afflicted in the study.
- (b) Experiment: the investigators applied the medication (treatment) themselves while keeping experimental conditions constant for each rat (and thus for each level of treatment).
- (c)
 - Treatment: medication level
 - Response: improvement in rat fitness
- (d) There are 2 experimental groups: one with the rats who were given the medication, one with the rats who were not given the medication.