

MATH 101c  
Sample Exam 1 - SOLUTIONS

1.
  - a. quantitative, ratio
  - b. qualitative, nominal
  - c. quantitative, interval
  - d. qualitative, ordinal
2.
  - a. continuous
  - b. discrete
3. (12 pts) Suppose you had a student telephone directory for Bates and wanted to sample 100 members of the faculty and staff. Explain how you would obtain each of the following:
  - a. a random sample – put every name on a separate slip of paper, put slips into a hat, shake it up, then select 100 slips of paper without replacement.
  - b. a simple random sample – take list of people, number them using 3-digit numbers from 001 to 999 (or less), then use a random number table to select 100 random numbers (and associated names).
  - c. a stratified sample – divide group into strata (such as faculty and staff) then take a simple random sample from each strata
4. This is a volunteer response (or self-selected survey). This type of sample is not representative of the larger population of Americans since only those with strong opinions will bother to call in and participate in the poll.
5.
  - a. Results will be biased because the more motivated students will be in class that day, whereas the less motivated students will be more likely to skip class to leave early for break.
  - b. It is too subjective. Each person will have a different definition of motivation; description of level will be different from person to person. Motivation is too difficult to accurately measure.
6. One which gives repeatable results but is not an appropriate measure, such as using a very precise bathroom scale to measure percentage of body fat.
7. Margin of error for sample of size 2500 is 0.02 or 2%, while the margin of error for the sample of size 4000 is 0.016 or 1.6%. Almost doubling the sample size costs much more in time and money but will only increase accuracy slightly (by 0.4%).
8. Q1: How many dates have you been on in the last 3 months?  
Q2: How happy have you been lately?  
If Q1 comes first then people are more likely to think of dating as a factor of happiness. If they haven't dated much then they might rate happiness on a lower level if Q1 is asked before Q2.
9. Low response rate: few people participate but were randomly selected originally  
Volunteer sample: people choose to be included, only those with strong opinions/interest in the study will bother to participate.  
Volunteer samples are not representative of the larger population, so it is worse than a low response rate.
10. A placebo might be used to determine if a treatment truly works, to establish that it is not just the psychological effect of taking a drug that you think might work. In other words, placebos are used so that subjects won't be influenced by belief bias.

- 11.
- No, it is just predictive at this point. This was an observational study, and there could be many confounding variables like genetics or lifestyle which might contribute to the likelihood of developing cancer. Observational studies cannot eliminate or explain the effects of confounding variables—so no causal conclusions can be made.
  - It is not possible to randomly assign women to either a low or high BMD. It would be unethical to forcibly create a high BMD for a group of women and see if it would increase their chances of developing breast cancer.
12. disadvantage: the researchers observe but cannot control the explanatory variable  
 advantage: they are more likely to measure participants in their natural setting (and do not manipulate their environment)

13. STEM LEAVES

```

6 0788
7 0249
8 00
9 45
10 2
11 1
12 1

```

- 14.
- explanatory variable: listening condition (Mozart, relaxation tape, silence)
  - response variable: IQ for abstract/visual reasoning
  - pulse rate, major (music or not), amount of contact with researchers during each segment, order of presentation of 3 conditions, whether or not subject likes classical music, type of tasks done, genetics (intelligence)
  - Even if participants weren't explicitly told the intent of the experimenters, it is likely that they may have figured out they were expected to do better after listening to Mozart. This could bias the results.
  - An accurate reflection of the impact of the variables in the real world or in everyday life. In other words, can the results be generalized to any larger group? This study is not ecologically valid. It is probably not true that results obtained after a few minutes in a laboratory would extend directly to the real world.
15. The shape is bimodal. Probably reflective of the fact that there are two types of trees in this forest, one about 50 ft tall (on average) and the other about 80 ft tall (on average). Sample size is 55.
16. (3 pts) Give an example of a measurement for which the mode would be more useful than the median or the mean as an indicator of the "typical" value.
- 17.
- Mean =  $1503.55/6=250.59$
  - The data set contains even number of values, so the median will be the average of the two middle values when listed from smallest to largest. Median =  $(250.08+252.75)/2=251.415$
  - Range =  $256.30-240.87=15.43$
  - On average, the values are about 5.32 mg away from the mean of 250.59.
  - Variance = standard deviation squared =  $5.32*5.32 = 28.3024$  square mg  
 (note: we did not cover variance in class for Winter 2006)
  - Given the context, the range seems more appropriate since dosage of medication matters. It gives a better sense of how much ibuprofen is found in a tablet.
  - Again consider context, the range is too great. Users of ibuprofen may not get the correct dosage to their detriment.