Unit 1 "Bare Necessities" - Statistics

Z-Scores

- Z-score is the number of standard deviations a value is from the mean.
- Z-scores are used to compare data from different sets
- To calculate, use formula: $z = \frac{x-\mu}{\sigma}$
- z: z-score x: data point μ: mean σ: standard deviation
- Higher z-score = higher above the mean

1) The weight of an average 3 month child is 13.7 lbs with a standard deviation of 1.6 lbs. Benjamin is 3 months old and weighs 13.9 lbs. What is Benjamin's z-score?

$z = .125$

2) The mean score on the SAT is 1500, with a standard deviation of 240. The ACT has a mean score of 21 with a standard deviation of 6. Bobby scored 1700 on the SAT and Kathy scored a 18 on the ACT. Calculate their z-scores. Who performed better on his or her admissions test?

Bobby

3) Andrew and his twin sister, Andrea are both enrolled in Math 3, but have different teachers. On the Unit 1 Test, Andrew scored 82. His class average was 79 with a standard deviation of 2. Andrea scored an 85. Andrea's class average was 81 with a standard deviation of 2.5. Calculate their z-scores and determine which student did better in respect to his or her class.

Andrea

Finding Probabilities - Normal Distribution Curve

- To find the probability, use normalcdf.
  - On calculator: 2nd, VARS, 2.
    Lower bound, Upper bound, Mean, Standard deviation
- To find the data point, use invNorm.
  - On calculator: 2nd, VARS, 3.
    Area (area to the LEFT of the point), mean, standard deviation

1)The scores on the Math 3 midterm were normally distributed. The mean is 80 with a standard deviation of 4. Find the probability that a randomly selected person scored:

a. between 77 and 87 .733

b. between 80 and 90 .494

c. less than 60 0

d. higher than 85 .106

e. What score would a student need in order to be in the top 25% of the class? 82.698

f. A student scores in the 85th percentile? What was the student's test score? 84.146

2) The average life of automobile tires is 30,000 miles with a standard deviation of 2000 miles. If a tire is selected and tested, find the probability that it will have a lifetime:

a. between 25,000 and 28,000 miles .152

b. between 27,000 and 32,000 miles .775

c. over 35,000 miles .006

d. less than 30,000 miles .500

e. The tire company will replaces tires whose tread life falls in the lowest 15% of all tires of this model. What is the lifetime of a tire that qualifies for this replacement? 27927.133

3) The scores on an Algebra II test have a mean of 76.4 and a standard deviation of 11.4. Find the probability that a student will score:

a. above 78 .425

b. below 60 .075

c. between 80 and 85 .151

d. Mr. Reeves scales his tests so that only 5% of students can receive an A. What is the minimum score Andrea can make on this test and still get an A? 95.151

Observation Vs. Experiment

- Observation: Observing a sample and not doing anything to affect the outcome
- Experiment: Changing something in the sample that will affect the outcome

1) Fifty people with clinical depression were divided into two groups. Over a 6 month period, one group was given a traditional treatment for depression while the other group was given a new drug. The people were evaluated at the end of the period to determine whether their depression had improved.

experiment

2) Compare the grades on a final math test of 25 students who use calculators and 25 students who do not use calculators.

experiment

3) 100 people who regularly work out at a gym and 100 people who do not workout are tested for their cholesterol levels to determine whether exercise helps lower cholesterol.

observation

4) A teacher announces a study session to be held the night before a test. The teacher lists the students who attended the session and compares their scores to the students who did not attend the study session.

observation

5) To determine whether or not apples really do keep the doctor away, forty patients at a doctor's office were asked to report how often they came to the doctor and the number of apples they had eaten recently.

observation

Sampling Techniques

- Simple random: all individuals have the same probability of being selected
- Stratified: divide population into groups and select from each group
- Systematic: selects a number, *n*, at random and then selects every n^{th} individual
- Convenience: researcher selects subjects that are conveniently accessible
- Cluster: divide population into groups and select entire group
- Voluntary Response: individuals are self-selected volunteers into the sample

Suppose you are conducting a survey of benefit packages available in the privately owned businesses in Raleigh. Some sampling techniques are described below, determine the type of sample.

1) Assign each business in the Wake County Business Directory a number, then use a random number table to select the businesses to be included in the sample.

Simple random

2) Use postal ZIP codes to divide the county into regions. Pick a sample of 3 ZIP code areas and include all businesses in each selected ZIP code area.

cluster

3) Using the Wake County Business Directory, number all of the businesses. Selecting a starting place at random, then use every 25^{th} business listed until you have 100 businesses.

systematic

4) Group businesses into 10 different categories. Select a random sample of 10 businesses from each group.

stratified

5) Use every business you drive past going down Capital Boulevard.

convenience

Types of Bias

- Question wording: researcher asks question in type of way that might influence the subject
- Undercoverage: sample is not representative of the population
- Response: respondents lie or misrepresent themselves
- Nonresponse: individual is chosen to participate, but refuses
- Voluntary response: people are asked to call or mail in their opinion

1) Students are asked by their teacher whether they had ever cheated on a test.

response

2) A fast food franchiser uses a cluster survey to find out about employer-employee relations.

undercoverage

3) A survey asks the question: "Are you in favor of holding the Olympics in Toronto, even though your taxes may increase?"

question wording

4) A radio station asks listeners to call in to voice their opinions on whether a Canadian figure skater should have won a gold medal.

voluntary

5) A survey is mailed to your house with directions to complete it and mail back, but you throw it in your recycling bin instead.

nonresponse