

## 20 - Final Review 1

### Problem 1.

- (a) Find the mean, population standard deviation, and sample standard deviation of the dataset  $\mathbf{x} = (1, 3, 7, 5)$ .  
(b) Compute the  $z$ -score of the data point  $x_2 = 3$  from the dataset  $\mathbf{x}$ .

### Problem 2.

Scores on an IQ test are normally distributed with  $\mu = 110$  and  $\sigma = 25$ . Write an R command that computes the proportion of scores between 70 and 130.

### Problem 3.

The dataset below shows how many pairs of shoes are owned by a random sample of boys and girls at a large high school.

```
Girls: 13 13 13 15 20 22 23 23 24 26
       26 30 31 34 38 49 50 50 51 57

Boys:  4  5  5  5  6  7  7  7  7  8
       10 10 10 10 11 12 14 22 35 38
```

- (a) Draw the boxplots of these two distributions separately.  
(b) Comment on the center, shape, spread, outliers of each of these distributions.  
(c) Which is more unusual: the girl with 22 pairs of shoes or the boy with 22 pairs of shoes? Explain.

### Problem 4.

A mineral water company wants to find out why people choose a particular brand of mineral water. Identify the sampling technique for each scenario.

- (a) A mail-in response card is attached to the neck of every bottle the company sells.  
(b) Phone 400 numbers chosen randomly from all the residential phone numbers in a state.  
(b) Randomly select 50 retail stores, and survey all people who visit the retail store on a particular day.  
(d) Mail questionnaires to 200 men and 200 women chosen randomly from a list of men and a list of women compiled from a market research company's mailing list.  
(e) Ask the first 20 people seen carrying mineral water in a park on a summer day.

### Problem 5.

State whether whether the study described below is an observational study or an experiment, and whether the study establishes causation. If it is an experiment, identify the control group and the treatments.

- (a) A total of 75 Peruvian children were given milk with and without xylitol and were asked to evaluate the taste of each. Overall, the children preferred the milk flavored with xylitol.  
(b) 974 homeless women in the Los Angeles area were surveyed to determine their level of satisfaction with the healthcare provided by shelter clinics versus the healthcare provided by government clinics. The women reported greater quality satisfaction with the shelter and outreach clinics compared to the government clinics.

### Problem 6.

- (a) Find the probability of getting two spades in a hand of 5 cards.  
(b) Find the probability of getting at least one spade in a hand of 5 cards.

**Problem 7.** (Venn diagram)

A marketing script scraped **500** posts from a tech conference.

- **200** posts use the hashtag **#AI**.
- **250** posts use the hashtag **#Robotics**.
- **100** posts use **neither**.

**Part A.** How many scraped posts mention both of these topics?

**Part B.** How many scraped posts mention **#AI** but not **#Robotics**?

**Part C.** How many scraped posts mention **#Robotics** but not **#AI**?

**Part D.** How many scraped posts mention exactly one of these topics?

**Problem 8.**

Any given patient is diagnosed with flu with probability 30% and with cold with probability 20%. Assume these two diagnoses are independent.

- Find the probability that a patient is diagnosed with neither flu nor cold.
- Find the probability that the patient is diagnosed with either flu or cold (or both).
- Find the probability that the patient is diagnosed with both the flu and cold.

**Problem 9.** (Conditional probability)

The University of Chicago's General Social Survey asked a representative sample of adults this question: "Which of the following statements best describes how your daily work is organized? (1) I am free to decide how my daily work is organized. (2) I can decide how my daily work is organized, within certain limits. (3) I am not free to decide how my daily work is organized." Here is a two-way table of the responses for three levels of education:

Response	Highest Degree Completed		
	Less than High School	High School	Bachelor's
1	31	161	81
2	49	269	85
3	47	112	14

- Find the probability a randomly selected person from this survey is answers (1), given that they have a Bachelor's.
- Find the probability a randomly selected person from this survey have a Bachelor's, given that they answer (1).
- Does the data suggest that there is an association between level of education and freedom to organize one's work in the adult population? Give appropriate evidence to support your answer.

**Problem 10.**

At a store, 60% of customers are from NJ and 40% are from PA. 80% PA customers and 30% of NJ customers buy soda at this store.

- Find the probability a randomly chosen customer buys a soda.
- Given that the customer buys soda, find the probability that that customer is from PA.