

Math 115 Midterm #1 Solutions

- The Wechsler Adult Intelligence Scale (WAIS) is the most common “IQ test.” The scale of scores is set separately for each age group and is approximately normal with mean 100 and standard deviation 15. The organization MENSA, which calls itself “the high IQ society,” requires a WAIS score of 130 or higher for membership. What percent of adults would qualify for membership?

(This is question 1.97 from your homework. The z-score for 130 is $\frac{130-100}{15} = 2$.

From Table A, we see that $P(Z > 2) = P(Z < -2) = .0228$, or 2.28%.

- The Bear Patrol has hired you to determine the relationship between a bear’s species and weight. You study five different bears and collect the following data (weights are in pounds):

SUBJECT	SPECIES	WEIGHT
Claudette Colbear	polar	1000
Mikhail Bearishnikov	brown	200
Beary Bonds	polar	1200
Bearrah Fawcett	grizzly	1300
Bearess Orczy	brown	300

- Is this an experiment or an observational study? Explain.
- Compute the overall mean and the standard deviation.
- Mayor Quimby wants you to compute the correlation between species and weight. Do so, or explain why you can’t.

(a) **Observational study. You’re not assigning the bears to different species; their parents took care of that.**

(b) **mean = 800, std. dev. = $\sqrt{1060000/4}=514.8$.**

(c) **This makes no sense. You can compute the correlation only between pairs of numerical variables, and here we have one numerical variable (weight) and one categorical (species).**

- You’re the manager of a hip clothing store, Gap for Bears. You have 100 employees, with an average salary of \$38,000 and standard deviation \$10,000. Business was good this year (especially after you dropped the money-losing line of wool sweaters), so you’ve decided to give everyone a 10% raise and a \$1000 bonus. Now what are the mean and standard deviation? (HINT: Giving someone a 10% raise is the same as multiplying her salary by 1.10.)

new = 1.1old + 1000, so $\mu_{new} = 1.1\mu_{old} + 1000 = 1.1 \cdot 38000 + 1000=42800$, and $\sigma_{new} = 1.1\sigma_{old} = 1.1 \cdot 10000 =11000$.

- A bunch of hungry bears live in a state park. A lot of people visit the park, and the bears have noticed that bigger cars tend to have more people in them. Being smarter than the average bear, they collected some data on the relationship between the length of the car (in feet) and the number of pounds of delicious humans in the car, and used Fathom to compute a regression line. Fathom gives the following output:

Equation of least-squares regression line: POUNDS_OF_HUMAN = 160 CAR_LENGTH - 1200
 $r = .60$

- A Chevy Suburban is 18 feet long. How many pounds of delicious humans do the bears predict a Suburban would have in it?
- What does the slope of 160 mean in this context?
- What fraction of the variation in pounds of delicious humans is explained by the regression line?

- (d) My nephew rides around in a toy car that's 3 feet long. How many pounds of delicious humans do the bears predict his car would have in it? Does the prediction make sense? Explain what went wrong.
- (e) Pierre Bear grew up in Canada. He likes the metric system, so he converted all of the data from feet and pounds to meters and kilograms. What is the correlation r in the new units?
- (a) $(160)(18) - 1200 = 1680$ pounds.
- (b) An increase of one foot in length leads the bears to predict an increase of 160 pounds of delicious humans.
- (c) $r^2 = .36$, or 36%.
- (d) $(160)(3) - 1200 = -720$, which doesn't make sense because people can't have negative weight. The problem is that real cars are much longer than 3 feet, so the bears are trying to extrapolate far outside the range of their data.
- (e) The correlation is independent of the choice of units, so it's still 0.60.
5. A popular event at the annual Teddy Bears' Picnic is the Honey Chug-a-Lug, in which bears try to eat as much honey as they can in five minutes. The following are the numbers of gallons consumed by the 10 finalists:

23 27 31 33 37 45 45 50 55 114

- (a) Draw a stemplot of the data.
- (b) Give the 5-number summary.
- (c) Are there any suspected outliers according to the 1.5 IQR criterion?
- (d) Based on the shape of the distribution, is the mean or the median a better measure of the center of the data? Explain.

stem	leaf
2	37
3	137
4	55
5	05
6	
7	
8	
9	
10	
11	4

- (b) The five-number summary is (min, Q1, median, Q3, max), so here it's (23, 31, 41, 50, 114).
- (c) $IQR = Q3 - Q1 = 50 - 31 = 19$. $1.5IQR = 28.5$. $Q1 - 1.5IQR = 31 - 28.5 = 2.5$, and $Q3 + 1.5IQR = 50 + 28.5 = 78.5$. The last bear's total of 114 is outside the range (2.5, 78.5), so it's a possible outlier.
- (d) Because the distribution is skewed to the right, the mean will be large, so the median is a better measure of center.