

Statistics 1040, Section 004, Midterm 1 (200 Points)

Friday, February 18, 2005

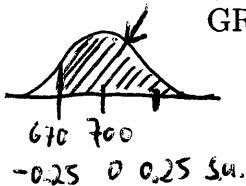
Your Name: _____

Question 1: Normal Approximation for Data (45 Points)

The Graduate Record Examination (GRE) is a test taken by college students who intend to pursue a graduate degree in the United States. For around 146,000 non-US citizens who took the General GRE Test in 2001-02, the mean for the quantitative ability portion of the exam was 700 and the standard deviation was 120 (<http://ftp.ets.org/pub/gre/994950.pdf>). Show your work!

-2 for each calculation error

- (15 Points) The percentage of non-US citizens who scored more than 670 on the GRE test is roughly 59.87%.



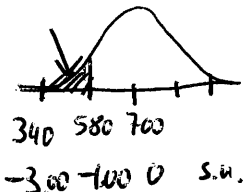
$$\frac{670 - 700}{120} = -0.25 \text{ s.u.} \quad (5)$$

area from -0.25 to 0.25: 19.74% (5)

area above -0.25: $\frac{19.74\%}{2} + 50\% = 9.87\% + 50\% = \underline{59.87\%}$ (5)

(3) for graph only

- (15 Points) The percentage of non-US citizens who scored between 340 and 580 is about 15.73%.



$$\frac{340 - 700}{120} = -3.00 \text{ s.u.} \quad (3)$$

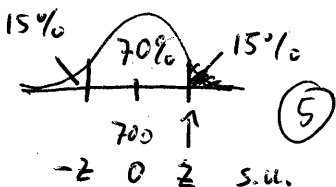
$$\frac{580 - 700}{120} = -1.00 \text{ s.u.} \quad (3)$$

area from -3.00 to 3.00: 99.73% (2) | area from -1.00 to 1.00: 68.27% (2)

area from -3.00 to -1.00: $\frac{99.73\% - 68.27\%}{2} = \frac{31.46\%}{2} = \underline{15.73\%}$ (5)

(3) for graph only

- (15 Points) In order to be among the top 15% of all non-US citizens, a student must have obtained a minimum GRE score of about 826.



area from -1.05 to 1.05: $\underline{70.63\%}$ (closest to 70%) (5)

original units:

$$1.05 \cdot 120 + 700 = 126 + 700 = \underline{826} \quad (5)$$

from: Hist 1040, Fall 2003, Final Test, December 8, 2003, Question 3

Question 2: Observational Studies and Experiments (40 Points)

"HEIGHT MATTERS for career success", said Timothy Judge, a University of Florida management professor whose research appeared in the Spring 2004 issue of Journal of Applied Psychology. Judge and Daniel Cable, a business professor at the University of North Carolina at Chapel Hill, analyzed results from four large-scale studies in the US and Britain that followed thousands of participants from childhood to adulthood, examining details of their work and personal lives. The study controlled for gender, weight, and age, and found that each inch in height added about \$789 a year in pay.

1. (10 Points) Was the described study an observational study or a controlled experiment? Circle one and explain briefly. (7)

No intervention took place - the participants were just followed. (3)

2. (10 Points) Was the described study a cross-sectional or a longitudinal study? Circle one and explain briefly. (7)

The participants were followed from childhood to adulthood, i.e., for many years. (3)

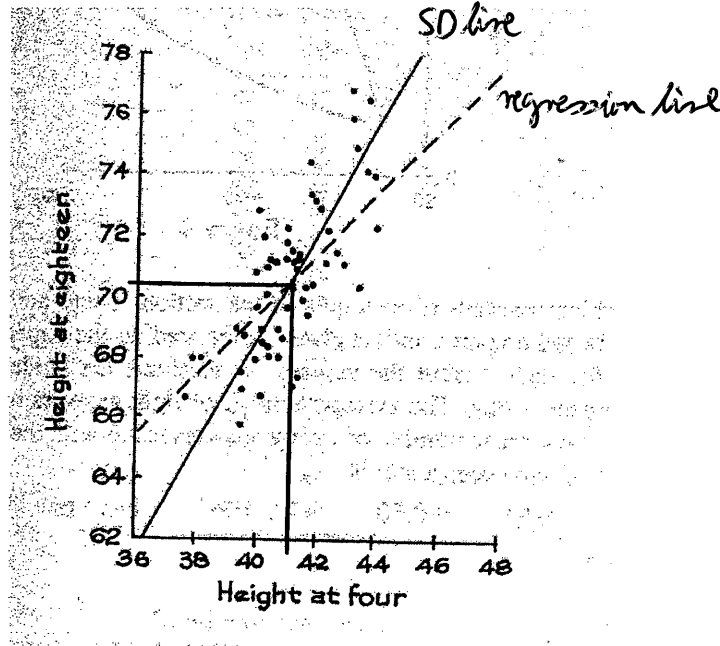
3. (20 Points) What does it mean "The study controlled for gender, weight, and age"? Explain why this is important. (10)

These may be confounding factors that could have an effect on the salary earned. Men often make more money than women but also are taller. Adults obviously make more money than children (or teenagers) and are taller. (10)

from: FPP, Chapter 8, page 137, Review Exercise 8a, c, d

& Stat 1040, Spring 2003, Midterm 1, February 14, 2003, Question 3
Question 3: Correlation (40 Points)

A longitudinal study of human growth has been under way since 1929, at the Berkley Institute of Human Development. The scatter diagram below shows the heights of 64 boys, measured at ages 4 and 18.



1. (10 Points) The average height at age 4 is around

38 inches 42 inches 44 inches 66 inches 68 inches 71 inches

③ SD line & regression line go through the point of averages; 42 inches is the closest choice
(it is actually 41.xxx inches)

2. (10 Points) The average height at age 18 is around

38 inches 42 inches 44 inches 66 inches 68 inches 71 inches

③ SD line & regression line go through the point of averages; 71 inches is the closest choice
(it is actually 70.xxx inches)

3. (10 Points) The correlation coefficient is around

0.50 0.80 0.95

③ The football is not extremely narrow, but also not too wide; 0.80 is the closest choice

4. (10 Points) Which is the SD line — solid or dashed?

③ The SD line is steeper than the regression line

Explain your answers!

from: FPP, Chapter 4, p. 73, Exercise Set E, Question 8 (\rightarrow Answers: p. A-50)

Question 4: Average and Standard Deviation (30 Points)

1. (15 Points) Assume that the Governor of California proposes to give all state employees a flat raise of \$70 a month. What would this do to the average monthly salary of state employees? And to the SD?

The average would be increased by \$70 as well. (8)

The SD would be left unchanged, i.e., the same as before. (7)

2. (15 Points) What would a 5% increase in the salaries, across the board, do to the average monthly salary? And to the SD?

The average would be increased by 5% as well, i.e., 1.05 times as big (8)
as before.

The SD would be increased by 5% as well, i.e., 1.05 times as big (7)
as before.

Just fill in the correct answers, e.g, 10 times as big, \$ 105 more than before, the same, etc. !

From: Stat 1040, Spring 2003, Midterm 1, February 14, 2003, Question 4

Question 5: Regression (45 Points)

A statistical analysis was made of the midterm and final scores in a large course with following results:

- X: average midterm score ≈ 50 SD ≈ 25
Y: average final score ≈ 55 SD ≈ 15
correlation $r \approx 0.60$

Show your work!

-2 for each calculation error

1. (15 Points) Predict the final score for a student whose midterm score was 80.

This score would be about 65.8 points.

$$s.u.x = \frac{x - avg_x}{SD_x} = \frac{80 - 50}{25} = \frac{30}{25} = 1.2 \quad (5)$$

$$s.u.y = s.u.x \cdot r = 1.2 \cdot 0.60 = 0.72 \quad (5)$$

$$Y = s.u.y \cdot SD_y + avg_y = 0.72 \cdot 15 + 55 = \underline{\underline{65.8}} \quad (5)$$

2. (15 Points) Predict the final score for a student whose midterm score was 15.

This score would be about 42.4 points.

$$s.u.x = \frac{15 - 50}{25} = \frac{-35}{25} = -1.4 \quad (5)$$

$$s.u.y = -1.4 \cdot 0.60 = -0.84 \quad (5)$$

$$Y = -0.84 \cdot 15 + 55 = \underline{\underline{42.4}} \quad (5)$$

3. (15 Points) Apparently, students who had very good midterm scores did not study enough later on and, consequently, did not do so well on the final. On the other hand, students with poor midterm scores worked hard during the rest of the semester and considerably improved their performance on the final. Do you agree with this statement? Why or why not? Explain!

Nothing unexpected happened - this is just the regression effect.

The statement above is incorrect and an example for the regression fallacy.

(8)

-3 if "regression effect/fallacy" not stated, but otherwise correct explanation