

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!

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

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

- (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 _____.

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.

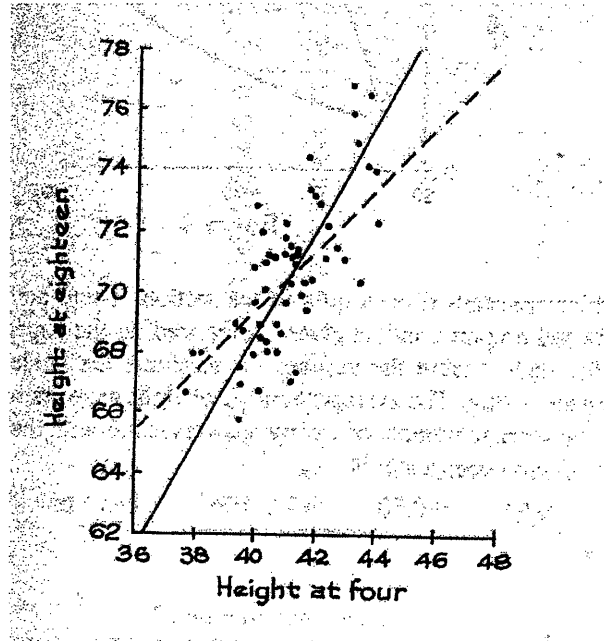
1. **(10 Points)** Was the described study an **observational study** or a **controlled experiment**? Circle one and explain briefly.

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

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

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
2. (10 Points) The average height at age 18 is around
38 inches 42 inches 44 inches 66 inches 68 inches 71 inches
3. (10 Points) The correlation coefficient is around
0.50 0.80 0.95
4. (10 Points) Which is the SD line – solid or dashed?

Explain your answers!

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 ...

The SD would be ...

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 ...

The SD would be ...

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

Question 5: Regression (45 Points)

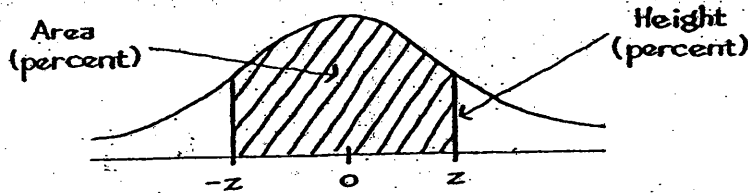
A statistical analysis was made of the midterm and final scores in a large course with following results:

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

Show your work!

1. **(15 Points)** Predict the final score for a student whose midterm score was 80. This score would be about _____ points.
2. **(15 Points)** Predict the final score for a student whose midterm score was 15. This score would be about _____ points.
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!

Tables



A NORMAL TABLE

<i>z</i>	<i>Area</i>
0.00	0
0.05	3.99
0.10	7.97
0.15	11.92
0.20	15.85
0.25	19.74
0.30	23.58
0.35	27.37
0.40	31.08
0.45	34.73
0.50	38.29
0.55	41.77
0.60	45.15
0.65	48.43
0.70	51.61
0.75	54.67
0.80	57.63
0.85	60.47
0.90	63.19
0.95	65.79
1.00	68.27
1.05	70.63
1.10	72.87
1.15	74.99
1.20	76.99
1.25	78.87
1.30	80.64
1.35	82.30
1.40	83.85
1.45	85.29

<i>z</i>	<i>Area</i>
1.50	86.64
1.55	87.89
1.60	89.04
1.65	90.11
1.70	91.09
1.75	91.99
1.80	92.81
1.85	93.57
1.90	94.26
1.95	94.88
2.00	95.45
2.05	95.96
2.10	96.43
2.15	96.84
2.20	97.22
2.25	97.56
2.30	97.86
2.35	98.12
2.40	98.36
2.45	98.57
2.50	98.76
2.55	98.92
2.60	99.07
2.65	99.20
2.70	99.31
2.75	99.40
2.80	99.49
2.85	99.56
2.90	99.63
2.95	99.68

<i>z</i>	<i>Area</i>
3.00	99.730
3.05	99.771
3.10	99.806
3.15	99.837
3.20	99.863
3.25	99.885
3.30	99.903
3.35	99.919
3.40	99.933
3.45	99.944
3.50	99.953
3.55	99.961
3.60	99.968
3.65	99.974
3.70	99.978
3.75	99.982
3.80	99.986
3.85	99.988
3.90	99.990
3.95	99.992
4.00	99.9937
4.05	99.9949
4.10	99.9959
4.15	99.9967
4.20	99.9973
4.25	99.9979
4.30	99.9983
4.35	99.9986
4.40	99.9989
4.45	99.9991

Statistics 1040, Section 004 Midterm 2 (200 Points)

Friday, April 1, 2005

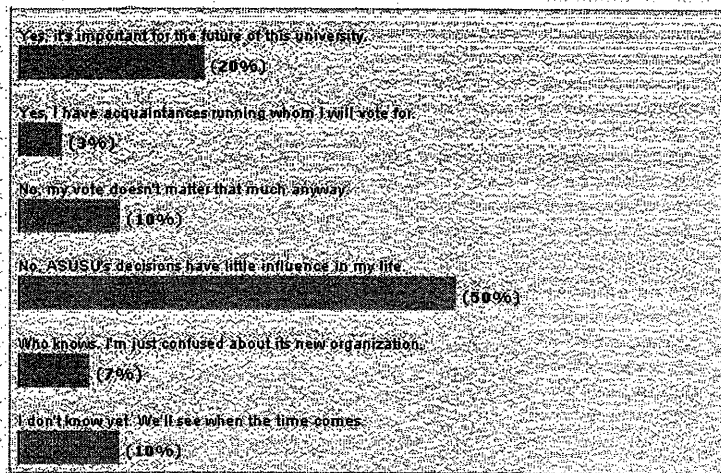
Your Name: _____

Question 1: Sampling (30 Points)

The pictures below show the The Utah Statement Online Poll regarding ASUSU elections as of 03/27/2005:

Will you be voting in the ASUSU primary or final elections?

- Yes, it's important for the future of this university.
- Yes, I have acquaintances running whom I will vote for.
- No, my vote doesn't matter that much anyway.
- No, ASUSU's decisions have little influence in my life.
- Who knows, I'm just confused about its new organization.
- I don't know yet. We'll see when the time comes.



Based on this poll, 50% of the USU students will not participate in the upcoming elections because ASUSU's decisions have little influence in their lives. Do you think the results of this poll objectively represent the opinion of ALL USU students? Answer yes or no and give **three arguments** to justify your answer, based on the facts given, *not* on your personal opinion.

Question 2: Probability / EV, ES, and Normal Curve (90 Points)

Professor J.S. recently experimented with homegrown chili plants. From 4 seeds that were planted, one seed germinated. Use this chance (25%) as the basis for all calculations in this question and assume that seeds germinate independently from each other.

Show your work!

Part 1 (40 Points)

In a second experiment, J.S. planted 4 more seeds. Determine the following chances:

1. (15 Points) The chance that **all 4** of these 4 seeds will germinate is about _____ %.

2. (15 Points) The chance that **none** of these 4 seeds will germinate is about _____ %.

3. (10 Points) The chance that **at least 1** of these 4* seeds will germinate is about _____ %.

Part 2 (50 Points)

To meet his family's annual need in chilis, J.S. plans to plant 100 more seeds later in the Spring.

1. (10 Points) Indicate the box model.

2. (20 Points) The expected number of these 100 seeds that will germinate is _____ with a standard error of about _____.

3. (20 Points) To meet his family's annual need in chilis, 20 chilis that germinate would be sufficient. The chance that **at least 20** of these 100 seeds will germinate is about _____ %.

Question 3: Regression (40 Points)

A selection of 65 varieties of cereal were tested for calories and sodium (in milligrams) for an one-cup serving. The results can be summarized as follows:

Average sodium = 240 mg; SD = 131 mg;
Average calories = 149 calories; SD = 62 calories; $r = 0.53$.

Show your work!

1. (10 Points) Find the equation of the regression line for predicting number of mg sodium in an one-cup serving of cereals from calories.
2. (10 Points) Predict the number of mg sodium in an one-cup serving of cereals that has 200 calories per cup.
3. (10 Points) Find the r.m.s. error for predicting mg sodium from calories.
4. (10 Points) Explain why it would not be a good idea to use the information in the question to estimate the amount of sodium for a cereal with 350 calories per cup.

Question 4: Normal Approximation for Probability Histograms (40 Points)

A coin is tossed 100 times. True or false, and briefly explain.

Answer and explain each of the following questions separately!

1. (10 Points) The expected value for the number of heads is 50.

True / False

Explanation:

2. (10 Points) The expected value for the number of heads is 50, give or take 5 or so.

True / False

Explanation:

3. (10 Points) The number of heads will be 50.

True / False

Explanation:

4. (10 Points) The number of heads will be around 50, give or take 5 or so.

True / False

Explanation:

Formulas:

$$\text{r.m.s. error} = \sqrt{1 - r^2} \times \text{SD}_y$$

$$\text{slope} = r \times \frac{\text{SD}_y}{\text{SD}_x} \quad \text{intercept} = \text{avg}_y - \text{slope} \times \text{avg}_x$$

$$\text{box average} = \frac{\text{sum of all numbers in box}}{\text{how many numbers in box}}$$

$$\text{box SD} = \sqrt{\text{average of } [(\text{deviations from box average})^2]}$$

$$\text{EV}_{\text{sum}} = \text{number of draws} \times \text{box average}$$

$$\text{SE}_{\text{sum}} = \sqrt{\text{number of draws} \times \text{box SD}}$$

Shortcut formulas for a box that contains only *two* different numbers:

$$\text{average} = \frac{(\text{smaller} \times \text{how many}) + (\text{bigger} \times \text{how many})}{\text{how many tickets in the box}}$$

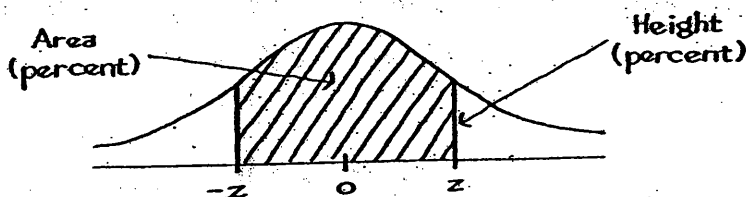
$$\text{SD} = (\text{bigger} - \text{smaller}) \times \sqrt{\frac{\text{fraction}}{\text{bigger}} \times \frac{\text{fraction}}{\text{smaller}}}$$

Shortcut formulas for a box that contains only $\boxed{0}$'s and $\boxed{1}$'s:

$$\text{average} = \frac{\text{number of } \boxed{1} \text{'s}}{\text{how many tickets in the box}} \quad \text{SD} = \sqrt{\frac{\text{fraction}}{\text{of } \boxed{1} \text{'s}} \times \frac{\text{fraction}}{\text{of } \boxed{0} \text{'s}}}$$

$$\text{EV}_{\%} = \% \text{ of } \boxed{1} \text{'s in the box} \quad \text{SE}_{\%} = \frac{\text{SE}_{\text{sum}}}{\text{number of draws}} \times 100\%$$

Tables



A NORMAL TABLE

<i>z</i>	<i>Area</i>	<i>z</i>	<i>Area</i>	<i>z</i>	<i>Area</i>
0.00	0	1.50	86.64	3.00	99.730
0.05	3.99	1.55	87.89	3.05	99.771
0.10	7.97	1.60	89.04	3.10	99.806
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0.40	31.08	1.90	94.26	3.40	99.933
0.45	34.73	1.95	94.88	3.45	99.944
0.50	38.29	2.00	95.45	3.50	99.953
0.55	41.77	2.05	95.96	3.55	99.961
0.60	45.15	2.10	96.43	3.60	99.968
0.65	48.43	2.15	96.84	3.65	99.974
0.70	51.61	2.20	97.22	3.70	99.978
0.75	54.67	2.25	97.56	3.75	99.982
0.80	57.63	2.30	97.86	3.80	99.986
0.85	60.47	2.35	98.12	3.85	99.988
0.90	63.19	2.40	98.36	3.90	99.990
0.95	65.79	2.45	98.57	3.95	99.992
1.00	68.27	2.50	98.76	4.00	99.9937
1.05	70.63	2.55	98.92	4.05	99.9949
1.10	72.87	2.60	99.07	4.10	99.9959
1.15	74.99	2.65	99.20	4.15	99.9967
1.20	76.99	2.70	99.31	4.20	99.9973
1.25	78.87	2.75	99.40	4.25	99.9979
1.30	80.64	2.80	99.49	4.30	99.9983
1.35	82.30	2.85	99.56	4.35	99.9986
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