

Statistics 21 - Hank Ibser

MIDTERM

Wednesday, March 9, 2011

PRINT YOUR NAME XU CHEN

SIGN YOUR NAME Xu Chen

CIRCLE YOUR SECTION TIME:

9-10 10-11 11-12 1-2 2-3 3-4 4-5

CIRCLE YOUR GSI'S NAME:

Tina Ansari Glen Ong Jack Wang Luis Campos Nazret Weldeghiorgis Francie Genz

TURN OFF YOUR CELL PHONE!

Calculators are allowed, but no notes or books.

All the explanations on this exam should be just a sentence or two.

For full credit, give reasons, show work, and use statistical words as appropriate.

The 3 problems are each worth points as marked, total is 100.

I think they are in order from longest to shortest.

Normal table is on the last page, you need not hand this page in.

The exam will be collected at 1pm. When I call time, close your exam and stand up.

If you continue to write, you will receive a 0 for that part of the problem.

GOOD LUCK!

Scores: ~~39~~ 39

1: 35

2: 25

Total: 99

1) (40 points: 10,10,10,10)

In a large class, the correlation between number of Facebook friends and score on the midterm is -0.4. (For purposes of this question, assume that everyone is on Facebook.) The 31st percentile of number of Facebook friends is 200. Also, 64 percent of the students have between 200 and 351 Facebook friends. The midterm average is 60 and the SD is 15. The scatter diagram is football-shaped. 95th

a) If possible, find the avg and SD of number of Facebook friends. If this is not possible, explain why not.

+10

$$(50\% - 31\%) \times 2 = 38\% \sim 0.5 \text{ SD} \Rightarrow \text{avg.} - 0.5 \text{ SD} = 200$$

$$(31\% + 64\% - 50\%) \times 2 = 90\% \sim 1.65 \text{ SD} \Rightarrow \text{avg.} + 1.65 \text{ SD} = 351$$

$$2.15 \text{ SD} = 151 \Rightarrow \boxed{\text{SD} = 70.23}$$

$$\boxed{\text{avg.} = 235.12}$$

b) Of the students at the 69th percentile of number of Facebook friends, about what percent scored below the 69th percentile on the midterm? (Note: you can do this regardless of how you answered part a.)

10

$$(69\% - 50\%) \times 2 = 38\% \sim 0.5 \text{ SD}$$

$$\text{new avg} = 60 + 0.5 \times (-0.4) \times 15 = 57$$

$$\text{new SD} = \sqrt{1 - 0.16} \times 15 = 13.75$$

$$69\text{th mt} = 60 + 0.5 \times 15 = 67.5$$

$$\frac{67.5 - 57}{13.75} = 0.76 \text{ SD} \sim 54.67\%$$

$$\text{below } 69\text{th} = 50\% + \frac{1}{2} \times 54.67\%$$

$$\boxed{= 77.34\%}$$

c) Find the equation of the regression line for predicting midterm scores from number of Facebook friends. For this question and part d), if you answered that a) isn't possible (or just didn't get an answer), assume that the average number of Facebook friends is 250 with an SD of 80.

x 9

$$\text{slope} = \frac{-0.4 \times 15}{80} = -0.075$$

$$60 + \frac{(0 - 235.12)}{70.23} \times (-0.4) \times 15 = 80.09$$

$$\text{Regression line: } \boxed{\text{pred. mt score} = -0.085 \times (\# \text{ of facebook friends}) + 80.09}$$

d) Leo has 100 more Facebook friends than Hannah; both are students in this class. If possible, fill in the first blank with either "better" or "worse" and the second blank with a number (possibly 0) in order to make the sentence below true. If not possible, explain why not.

x 10 Without any additional information, we expect that Leo did worse on the midterm by about 8.5 points.

$$-0.085 \times 100 = -8.5$$

2) (35 points: 5,10,10,10)

You have 12 red tickets and 8 green tickets. For a), b), and c), I take 5 draws from this box without replacement; find the chances.

a) At least one is green

$$\text{All red: } \frac{12}{20} \times \frac{11}{19} \times \frac{10}{18} \times \frac{9}{17} \times \frac{8}{16} = 5.11\%$$

$$\text{At least one green: } 1 - 5.11\% = \boxed{94.89\%}$$

+5

b) Exactly 3 draws are red

$$10 \quad C_5^3 \times \frac{12}{20} \times \frac{11}{19} \times \frac{10}{18} \times \frac{8}{17} \times \frac{7}{16} = 10 \times \frac{3}{5} \times \frac{11}{19} \times \frac{5}{9} \times \frac{8}{17} \times \frac{7}{16} = \boxed{39.73\%}$$

c) At least one is green or the first two draws are the same

exclusive: no green and the first two draws are different
if there is no green, then the first two draws are the same
if first two draws are different, then at least one green.

+10

good!

Thus, possibility for exclusive is 0%, and possibility for "at least one green or first two draws are the same" is $\boxed{100\%}$

d) Suppose I win \$1 if the percent of times I get a red ticket is less than 55%. I can take either 50 draws or 150 draws (with replacement).

10

Choose one of the following options and explain briefly:

- I should draw 50 times.
- I should draw 150 times.
- The chance is the same for either 50 or 150 times.
- Can't tell without more information (say what information you need).

The possibility of getting a red is 60%, so as the number of draws increases, the percent of times I get a red will get closer to 60% and it is more unlikely for the percentage to go below 55%. Therefore, I should draw fewer times, which, in this case, is 50.

35

3) (25 points: 10,10,5)

A list of 5 numbers has an average of 11, median of 9, and an SD of 3. One of the numbers is changed from 10 to 15.

a) If possible, find the average and median after this change is made. If either of these is not possible, explain why not.

$$\text{new avg.} = \frac{1}{5} \times [11 \times 5 + (15 - 10)] = \frac{1}{5} \times 60 = \boxed{12}$$

$$\text{new median} = \boxed{9}$$

+10

b) If possible, find the SD after this change is made. If not possible, explain why not.

$$\text{original SD} = \sqrt{\frac{1}{5} (x_1^2 + x_2^2 + x_3^2 + x_4^2 + 10^2) - 11^2} = 3$$

$$\frac{1}{5} \sum_{i=1}^4 x_i^2 + 20 - 121 = 9 \Rightarrow \sum_{i=1}^4 x_i^2 = 550$$

$$\text{new SD} = \sqrt{\frac{1}{5} \left(\sum_{i=1}^4 x_i^2 + 15^2 \right) - 12^2}$$

$$+10 \quad = \sqrt{\frac{1}{5} \times (550 + 225) - 12^2} = \boxed{3.32}$$

c) A histogram for ^{original} these values would:

- i) be symmetrical
- ii) have a long left tail
- iii) have a long right tail
- iv) can't tell without more information

Choose one option and explain briefly.

+5



For the original value, mean is greater than median, so the histogram should have a long right tail (as shown on the left)