

Group Exams but an Individual Final Exam:

How Does That Work?

S 170 - 2:15 – 3:05

Get a handout please!

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# 5 Minute University

- Video? Or part

# 5 Minute University

- Video clip, or part?
- Individual classes have their points:
  - Calculus – How fast; How much
  - Statistics – Randomness happens, so differences may not matter; data informs us to a degree
  - College Algebra - Functions
  - Liberal Arts mathematics – Depends

# What is Mathematics Really?

- Luke's talk on art of mathematics?
- Mathematics is the science that deals with the logic of shape, quantity and arrangement. ([livescience.com](http://livescience.com))
- Finding Patterns

# Group work rocks!

- Active and collaborative learning if you insist
- Gives students the chance to explain themselves to each other
- Helps the weaker students
- Answers the “Will this be on the exam?” question
- Helps to focus students reviewing
- I also have a practice exam posted

# Background about my college

- Next door to Texas A & M
- Most of our students are looking to transfer
- Currently, 224 classes, 29 developmental. 87 % of our mathematics classes are credit level this fall.
- Department policy is there is an individual, comprehensive final exam for each student in each class.
- The final exam must count a minimum of 20% of the overall grade.

# Format for the class

- There is a review day the class period before each exam
- The take home part is posted online the class period before the review day. (At least a week before the exam)
- One set of answers per group
- The take home is due at the end of the review class
- The students are warned it will take much longer than one class period.

# Format for the in class exam

- Answers to the take home part are posted online right after the take home is handed in
- The students have been warned the in class exam will have portions that extend the take home part
- Generally it contains some harder or non-standard problems
- Remember I have a practice exam for standard problems
- Take home part  $1/3$ , in class part  $2/3$  of the overall grade

# Format for the in class exam

- Take home part 1/3, in class part 2/3 of the overall grade

$$(0.90) \frac{1}{3} + (0.50) \frac{2}{3} = 0.63$$

$$(1.00) \frac{1}{3} + (0.50) \frac{2}{3} = 0.67$$

$$(1.00) \frac{1}{3} + (0.60) \frac{2}{3} = 0.73$$

Handouts

please!

# Take Home Questions For LA Math

1. A yardstick measures  $\frac{1}{4}$  by 3 by 36 inches. How many yard sticks will fit in a box:
2. Rob and Lydia are going to play a game. They roll one fair die. If an even number comes up, Lydia gets \$1 from Rob. If an odd number comes up, Rob gets \$1 from Lydia. Find the expected value of this game from Rob's perspective in each of the following cases:
3. Rob and Lydia are going to play a new game. They roll one fair die. If an even number comes up, Lydia gets the amount showing in dollars. (So \$4 if a four comes up) If an odd number comes up, Rob gets the amount showing in dollars. (So \$3 if a three comes up) Find the expected value of this game from Rob's perspective in each of the following cases:

# In Class Exam for Liberal Arts Math

- Problem 1 (Liberal Arts Mathematics)

1. So how many of these yardsticks will fit into a box that is 6 inches wide and 72 inches high, if the girth of the box is 60 inches?
2. How many will fit into a box that is  $3 \cdot R$  inches wide and  $36 \cdot R$  inches high, if the girth of the box is  $30 \cdot R$  inches, where  $R$  is some positive number greater than one?

# In Class Exam for Liberal Arts Math

- Problem 2 (Liberal Arts Mathematics)
  1. Explain, without actually computing it, why the expected value for ANY die with an even number of sides will end up with an expected value of zero but a die with an odd number of sides will always be in Rob's favor..

# In Class Exam for Liberal Arts Math

- Problem 3 (Liberal Arts Mathematics)
  1. Explain why for ANY die with an even number of sides Rob is in a losing game but for ANY die with an odd number of sides Rob is in a winning game.

# Other Uses for the Take Home Part of the Exam

- Reinforce a concept you discussed in class.
  1. Each of the following are for a data set that is normally distributed. In each case, compute the area between  $r_1$  and  $r_2$ . Make note of any major patterns you see.
- Give an involved question you want every student to work on.
  1. Salmon tagging problem.

# Statistics Take Home Questions

- For each of the following set ups, run the hypothesis test and report the p-value.
  1. A die is rolled 100 times. The total of the spots is 368 instead of the expected 350. Is the die loaded?
  2. A die is rolled 200 times. The total of the spots is 736 instead of the expected 700. Is the die loaded?
  3. A die is rolled 500 times. The total of the spots is 1840 instead of the expected 1750. Is the die loaded?
  4. A die is rolled 1000 times. The total of the spots is 3680 instead of the expected 3500. Is the die loaded?
- A box contains 1 maroon marble and 99 white marbles. 100 marbles are drawn with replacement.
  1. Find the expected number of maroon marbles in the 100 draws and the standard error
  2. What is the chance of drawing fewer than 0 maroon marbles?
  3. Now we get a new box, and are told there are 10,000 marbles in it, some of which are maroon and some of which are white. However we cannot see into the box, only reach in and grab a marble. To estimate the percentage of maroon marbles, 100 are drawn without replacement. Only 1 turns out to be maroon.
  4. Is this binomial? Explain.
  5. What did we discuss in class about these kind of situations and the binomial distribution?
  6. Based upon the data, find a 95% confidence interval for the true percentage of maroon marbles in the box.

# In Class Exam Questions for Statistics

- For each: run the hypothesis test and report the p-value.
  1. A die is rolled 100 times. The total of the spots is 360. Is the die loaded?
  2. A die is rolled 200 times. The total of the spots is 736. Is the die loaded?
  3. A die is rolled 500 times. The total of the spots is 1840. Is the die loaded?
  4. A die is rolled 1000 times. The total of the spots is 3680. Is the die loaded?
- 1) In each case, the sample mean is 3.68 and  $H_0: \mu = 3.5$ . Explain why the p-value is decreasing.
  - A. Consider 1 to 2. We doubled the sample size, but the p-value did NOT get cut in half.
  - B. Similar for 1 to 3. The sample size was increased by a factor of five, but the p-value was not.
  - C. Likewise for 1 to 4. The sample size was increased by a factor of ten which is not the p-value.
  - D. So what is happening here (in A, B, and C) to cause the p-values to plummet like they are instead of going in a nice orderly way?

# In Class Exam Questions for Statistics

- Maroon and White Marble Question

1. Is this binomial? Explain. Not quite, as the probability changes
2. What did we discuss in class about these kind of situations and the binomial distribution?
3. Based upon the data, find a 95% CI (-0.0095, 0.0295)

Clearly the probability of drawing less than one maroon marble is zero, as that is not possible. Explain (1) why then the confidence interval generated contains a negative number and (2) explain how you would 'fix' this problem if you had to use the standard procedure to find an interval that contained 'reasonable' numbers in it.



# Calculus I in class questions

1. Let  $M=C(r)$  be the total cost of paying off a 6 year car loan that has an annual interest rate of  $r\%$

- What are the units of  $C'(r)$ ?

What is the sign of  $C(5)$ ?

- What is the sign of  $C(7)$ ?

What is the practical meaning of  $C(5)$ ?

2. Now let  $A = f(t)$  be the depth of tread, in centimeters, on a radial tire as a function of the time elapsed  $t$ , in months, since the purchase of the tire.

(I) Interpret each of the following in practical terms, paying close attention to units.

(A)  $f(6) = 0.5$       (B)  $f^{-1}(0.31)=15$       (C)  $f'(12)=-0.015$       (D)  $(f^{-1})'(0.4) = -60$

(II) What is the sign of  $f'(t)$ ? Explain why that is the case.

(III) What would it mean if  $f'(t)$  had the opposite sign to what you answered in II above? Explain.

(IV) What is the sign of  $(f^{-1})'(A)$ ? Explain why both in words and graphically.

# Calculus I in class questions

For each of the following functions, find the critical point(s) and inflection points(s), and label them as max, mins, etc.

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It is often claimed by students that for a cubic polynomial, “*The inflection point is always half way between the critical points.*”

- Was that true for I, II, and III?
- In what way was it true for 1, 2, and 3?
- In what way was it true for i, ii, and iii?
- Can you determine on what level, and why, it is true for every cubic polynomial?

# Group Exams but an Individual Final Exam: How Does That Work?

S 170

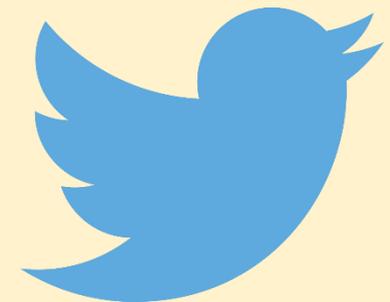
## Blog page

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