Math 120
Final Exam Study Guide

The following document outlines the knowledge presented in all Themes that are likely to be seen on your final exam. It is listed in the order of the text (not necessarily the order presented in class or on the exam). Blue items (marked CT) are critical thinking questions and red items (marked SA) are short answer. You are provided with an example problem and are referred to a list of book exercises for an example problem. You are highly encouraged, even if you "understand" the sample problem, to look at the many possible variations of the learning outcome.

LEARNING OUTCOMES:

1. Analyze Fallacies (Unit 1A exercises 11-20) CT. You will be provided an example fallacy and asked to identify the premise(s) and conclusion, describe how the fallacy occurs, and make up another argument that exhibits the same fallacy.
   My father never went to college, so I suppose I won't either. Identify the premise and conclusion of the argument. Briefly describe how the fallacy occurs. Make up an argument that exhibits the same fallacy.

2. Use Venn Diagrams to Analyze Relationships (Unit 1C exercises 65-71, you generate table) CT. You will be provided with a relationship among groups and asked to construct a Venn diagram to answer a question (or questions) about the relationship among sets.
   In a trial of a new vaccine, 100 people were given the vaccine and 50 were given a placebo. Of those given the medicine, 80 never developed symptoms. Of those given the placebo, 10 never developed symptoms. Make a Venn diagram summarizing the results. How many people who received the vaccine did not improve?
   CROSSLIST: This problem can/may also contain the outcome of finding ratios

3. Inductive and Deductive Arguments (Unit 1D exercises 23-36) CT. You will be provided with a premise(s) and conclusion and asked to discuss its validity/truth, and assess the strength (inductive) or use a Venn diagram to determine validity (deductive).
   Consider the following deductive argument: All Labrador's love to swim. Rex loves to swim. Rex is a Labrador. Discuss the truth of the premises. Draw a Venn diagram that represents the relationships between the sets, and put an "X" where Rex belongs in the diagram. State whether the argument is valid and sound.

4. Sense of Units (Unit 2A exercises 7-12) CT. When provided with a statement involving units, decide whether the statement is reasonable (the units provided will be familiar or you will be provided a proper conversion ratio).
   Decide whether the following statement makes sense (or is clearly true) or does not make sense (is clearly false). Be sure to explain your reasoning (and use unit conversions and mathematics to do so). The recommended amount of water for an adult is 64 ounces per day. I like to buy in bulk, so for a week I will need 24 liters. NOTE: There are 33.8 ounces in one liter.

5. Recipe Conversions (Unit 2A mini project 2) SA. Given a recipe you want to convert the recipe to make as much as you can with a limiting ingredient.
   Grandma's favorite cookie recipe is given (see mini project for example recipe). You only have 9 eggs and want to make as many cookies as you can. How many cookies can you make? Find the necessary amount of baking soda.

6. Find absolute and relative change (Unit 3A exercises 51-54) SA. You will be provided with an increase or decrease of a quantity over time, and asked to find the absolute and relative change. A formula for absolute and relative change will NOT be provided.
   Out of 10,000 teens ages 16-18 surveyed in 2008, 555 used marijuana on a regular basis. In 2017 the same survey reported 1,000 used the drug on a regular basis. Find the absolute and relative change between the 2008 and 2017 values.

7. Find a grade in a class, and answer questions regarding performance (Unit 3C MiniProject 3) CT.
   The following table indicates a student's performance in a class along with the corresponding weights of their grades.

	Percent Worth of Cumulative Grade	Student Grade (%)
Homework Average	10%	97
Mini Project Average	10%	84
Test 1	10%	75
Test 2	10%	86
Test 3	10%	25
Project 1	10%	96
Project 2	10%	91
Project 3	10%	88
Final Exam	20%	62

   Compute the student's cumulative grade in the course. Assume the student has not yet taken the final exam and wants at least a C- (70%) in the course. What do they need to earn on the final exam to earn that grade?

8. Define accuracy and precision (Unit 3C) CT.

9. Compute absolute and relative error (Unit 3C exercises 47-54) SA. Given two values, determine the absolute and relative error between them.
   Your bathroom scale says 145 pounds when you really weigh 138 pounds. Find the relative error between the two values.

10. Find the balance on an account that accrues compound interest (Unit 4B exercises 57-70) SA. Given an investment, APR, compounding rate and length of investment find the balance after maturity.
    You have $10,000 in a savings account that pays 2% APR compounded monthly. Find the balance on the account after 5 years.
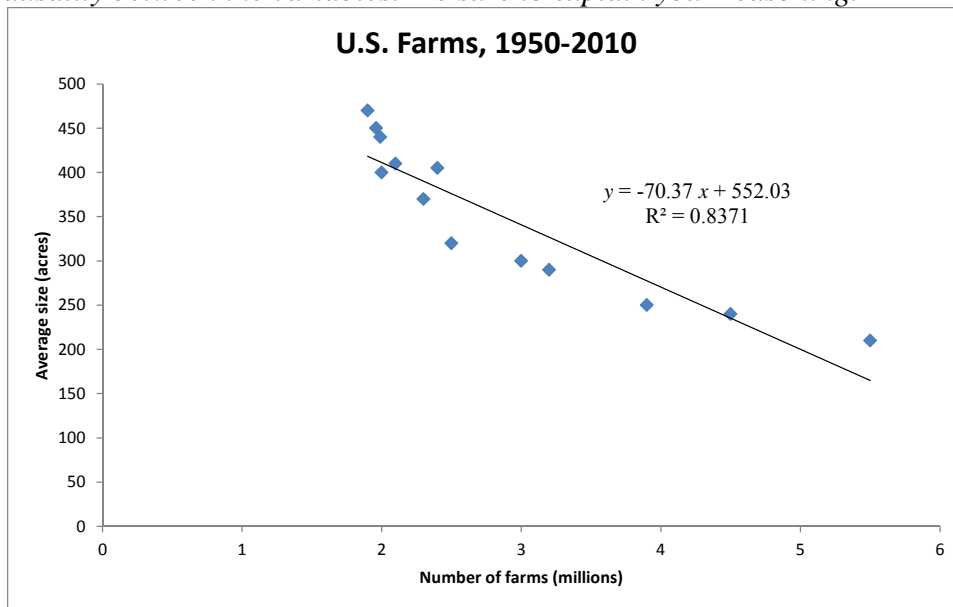
11. Determine mortgage (Unit 3A Mini Project 3A and Unit 4D) CT. Given home price, calculate the monthly payment, cash at closing, points, and find the percentage of your salary that goes towards housing.
    CROSSLIST: Find payment information on a loan (Unit 4D exercises 15-24) SA. You will be provided with a principal, and loan terms (APR and number of years). Determine the monthly payment, total amount paid and the percentage paid towards interest.

You decide to buy a house for $130,000. You found a bank that will provide you a loan of 15 years with an APR of 7.5%, a down payment of 30% and 1 point. What is your monthly payment? What are your total monthly payments? What percentage of that is interest? What is the cash needed at closing? If you have a job paying $24,000 per year, is this a reasonable mortgage for you? Explain.

12. Use correlation to describe relationships between two data variables (Unit 5E, Mini Project 5) CT. Given a scatterplot with a trendline and correlation coefficient, identify the variables being compared, discuss whether you think there is a strong or weak correlation (and whether positive or negative), and whether you suspect there is causality between the variables.

   Consider the scatterplot below. Identify the two variables being compared. Discuss the potential correlation between these variables (use descriptors such as strong or weak, negative or positive, and be sure to incorporate the correlation coefficient). Discuss whether you believe there is causality between the variables. Be sure to explain your reasoning.

U.S. Farms, 1950-2010

$y = -70.37\,x + 552.03$
$R^2 = 0.8371$

X-axis: Number of farms (millions)
Y-axis: Average size (acres)

13. Describe the shape of a distribution with modes, symmetry, skewness and variation (Unit 6A exercises 35-36) SA. Given information on mean, median, mode and range, identify symmetry, skewness and variation of the data.

   Consider the following results for a test in a class: 1000 students, median of 87, mean of 92, low score of 24, high score of 98. Is the data symmetric, or is it skewed right or left? Is the variation high or low? Be sure to explain your reasoning.

14. Interpret quartiles (Unit 6B) CT. Interpret a comparative boxplot of two data sets.

> *You heard from a student that your Tuesday/Thursday (TR) class had gotten a "sneak copy" of the test you gave to your Monday/Wednesday (MW) class. Take a look at the boxplots of the data below to verify whether this might be true. Explain.*
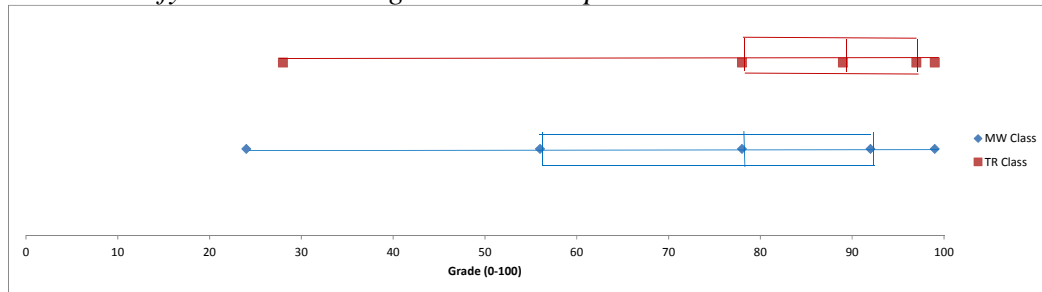
15. Find standard deviation (Unit 6B 15-18, Mini Project 6) SA. Given a data set and mean, find the standard deviation.

> *Find the standard deviation for the following data: 20, 12, 16, 14, 18 (mean 16).*

16. Use the 68-95-97.7 rule to find the percentage of values in certain categories and calculate standard score (Unit 6C exercises 19, 20 and 38) SA.

> *A set of infant weights is normally distributed with a mean of 5 and a standard deviation of 1. Use the 68-95-99.7 rule to find the percentage of infants that weigh more than 6 pounds. What is your infants' standard score if they weigh 7 pounds?*

17. Compute Theoretical Probability (Unit 7A exercises 19-28 and 49-67 as appropriate) SA. Determine the theoretical probability of an outcome or event.
> *What is the theoretical probability of drawing a face card (jack, queen, or king) from a standard deck of cards?*

18. Find a linear equation (Mini Project 8) CT. Given a scenario, determine a linear equation that best represents it (including slope and intercept) and analyze the effects.

> *You have a new job working as a bartender in a small, local bar. Your boss gives you a choice… you can earn a commission salary – a base pay of $150 per night plus $10 for every $200 in alcohol sales. Or you can earn a flat salary of simply $200 per night. Find the equation of the line that represents the commission salary on any given night. What would need to be the total sales in order for the commission salary to be more than the flat salary? Explain your reasoning.*

19. Calculate with half life and doubling time (Unit 8B exercises 25-26) SA. Given the half life or doubling time, find how much of a quantity is present at a certain time.

> *Right now your countertop has 1 e-coli cell. In the right environment, e-coli can double every 11 minutes. How many cells will be on your counter in 3 hours (be careful of units)?*

20. Identify and find exponential models (Unit 9C, Mini Project 8-9) SA. Find an exponential model given a scenario.

> *You are trying to increase your strength, and your trainer indicated you can increase the weight of your bench press by 10% every week. If you start by benching 20 pounds, find an equation to represent how much you will bench for any given week after that.*