MATH 118 FINAL EXAM STUDY GUIDE

Recommendations:

1. Take the Final Practice Exam and take note of questions
2. Use this study guide as you take the tests and cross off what you know well
3. Take the Practice Exams from each previous test as refresher
4. Study the *Reviews* with each unit for more in-depth understanding
5. Go through past quizzes and homework questions

Exam 1

Sets and Subsets:

- Element: Each individual unit (Numbers, letters, etc.)
- Empty Set: Set with no elements in it. ø
- Subset: A set within a set. = 2^n
- Universal Set: All elements given
- Complement: Anything not in the corresponding set
- Intersection: Overlap between two sets
- Union: Total elements between two sets

Union Rule and Venn Diagrams

- Union Rule: $A \cup B = A + B - A \cap B$
- For probabilities, remember independent rule: $P(E|F) = P(E)*P(F) = P(E \cap F)$
- Draw out Venn Diagrams
- With tables, be careful to which values you are using

Probability

- Experiment: A test of an event in a sample for a certain number of trials
- Trial: How many times do you repeat or try the experiment?
- Sample Space: The total number of possible outcomes
- Event: What a "success" is. i.e. what are you looking for?
- Certain Event: Some event is guaranteed to happen (100%)
- Impossible Event: Some event will never happen (0%)
- Mutually Exclusive: Two things cannot be true at the same time (heads/tails)
- Empirical Probability: Ratio of event : trials (Odds are 4:7. Probability = 4/11)
- Independent Events: One event does not effect the outcome of the other

- Probabilities will always be between 0-1 (0% - 100%)
- Probabilities must sum to 1 ($p1 + p2 + p3 + \ldots + pn = 1$)
- Look for words "different", "are not"
- Use Tree-Diagrams for more than one trial or experiment
- Follow wording very carefully. $P(E|F) \neq P(F|E)$
- Probability is always: EVENT / SAMPLE
- Know about card (52 total, 4 suits, 13 in each suit, 12 Face Cards – no aces

Counting

- Permutations
    - n!/(n–r)!
    - Ask, does order make a difference?
    - ABC and CBA are two different outcomes
- Combinations
    - n!/(n-r)!r!
    - Order does not matter
    - ABC and CBA are the same, because same three letters
- Factorials
- Distinguishable Permutation
    - Letters, words, etc. from a given set.
- Think of each of these as the "total number of ways"
- Look for words "at least", "at most", and "not"

EXAM 2

Binomial Probability

- $nCx * (p)^x * (1-p)^{n-x}$
- Only two possible outcomes – success and failure (bi-nomial)
- Same experiment repeated a fixed amount of times
- Probability of success does not change

Expected Value

- $E(X) = x_1 * p(x_1) + x_2 * p(x_2) + \ldots + x_n * p(x_n)$
- Use net value

Mean, Median, Mode, Range

- Mean: (sum of all values) / (number of variables)
    - Frequency: The same value is repeated a certain amount of times
    - When given a gap, take the mean of the gap (age)
- Median: The middle of all the numbers
- Mode: "Most" what value is most repeated?
- Range: Highest value – Lowest value

Standard Deviation

- $\sigma = \sqrt{(\sum(x- \bar{x})^2 / n - 1)}$
- $\bar{x}$ = mean of sample
- μ = mean of population
- Remember not to have any radicals ($\sqrt{}$) under a fraction
- Variance = $\sigma^2 = (\sum(x- \bar{x})^2 / n - 1)$

Standard Normal Curve / Bell Curve

- Symmetrical
  - 68 – 95 – 99.7
  - 1σ – 2σ – 3σ
- Z – Score
  - The number of standard deviations away from the mean a value is
  - Corresponds with a percentage to the ***left*** of the z-score
  - Use z-score to find the percentage, or use the percentage give to find z-score
  - $Z = (x - \bar{x}) / \sigma$
  - You will be given a z-score chart on the final exam with both positive and negative values (same as your exam 2)

Equations of Lines

- Given an equation of a line (y = mx + b)
  - Be able to find X and Y intercepts
  - Understand Slope and how to graph it
- Given two points, be able to find the equation of a line
- Know parallel vs. perpendicular
- Supply and Demand lines
  - Price is on Y-axis
  - Quantity is on the X-axis
  - Fixed cost = Y-intercept
  - Equilibrium is when S = D

Line of Best Fit

- Memorize formulas
- $m = n(\sum xy) - (\sum x)(\sum y) / n(\sum x^2) - (\sum x)^2$
- $b = \sum y - m(\sum x) / n$
- Calculate correlation coefficient
  - There will be no questions with more than 5 points
  - $n(\sum xy) - (\sum x)(\sum y) / \sqrt{n(\sum x^2) - (\sum x)^2} - \sqrt{n(\sum y^2) - (\sum y)^2}$
  - Always between -1 and 1
  - Measures how tightly the points are to the line of best fit
  - 1 = a perfect line

Linear Systems to solve for variables

- Using matrix, Gauss-Jordan, Row Operations, or Substitution
- Always use labels ($, Hours, Acres, Material, etc.)
- Know how to put a system of equations into a matrix – “Augmented Matrix”
- Arbitrary parameters
  - Unknowns that can be used to solve for another variable
  - Look at answers to see what variables you’re asked to solve for

EXAM 3

Matrix

- Adding and Subtracting
  - Must be the same size
- Multiplying
  - Row * Column = New Matrix
  - "Middle numbers" must be the same
- Identity matrix
- Inverse of a 2x2 and a 3x3 matrix
  - Make the subject matrix look like the identity matrix

Economy Questions

- Open
  - aka: Leontief
  - Usually given Demand
  - $(I - A)^{-1}D = X$
  - Always list factors in A in columns – list them downwards
  - Answer the question of *How much should be produced?*
- Closed
  - $(I - A)X = D = 0$
  - Always list factors in A in columns – list them downwards
  - Answers the question of what the ratio of products are to one another

Graphing Inequalities

- ≥ , > , ≤ , <
  - Dotted vs. Solid Line
  - Shade the right region
  - Test points to make sure the correct side of the line is shaded
- Draw out the graphs
- If the question is given as x and y, graph it instead of using matrices
- Corner point theorem
  - Use different points to solve for the objective function – max or min
- Constraints vs. Objective functions
  - What are you trying to maximize/minimize? Under what constraints?

Tableau for Maximizing

- Must be in standard maximum or standard minimum form
  - Max: All constraints are less than, (≤ , <) some value
  - Min: All constraints are greater than (≥ , >) some value
- Slack Variables
  - Every constraint needs one slack variable.
  - Slack variables make up for the left-over amount if it is not exact
- Basic Indicators - Maximizing
  - When the x_1, x_2 ,.. are the only values in the column
  - The rest are 0 if there are more than one value in the column

    - Indicators: variable and slacks
- Solutions
    - Read off the right column
    - Z must be 1, and the solution is the bottom right corner
- Pivoting
    - Start with most negative number on bottom row to determine column
    - Divide the solutions column by the numbers in the column to determine row
    - Cannot be a negative quotient, and cannot be zero
    - Element positioning: (row, column)

Dual Systems / Minimizing

- Transpose and Read Indicators
    - Read off bottom row after pivoting and solving through
    - Do not need to be in basic variable form
    - Indicators are in the place of slack variables after transposing
    - Think of it as finding the inverse of a maximizing problem

UNIT 4

- Markov Chain
    - A statistical model where the probability of each event depends on the state from the previous event
    - "Regular" means all values are positive when squared
- Transition Matrix
    - Think of it as percentage of movement each rotation
    - What percentage moves? Where? What percentage stays?
    - Note how long a repetition is and how many times you repeat
    - Each *ROW* must sum to 1 (100%)
    - "Regular Transition Matrix" : all rows sum to 1, and are all positive or 0
- Vectors
    - Original starting point (Probability Vector)
    - Equilibrium Vector: The original vector and the ending vector are the same, meaning that even after a rotation, the same percentages are in each vector.
        - Know how to solve for equilibrium vectors
    - Must always sum to 1 (100%)
- Absorbing States
    - Understand when absorbing and when not
    - 100% of what is in state *x* remains in state *x* after a rotation
    - Other states must be able to reach the absorbing state for the matrix to be considered absorbing.