



SCHOOL OF
PROFESSIONAL
STUDIES

Fall 2016 Midterm Exam

PREDICT 400: Math for Modelers

Points possible: 100

Description: The midterm exam will cover topics from sessions 1-4.

Resources: The exam is completely open book. You may use course textbooks, materials provided on Canvas, graphing calculators (such as TI 83 or 84); *but any more advanced calculators, Excel Solver, Web calculators, Web-graphic calculators, or simplex method calculators are not allowed. Programming languages other than Python are also not permitted.*

For questions that require calculations, all calculations should be shown, not just the final answer. This will allow for partial credit for those answers that might be set up correctly but have calculation errors. For questions that specifically require Python, the code and output should be included with your answer. For questions that require graphs, only use Python.

Restrictions: All answers are to be your work only. You are not to receive assistance from any other person.

To complete the exam:

1. Answer all questions on the exam thoroughly. Create a Microsoft Word document, including the question number, the question, your typed answer, and graphs if required. You may use Word's equation editor to complete your answers.
2. Once you have completed your exam, return to the exam item where you downloaded the exam PDF, click View/Complete Assignment, and submit your document.

1. The paired data below consist of the costs of advertising (in thousands of dollars) and the number of widgets sold (in thousands). Determine the least squares line and use this to predict the number of widgets sold if the cost of advertising is \$9,000. Using Python, create a scatterplot and include the least squares line.

Cost (x)	9	2	3	4	2	5	9	10
Number (y)	85	52	55	68	67	86	83	73

2. Janet, Tim, and Josh work on an assembly line at a manufacturing company. The assembly of the company's best-selling product can be completed if Janet and Tim work together for 4 hours and Josh works alone for 2 hours; or if Janet and Tim work together for 2 hours and Josh works alone for 5 hours; or if Janet works alone for 6 hours, Tim works alone for 2 hours, and Josh works alone for 1 hour. Due to budget constraints one employee must be laid off. Decide which employee should be laid off by determining the time it takes each employee working alone to assemble this product and selecting the least productive employee.
3. A company makes 3 types of cable. Cable A requires 3 black wires, 3 white wires, and 2 red wires. Cable B requires 1 black, 2 white, and 1 red. Cable C requires 2 black, 1 white, and 2 red. If 95 black wires, 100 white wires, and 85 red wires were used, how many of each cable were made?
4. Gary's lawn supply store has 165kg of rye grass seed and 93kg of bluegrass seed. He plans to sell two different grass seed mixes. One mix will contain half rye grass seed and half bluegrass seed and will sell for \$8.25 per kg. The other mix will contain $\frac{3}{4}$ rye grass seed and $\frac{1}{4}$ bluegrass seed and will sell for \$7.50 per kg. Use Python to determine how many kilograms of each seed mixture he should prepare for the maximum revenue, and the maximum revenue.
5. Gary Johnson's campaign wants to hire regional strategists and assistants to fill its staffing needs at a minimum cost. The average monthly salary of a strategist is \$2400

and the average monthly salary of an assistant is \$1100. The campaign can hire up to 35 staff members and needs at least 20 to run properly. They must have at least 10 assistants and may have up to 3 assistants for every 2 strategists. Using Python, graph the feasible region and determine the number of strategists and assistants the campaign should hire.

6. Honest Abe builds rocking chairs and porch swings and sells them at a local flea market. The lumber requirements are given below. Currently, Abe has 100 2 x 4's, 55 2 x 6's, 100 1 x 4's in stock. Rocking chairs sell for \$40 and porch swings sell for \$85. How many pieces of lumber are left over after Abe has built the number of chairs and swings that maximize his revenue.

	Rocking Chair	Porch Swing
2×4's	1	5
2×6's	1	2
1×4's	2	3

7. To properly stock her restaurant each week, Kaitlyn needs at least 10lbs of carrots, 12lbs of onions, and 20lbs of potatoes. One of her suppliers offers three packages containing combinations of these vegetables. Package 1 contains 4lbs of carrots and 3lbs of onions. Package 2 contains 1lb of carrots, 2lbs of onions, and 4lbs of potatoes. Package 3 contains 10 pounds of carrots, 1lb of onions, and 5lbs of potatoes. Package 1 costs \$40, Package 2 costs \$50, and package 3 costs \$10. Using Python, determine how many of each package Kaitlyn should purchase each week to minimize her costs.
8. A manufacturer makes three different drinks. Drink 1 contains 16% juice and 84% carbonated water. Drink 2 contains 50% juice and 50% carbonated water. Drink 3 contains 84% juice and 16% carbonated water. The manufacturer currently has available 100 liters of juice and 140 liters of carbonated water. Drink 1 sells for \$1 per liter, Drink 2 sells for \$2 per liter, and Drink 3 sells for \$3.80 per liter. How many liters of each drink should the manufacturer make to maximize revenues?

9. A random sample of Northwestern students was asked their top choice for Student Senate President and the data are in the table below. If a student is selected at random, find the probability that the student's top choice is Candidate C given that the student is a junior or senior.

Candidate	Freshman	Sophomore	Junior	Senior
A	14	10	27	27
B	23	27	10	14
C	10	14	23	27

10. The incidence of a certain disease in Evanston is 2%. A new test has been developed to diagnose the disease. Using this test, 95% of those who have the disease test positive while 7% of those who do not have the disease test positive ("false positive"). If a person tests positive, what is the probability that he or she actually has the disease?