

Math 141 Final Exam Review Problem Set

Note: This review does not cover every concept that could be tested on a final. Please also take a look at previous Week in Reviews for more practice problems. Every instructor makes up their own final, so it would be beneficial for you to also look over your old tests, quizzes, assignments, and class notes.

1. Determine whether the following matrices are regular.

$$(a) \begin{bmatrix} .7 & .2 & .5 \\ .2 & .6 & .3 \\ .1 & .2 & .4 \end{bmatrix}$$

$$(b) \begin{bmatrix} .8 & 1 & .4 \\ .1 & 0 & .3 \\ .1 & 0 & .3 \end{bmatrix}$$

$$(c) \begin{bmatrix} 1 & .2 & .5 \\ 0 & .6 & .3 \\ 0 & .2 & .2 \end{bmatrix}$$

2. Suppose that in a study of Coke and Pepsi, it was found that currently, 75% of people drink Coke and 25% drink Pepsi. Every year, 72% of those who drink Coke will continue to do so, while 28% will switch to Pepsi. Further, 54% of those who drink Pepsi will continue to do so, while 46% switch to Coke.

- (a) What percentage of drinkers will Coke and Pepsi have after 2 years?
 (b) In the long run, what percentage of soda drinkers will Coke and Pepsi have?

3. A guitar manufacturer determines that when the price of a guitar is \$150 that the quantity demanded is 1200. When the price is \$225, the quantity demanded decreases by 100. The supplier is not willing to supply any guitars at a price of \$100, but will supply 300 guitars at a price of \$175. What is the market equilibrium for this guitar manufacturer?

4. Use the Gauss-Jordan Elimination Method to get the following matrix in row-reduced form.

$$\left[\begin{array}{cc|c} 2 & -4 & 10 \\ 6 & 3 & -15 \end{array} \right]$$

5. Solve the following systems of equations.

$$(a) \begin{aligned} x - y + z &= 16 \\ -2x + y + z &= -5 \\ 3x + 2y - z &= 1 \end{aligned}$$

$$(b) \begin{aligned} 2x + 4y - 6z &= 8 \\ -3x - 6y + 9z &= 7 \\ x + 2y - 3z &= 5 \end{aligned}$$

$$(c) \begin{aligned} 5x + y - 2z &= -13 \\ 3x - 6y + 3z &= -18 \\ -2x + 4y - 2z &= 12 \end{aligned}$$

6. Solve the following matrix equation for the variables $a, b, c,$ and $d.$

$$\begin{bmatrix} 2 & a \\ 3 & b \end{bmatrix}^T + \begin{bmatrix} 1 & -2 & c \\ 0 & 5 & 8 \end{bmatrix} \begin{bmatrix} 6 & d \\ -4 & 1 \\ -1 & 0 \end{bmatrix} = -2 \begin{bmatrix} -6 & -5 \\ 1 & 4 \end{bmatrix}$$

7. A house costs \$189,000. Benjamin makes a down payment of \$12,000 and secures a loan for the remaining balance. The loan is to be paid off over 25 years at an interest rate of 6%/yr compounded monthly.
- What is the required monthly payment?
 - How much total interest will be paid on this loan?
 - Benjamin decides to refinance the loan after 9 years. The new loan is for 15 years at an interest rate of 5%/yr compounded monthly. What would be his new monthly payment?
8. A quiz has a total of 10 questions on it: 5 True/False and 5 Multiple Choice. The professor is very generous and says that the students only have to answer 7 questions of which 3 must be True/False and 4 must be Multiple Choice. Each multiple choice problem has 5 possible answers. How many ways are there to complete the test if a student answers exactly 3 True/False and exactly 4 Multiple Choice?
9. A potter makes only vases and ash trays. (He's a beginner.) Each vase requires 6 pieces of clay and takes 8 hours to make. Each ash tray requires 4 pieces of clay and takes 2 hours to make. The potter makes a profit of \$12 on each vase and \$3 on each ash tray. He knows that the number of ash trays made should be at most twice the number of vases made. The potter only has available 42 pieces of clay each week, but wants to work at least 24 hours each week. How many vases and ash trays should the potter make each week in order to maximize profit? Is there any leftover clay at this level of production? What would be the level of production that minimizes profit?
10. A survey of 300 A&M students was done asking what video game systems (Atari, Nintendo, Gameboy) they had growing up. Let A be the set of students who had an Atari, N be the set of students who had a Nintendo, and G be the set of students who had a Gameboy. The following data was found.
- 45 students only had Nintendo.
 - 156 students had a Gameboy.
 - 73 students had all 3 systems.
 - 11 students had an Atari and a Gameboy but not a Nintendo.
 - 115 students had a Nintendo and a Gameboy.
 - 100 students had exactly one of these systems.
 - 101 students had a Nintendo or an Atari, but not a Gameboy.
- How many students had none of these game systems?
 - How many students had an Atari?
 - What is $n((N \cap A) \cup (G \cap N^c))$?
 - What is the probability that a student in this group had exactly 2 of these systems?

11. In a bag I have 9 Skittles and 10 M&M's. There are 3 red Skittles, 4 yellow Skittles, and 2 green Skittles. There are 2 red M&M's, 7 yellow M&M's, and 1 green M&M. An experiment consists of reaching into the bag and pulling out a piece of candy.
- What is the probability that the chosen piece is yellow or a Skittle?
 - What is the probability that a green piece is not chosen?
 - Let E be the event that a red candy is drawn. Let F be the event that an M&M is drawn. Are E and F mutually exclusive? Are E and F independent?

12. Data is given below relating the quiz averages and final exam scores of 10 students in a Math 141 class.

Quiz Average, x	43	54	62	69	74	77	81	88	94	98
Final Exam Score, y	37	55	65	67	78	80	80	85	85	99

Find the least-squares line for this data and use it to predict the final exam score of a student in this class who has a 70 quiz average.

13. A bag of Hershey's miniatures contains 10 milk chocolates, 9 Mr. Goodbar's, 7 Krackels, and 8 dark chocolates. A sample of 8 chocolates is taken from the bag. What is the probability that the sample contains
- exactly 3 milk chocolates or exactly 4 dark chocolates?
 - at least 1 Krackel?
14. In a certain group of students, it is known that 21% live in the dorms. Further, 67% of those who live in the dorms are freshmen whereas 39% of those who do not live in the dorms are freshmen. What is the probability that a student in this group who is not a freshman lives in the dorms?
15. A simple game consists of rolling a pair of dice. The game costs \$2 to play. If a double is rolled, you win \$4. If the sum of the dice is 9, you win \$7. If exactly one two is rolled, you win \$1. Otherwise, you win nothing. Let X be the net winnings of a person who plays this game. Find the expected value, standard deviation, and variance of X .
16. A simple economy consists of 2 sectors: food and shelter. The production of 1 unit of food requires the consumption of .4 units of food and .2 units of shelter. The production of 1 unit of shelter requires the consumption of .3 units of food and .2 units of shelter. Find the gross output of goods needed to satisfy a consumer demand of 12,285 units of food and 3,185 units of shelter.
17. It is found that 31% of batteries last for more than 5 hours. If a factory produces 400 batteries, what is the probability that at least 150 of them will last for more than 5 hours?
18. A calendar company incurs monthly costs of \$3300 in rent and utilities. Each calendar costs the company \$8 to make and is sold for \$14. What is the break-even point for this company?
19. Use an appropriate normal distribution to approximate this binomial distribution. Suppose that in 1995, the probability a family had a computer in the United States was 0.54. In a group of 650 families, what is the probability that at least 375 of them had a computer?

20. Suppose I have 16 DVDs. 5 are comedies, 6 are dramas, and 5 are action movies. My DVD case only holds 9 DVDs. I know that I want 3 comedies, 4 dramas, and 2 action movies in the DVD case. How many ways are there to arrange 9 DVDs in my DVD case if I want the comedies together, the dramas together, and the action movies together?
21. Find the value of z that satisfies $P(-z < Z < z) = 0.5832$.
22. Benjamin wants to have \$7000 so that he can go on a vacation. If he deposits \$400 every quarter in a savings account that earns interest at a rate of 9%/yr compounded quarterly, how long will it take for him to accrue the desired amount? How much of this is interest?
23. Let $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 3, 5\}$, $B = \{2, 3, 4\}$, and $C = \{2, 4, 5\}$. Find the following sets.
- (a) $A^c \cap B$
 - (b) $(B \cup C)^c$
 - (c) $B \cup (A \cap C)^c$
24. Find the equation of the line that passes through the x -intercept of the line $2x - 6y = 18$ and is perpendicular to the line that passes through the points $(1, 5)$ and $(3, -4)$.
25. Suppose the weights of elephants are normally distributed with a mean of 14000 pounds and a standard deviation of 3000 pounds. What is the probability that an elephant selected at random weighs more than 16500 pounds?