Sample Problems For Exam 3
Spring 2010 Compiled by Joe Kahlig

This collection of questions is intended to give an idea of different types of question that might be asked on the exam. This is not intended to represent an exam.

These question cover chapter F, chapter 5, and sections 4.3 and 4.4 in the Applied Finite Mathematics, 2th edition by Tomastik and Epstein.

Video solutions can be found at this link: http://www.math.tamu.edu/~kahlig/166WIRpage.html

1. Three hundred dollars are invested at a simple interest rate of 7.5% per year.

   (a) How much do you have at the end of 5 years?

   (b) If you wanted $540 at the end of 5 years, what annual simple interest rate is needed?

2. James received $900 when he took out a discount loan that had an annual simple discount rate of 14%. The loan had to be repaid in 8 months.

   (a) What amount of money does James have to repay for this loan?

   (b) What is the discount on the loan?

3. What single deposit do you make so that you will have $8000 in three years if the account has an interest rate of 7% per year compounded quarterly?

4. John deposits $5,000 into an account with an annual interest rate of 5.6% compounded monthly. How much interest did the account earn during the third year?

5. John deposits $5,000 and then makes monthly payments of $200 into an account with an annual interest rate of 5.6% compounded monthly.

   (a) What is the ballance after 5 years?

   (b) How much interest did John earn during this 5 years?

   (c) How much interest did John earn during the third year?

6. Sue wants to have $15,000 in 5 years. She is going to put $2000 into an account that has an annual interest rate of 7% compounded monthly and then make monthly payments. What is the amount of the payments so that she can reach her goal?

7. Bob deposits $75,000 into an account that has an annual rate of 6.5% compounded quarterly.

   (a) If Bob receives a payment of $2000 every three months, what will be the ballance of the account after 6 years?

   (b) How much interest did the account receive during the first 6 years of the account?

   (c) How many full payments of $2000 will the account generate?

   (d) What is the largest payment Bob can receive from the account that will not diminish the ballance of the account?

8. Jason is buying a house for $210,000. He will put 12% down and finance the rest for 15 years at an annual interest rate of 5.1% compounded monthly.

   (a) What payments will he need to make to pay off the loan?

   (b) After 7 years of making payments, how much equity will he have? Assume the value of the house does not change.

(c) Create an amortization chart for the first months of the loan.

period	interest owed	payment	amt. toward principal	outstanding principal
0	—	—	—	
1				

9. Give an example of a matrix in row-reduced form (reduced row-echelon form) that describes a system with an infinite number of solutions.

10. Give an example of a matrix in row-reduced form (reduce row-echelon form) with exactly one solution.

11. Give an example of a matrix in row-reduced form (reduce row-echelon form) with no solution.

12. For the next two word problems do the following.
    I) Define the variables that are used in setting up the system of equations.
    II) Set up the system of equations that represent this problem.
    III) Solve for the solution.
    IV) If the solutions is parametric, then tell what restrictions can be placed on the parameter. Also give three specific solutions.

    (a) The management of a private investment club has a fund of $300,000 earmarked for investment in stocks. To arrive at an acceptable overall level of risk, the stocks that management is considering have been classified into three categories: high-risk, medium-risk, and low-risk. Management estimates that high-risk stocks will have a rate of return of 16 percent per year; medium-risk stocks, 10 percent per year; and low-risk stocks, 4 percent per year. The investment in medium-risk stocks is to be twice the investment in stocks of the other two categories combined. If the investment goal is to have an average rate of return of 11 percent per year on the total investment, determine how much the club should invest in each type of stock.

    (b) A chemical manufacturer wants to purchase a fleet of 24 railroad tank cars with a combined carrying capacity of 250,000 gallons. Tank cars with three different carrying capacities are available: 6,000 gallons, 8,000 gallons, and 18,000 gallons. How many of each type of tank car should be purchased?

13. Fill in the missing entries by performing the indicated row operations.

$$\begin{bmatrix} 3 & 6 & 15 & 9 \\ 7 & 12 & 39 & 25 \\ 2 & 6 & 5 & 4 \\ 3 & 0 & 6 & 1 \end{bmatrix} \quad R_1(\tfrac{1}{3}) \rightarrow R_1 \quad \begin{bmatrix} * & * & * & * \\ 7 & 12 & 39 & 25 \\ 2 & 6 & 5 & 4 \\ 3 & 0 & 6 & 1 \end{bmatrix} \quad \begin{matrix} R_2 + (-7)R_1 \rightarrow R_2 \\ 3R_3 + (-2)R_4 \rightarrow R_3 \end{matrix} \quad \begin{bmatrix} 1 & 2 & 5 & 3 \\ * & * & * & * \\ * & * & * & * \\ 3 & 0 & 6 & 1 \end{bmatrix}$$

14. Solve for the variables x, y, z, and u. If this is not possible, then explain why

$$\begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 1 & -2 & 3 \end{bmatrix} \begin{bmatrix} -2x & 0 \\ 3 & 4 \\ x+2 & 3 \end{bmatrix} - 3 \begin{bmatrix} y-1 & 2 \\ 1 & 2 \\ 4 & 2z+1 \end{bmatrix} = \begin{bmatrix} -7 & -2u \\ 0 & -2 \\ 8 & 10 \end{bmatrix}$$

15. Find the matrix K that makes the following true. If this is not possible, then explain why.

$$\begin{bmatrix} 0 & 8 & 1 \\ 7 & -6 & 0 \\ 3 & 0 & 1 \end{bmatrix} + \frac{1}{2} \begin{bmatrix} 2 & 0 & 0 \\ 5 & 2 & 0 \\ 6 & 6 & 1 \end{bmatrix} K = \begin{bmatrix} 7 & 0 & 6 \\ 0 & 1 & 4 \\ 3 & 7 & 0 \end{bmatrix}$$

16. Use the matrices A and B, given below, along with the fact that C =AB and D = BA to answer the following.

$$A = \begin{bmatrix} 1 & 0 \\ x & 2 \\ 3 & y \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 2 & 5 \\ 0 & 3 & 4 \end{bmatrix}$$

   (a) $C_{3,2} =$
   (b) $D_{2,1} =$

17. Use the following matrices for this problem. Compute the following operations. If it is not possible, then explain why.

$$A = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 2 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & -2 \\ 0 & 2 \\ 4 & -1 \end{bmatrix} \quad D = \begin{bmatrix} 1 & -2 & 0 \\ -1 & 3 & 2 \end{bmatrix} \quad E = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 1 & 0 \\ 1 & -2 & 3 \end{bmatrix}$$

   $D + C =$ $D - 3B =$ $DC =$ $DA =$
   $B + C^T =$ $B^{-1} =$ $A^{-1} =$ $E^{-1} =$

18. John and Matt have a roofing company and they each have a crew that they work with to roof houses. John and Matt have given each worker a designation based on the number of years of experience. A worker who has less than one year of experience is classified as N. A worker with at least one and less than 3 years of experience is classifies as B. A worker with at least 3 and less than 7 years of experience is classified as E. A worker with more than 7 years of experience is classified as VE. The breakup of John and Matt's crews can be shown in this matrix W. The matrix P represents the pay per hour of each worker designation.

$$P = \begin{matrix} N \\ B \\ E \\ VE \end{matrix} \begin{bmatrix} 5.15 \\ 6.25 \\ 7.50 \\ 9.00 \end{bmatrix} \qquad\qquad W = \begin{matrix} \\ John \\ Matt \end{matrix} \begin{matrix} N & B & E & VE \\ 2 & 3 & 4 & 1 \\ 4 & 2 & 0 & 3 \end{matrix}$$

Explain the meaning of the entries in the matrix $WP = \begin{bmatrix} 68.05 \\ 60.10 \end{bmatrix}$

19. Solve the systems of equations by using inverses.

$$\begin{aligned} 2x + y + z &= b_1 \\ 5x + 2y + z &= b_2 \\ 3x + 2y + 4z &= b_3 \end{aligned}$$

   (a) $b_1 = 2$, $b_2 = -1$, $b_3 = 0$
   (b) $b_1 = 3$, $b_2 = 4$, $b_3 = -2$