Sample Problems For Exam 2

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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 3, chapter 6, and section 7.1 in the Applied Finite Mathematics, 9^{th} edition by S. T. Tan.

Video solutions can be found at this link: http://www.math.tamu.edu/~kahlig/141WIRpage.html

1. The following system of inequalities are constraints in a linear programming problem. Graph the feasible region. Label all lines and corner points.

$$\begin{aligned} x - y &\geq -5 \\ x + y &\leq 10 \\ 10x + 9y &\geq 45 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

2. Use the feasible region from problem 1. At what point is the objective function $f = x + 3y$ maximized and what is the maximum value? (if not possible, explain why.)

3. Use the feasible region from problem 1. At what point is the objective function $f = x + 3y$ minimized and what is the minimum value? (if not possible, explain why.)

4. Set up this linear programming problem. Do not solve.

   You manage an ice cream factory that makes three flavors: Creamy Vanilla, Continental Mocha, and Succulent Strawberry. Into each batch of Creamy Vanilla go two eggs, one cup of milk and two cups of cream. Into each batch of Continental Mocha go one egg, one cup of milk and two cups of cream, while into each batch of Succulent Strawberry go one egg, two cups of milk and two cups of cream. You have in stock 220 eggs, 120 cups of milk, and 200 cups of cream. You make a profit of $3 on each batch of Creamy Vanilla, $2 on each batch of Continental Mocha, and $4 on each batch of Succulent Strawberry. Due to a poor strawberry harvest, no more than 10 batches of Succlent Strawberry can be produced. How many batches of each flavor should you make in order to maximize your profit?

5. True or False. $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and $A = \{0, 1, 2, 3, 4, 5\}$

T	F	$\phi \in A$	T	F	n(A) = 5	T	F	n({3, 4}) = 2
T	F	$\phi \subseteq A$	T	F	$\{1, 3, 5\} \in A$	T	F	$n(\phi) = 1$
T	F	$\{1, 2, 3\} \subseteq A$	T	F	$2 \in A$	T	F	$3 \in A^C$
T	F	$2 \subseteq A$	T	F	$\{\phi\} = \phi$	T	F	$0 = \phi$

6. A = $\{a, b, c\}$

   (a) List all subsets of A.

   (b) List all of the proper subsets of A.

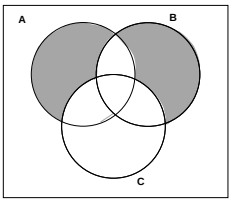
   (c) Give an example of two subsets of A that are disjoint. If this is not possible, then explain why.

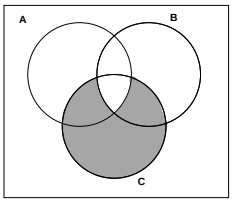
7. Shade the part of the Venn diagram that is represented by

   (a) $(A^C \cup B) \cap (C \cup A)$

   (b) $(B \cup C) \cap A^C$

8. Write down the set notation that would represent the shaded portion of the Venn diagram.





9. $U = \{0,1,2,3,4,5,6,7,8,9\}$, $A = \{1,3,5,7,9\}$, $B = \{1,2,4,7,8\}$, and $C = \{2,4,6,8\}$. Compute the following.

   a) $(A \cap B) \cup C$ b) $A^C \cap B$ c) $A \cap (B \cup C)^C$

10. Any problem like problem 6 and 7 from chapter 6 on-line suggest homework.

11. In a survey of 300 high school seniors:
    120 had not read *Macbeth* but had read *As You Like It* or *Romeo and Juliet*.
    61 had read *As You Like It* but not *Romeo and Juliet*.
    15 had read *Macbeth* and *As You Like It*.
    14 had read *As You Like It* and *Romeo and Juliet*.
    9 had read *Macbeth* and *Romeo and Juliet*.
    5 had read *Macbeth* and *Romeo and Juliet* but not *As You Like It*.
    40 had read only *Macbeth*.

    Let M = *Macbeth*, R = *Romeo and Juliet*, and A = *As You Like It*.

    (a) Fill in a Venn diagram illustrating the above information.

    (b) How many students read exactly one of these books?

    (c) How many students did not read *Romeo and Juliet*?

    (d) How many students read either *Macbeth* or *As You Like It* and read *Romeo and Juliet*?

    (e) Compute $n(M \cup (R^C \cap A)) =$

    (f) Compute $n(A^C \cap (R \cup M)) =$

12. Find $n(A \cap B)$ if $n(A) = 8$, $n(B) = 9$, and $n(A \cup B) = 14$.

13. Many U.S. license plates display a sequence of three letters followed by three digits.

    (a) How many such license plates are possible?

    (b) In order to avoid confusion of letters with digits, some states do not use the letters I, O or Q on their license plates. How many of these license plates are possible?

    (c) Assuming that the letter combinations VET, MDZ and DPZ are reserved for disabled veterans, medical practitioners, and disabled persons respectively, and also taking the restriction in part b into account, how many license plates are possible?

14. Dripping wet after your shower, you have completely forgotten the combination of your lock. It is one of those "standard" combination locks, which uses a three number combination with each number in the range of 0 through 39. All you remember is that the second number is either 27 or 37, while the third number ends in a 5. In desperation, you decide to go through all possible combinations. Assuming that it takes about 10 seconds to try each combination, what is the longest possible time it can take to open your locker?

15. Compute $C(20,5) =$ $P(20,5) =$

16. How many 4-person committees are possible from a group of 9 people if:

    (a) There are no restrictions?

    (b) Both Jim and Mary must be on the committee?

    (c) Only Jim or only Mary is on the committee?

17. The U.B.S. Television company is considering bids submitted by seven different firms for three different contracts. In how many ways can the contracts be awarded among these firms if no firm is to receive more than two contracts.

18. You have a box that contains 3 red balls, 4 black balls, 2 green balls, and 5 purple balls. If you take a sample of three balls from the box, how many ways can you get

    (a) 2 black balls and one green ball?

    (b) exactly 2 red balls or exactly one purple ball?

    (c) at least two purple balls?

19. How many different arrangements can be made from the letters of MASSACHUSETTS?

20. An experiment consists of tossing a 4 sided die and flipping a coin.

    (a) Describe an appropriate sample space for this experiment.

    (b) Are the events, E: getting a head and F: rollind a 2 on the die, mutually exclusive? Justify your answer.

    (c) Give two events of this sample space that are mutually exclusive.