

Show all work. Explain your answers.

Name _____

Circle the time of your TA section:

Tues 8:50

Tues 9:55

Thurs 8:50

Thurs 9:55

Problem	Points	Score
1	20 %	
2	20 %	
3	20 %	
4	20 %	
5	20 %	
Total	100%	

The final exam will be in
180 Science
on
Tues, Dec 22 at 5:05 pm

1. (15 %) A set of points is described the inequalities:

$$\begin{aligned}y - x - 4 &\leq 0 \\y - 1 &\geq 0 \\4x - y - 5 &\geq 0 \\x &\geq 0\end{aligned}$$

Graph this set of points, shading the region described. Find the coordinates of the corners (i.e., extreme points) of this region.

2. (15 %) A large animal lives in a territory that can be divided into areas described as mountain and valley, and it moves randomly from one area to another. If the animal is in the valley on one observation, then it is four times as likely to be in the valley as on the mountain on the next observation. Likewise, if the animal is on the mountain on one observation, then it is four times as likely to be on the mountain as in the valley on the next observation.

- (a) Identify the appropriate states.
- (b) Draw a transition diagram.
- (c) Find the transition matrix.

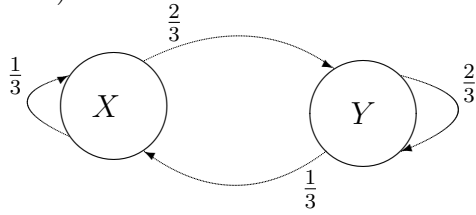
3. (20 %) Suppose that the constraints of a linear optimization problem are given by:

$$\begin{aligned}x + y &\geq 3 \\ 2y &\geq x\end{aligned}$$

For each objective function z given below find the maximum or minimum or say that it doesn't exist. In each case **explain** why your answer is correct.

- (a) maximum of $z = x - 3y$
- (b) minimum of $z = x - 3y$
- (c) maximum of $z = x - 2y$
- (d) minimum of $z = x - 2y$

4. (30 %) A Markov chain has a transition diagram given below.



- (a) Find the probability of going from state Y to state X in exactly four steps.

- (b) Find the probability of being in state Y after four hundred billion steps.

5. (20 %) You are planning to take a ten day backpacking trip in the wilds of the Pacific Northwest. In order to sustain yourself during the trip you plan to eat only peanut butter and rye bread. A nutritionist has advised you that you will need to eat at least 24 grams of protein, 175 grams of carbohydrates, and 85 grams of fat, daily. Looking at the nutritional labels you find that:

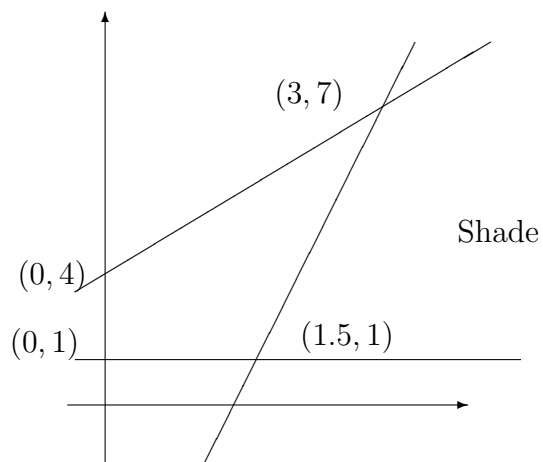
An ounce serving of peanut butter contains 15 grams of fat, 5 grams of carbohydrates, and 8 grams of protein.

An ounce serving of bread contains 1 gram of fat, 15 grams of carbohydrates, 3 grams of protein, and 9 grams of water.

Naturally you wish to carry the lightest pack possible. How many servings of peanut butter together with how many servings of bread will you need to carry?

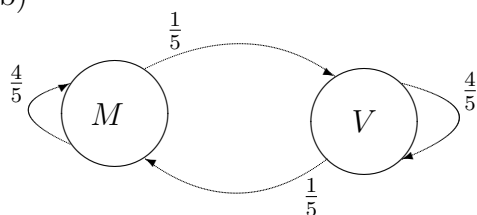
Answers

1.



2. (a) M = observed in the mountain, V = observed in the valley

(b)



(c)

$$\begin{bmatrix} 4/5 & 1/5 \\ 1/5 & 4/5 \end{bmatrix}$$

3. (a) -1 at $(2, 1)$

(b) none

(c) 0 anywhere on line $2y = x$

(d) none

4. (a) $1/3$ (b) $2/3$

5. 5 servings of peanut butter and 10 of bread per day, i.e., multiply each by 10 for whole trip.