Not announced in class...

Please tell your Classmates.

Tutoring sessions

Weds	BH 103	1-3 PM
Thurs	CCH 110	10 A to 12 Noon

Ch 9 Hw

p 213 Exercises 2 5 8ab
(all) (all)

Due 1st Class Meeting after Thanksgiving

Maddasuh ~~Hadder~~ Company. p 201

Objective. Minimize Cost (2) How to calculate

Choices # hours of Am Plant. (1) Variables
- - - - — S. Plant.

Constraints Union (3) Inequalities

Market

Write this algebraically.

(1) Variables from Choices

A = # hours American Plant.

S = # hours Singapore Plant

(2) Formula for objective

Cost = 10,000 A + 10,000 S

Constraints

Union: Am plant at least 6 hrs/day

$$A \geq 6$$

Market

Doodads make at least 750 doodads/day

American Plant Singapore

$$40A + 50S \geq 750$$

depend on # hrs each plant runs.

Widgets

$$25A + 80S \geq 800$$

Summarize

Min Cost = $10{,}000A + 19{,}000S$

Given
$$\begin{cases} A \geq 6 & \text{U} \\ 40A + 50S \geq 750 & \text{D} \checkmark \\ 25A + 80S \geq 800 & \text{W} \checkmark \end{cases}$$

Where A = # hrs American Plant
S = # hrs Singapore Plant.

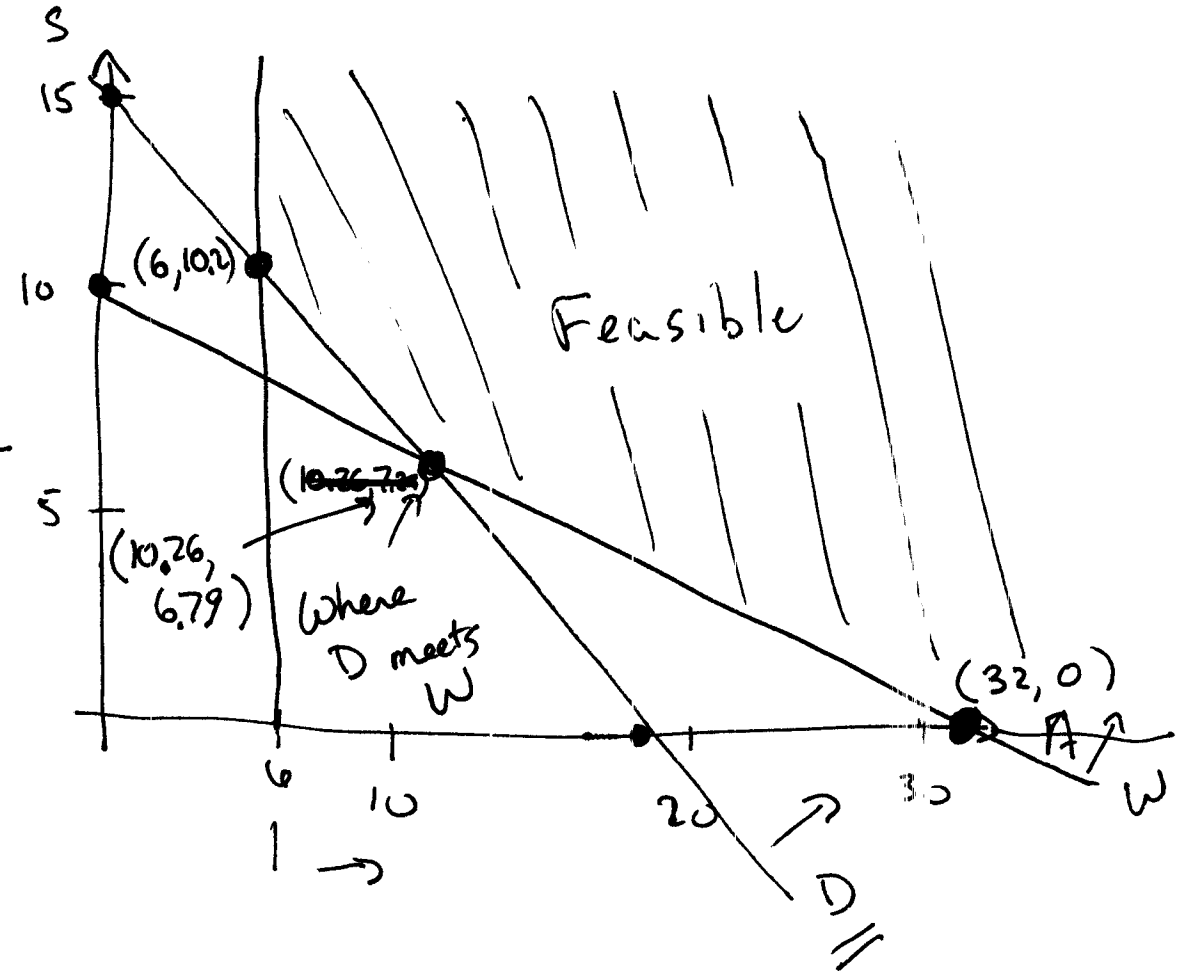
Solve by graphing, id'ing corner points

D

A	S
0	15
18.75	0

W

A	S
0	10
32	0



Let A=6 in Doodad

$$40(6) + 50S \geq 750$$

$$240 + 50S \geq 750$$

$$50S \geq 510$$

$$S \geq 10.2$$

3 Points

Cost = 10,000 S + 10,000 A = 10,000 (S + A)

A	S	Cost = 10,000 S + 10,000 A =
32	0	320,000
10.26	6.79	170,5000
6	10.2	162,000 ← Choose this one - it min cost.

Which of the following is true in a Lotka-Volterra predator prey model:

(A) The prey birth rate is constant.
B. The predator birth rate depends on the # of prey.
C. The prey death rate depends on the # of predators.
D. The predator death rate depends on the # of prey.

What is the name of points where neither species changes quantity?

A. Poincare Points
(B.) Equilibrium Points
C. Null Points
D. Cooperative Points

Species r and s are represented in a phase plane with r on the horizontal axis and s on the vertical axis. In a portion of the phase plane, $\Delta r > 0$ and $\Delta s < 0$. In that portion of the phase plane

$\Delta r > 0 \quad \Delta S < 0$

A. r increases and s increases.
(B.) r increases and s decreases.
C. r decreases and s increases.
D. r decreases and s decreases.

The basic SIR model for measles is modified to allow for the possibility that the measles are fatal. Which is true about the change in the diagram for the model?

A. A new group is added to the model but no arrows
B. A new arrow is added but no new groups
C. Both a new arrow and a new group are added
D. The diagram is unchanged.

D

S → I → R
↓
D added

A group of medical doctors researched ways to increase handwashing by children. They believe they can cut ~~in half the chance~~ children's chance of infection in half as a result. What will be the impact on the threshold population?

$\Delta I < 0$

$aSI - bI < 0$

$aS - b < 0$

$S < \frac{b}{a}$

$\text{Threshold} = \frac{b}{a} = \frac{\text{total Pop}}{\text{time in I} \cdot \text{Ch inf} \cdot \#\text{cont.}}$

recovery time

Cut denominator in half ⇔ double Threshold!

A. Cut the threshold population in half.
(B.) Double the threshold population.
C. No changed in the threshold population.
D. Increase the threshold population by 2%.

In the basic SIR model, the parameter b is calculated as

A. 1/(time in S)
(B.) 1/(time in I)
C. 1/(time in R)
D. chance of infection/#contacts

NAME: _____

MATH 1470 Fall 2003 Tintera

TEST 3: Two-Species, Epidemic and Linear Programming Models. Covers Chapters 7 9

You may use calculators and one 8.5 by 11 inch page of notes. Please show all work on this test booklet. Partial credit is awarded only for work shown. Each problem is worth as indicated. Good luck!

5% ch inf. 20,000 10

1. A variation on the measles has broken out in a town of 20,000 people. In that town, people make 10 contacts per day and 5% of the contacts between an infected person and a susceptible person leads to the measles for the susceptible person. Since this is a new disease, no one is immune nor have they been vaccinated. It takes a week to recover from this type of measles.

7 days

a) (10 points) Write the change model (Delta model) for this situation based on the SIR model.. ~~(I'll write the formulas for a and b on the board if you ask).~~

aSI bI

$S \to I \to R$ $\quad a = \frac{\text{ch inf} * \#\text{ cont}}{\text{Total Pop}} = \frac{(.05)(10)}{20{,}000} = .000025$

$b = \frac{1}{7}$ $\quad \left[\frac{\Delta S}{\Delta t} = -.000025SI \quad \frac{\Delta I}{\Delta t} = +.000025SI - \frac{1}{7}I \quad \frac{\Delta R}{\Delta t} = +\frac{1}{7}I \right]$

b) (5 points) Early on in the outbreak, there are 10 people infected and 2 have recovered. How many will there be in each group (S, I, R) the next day? $I = 10 \quad R = 2 \quad S = 20{,}000 - 10 - 2 = 19{,}988$

$S_{next} = 19988 - (.000025)(19988)(10) = 19983.6$

$I_{next} = 10 + (.000025)(19988)(10) - \frac{1}{7}(10) = 14.$

$R_{next} = 2 + (1/7)(10) = 3.4$

c) (5 points) Later, the number of infected has risen to 250. A reporter from a local newspaper asks you, the mayor of the town, if the number of infected will go up. Can you tell him?

$I = 250$

I increases $\Leftrightarrow \Delta I > 0 \Leftrightarrow S > \frac{b}{a}$

Need to know S to be able to answer.

d) (5 points) For which values of S will I increase (ie, have $\Delta I > 0$) ?

$S > \frac{b}{a} = \frac{1/7}{.000025} = 5720\ 5714.$

(6)

$(a,b) = (0,70)$

Suppose species a and b are modeled by the equations

$$\frac{\Delta a}{\Delta t} = 0.7a - 0.014a^2 - 0.01ab = a(.7 - .014a - .01b)$$

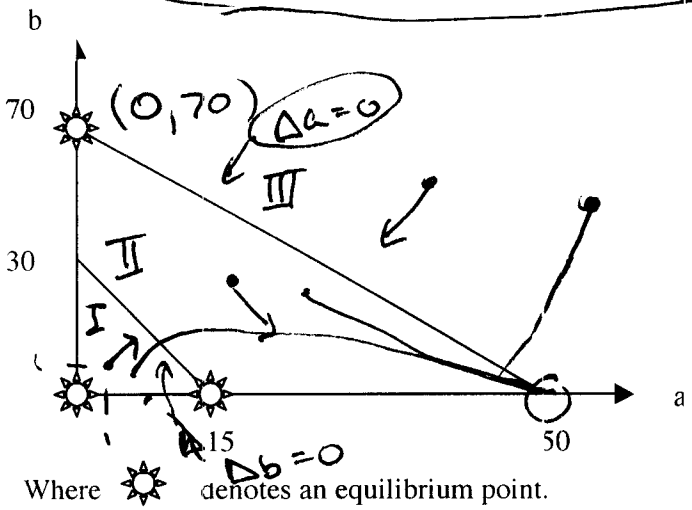
$$\frac{\Delta b}{\Delta t} = 0.3b - 0.01b^2 - 0.02ab = b(.3 - .01b - .02a)$$

a) Label the skew lines in the phase plane below as $\Delta a = 0$ or $\Delta b = 0$.

b) Add arrows to the regions of the diagram

c) Interpret the phase plane biologically.

$(a,b) = (0,70)$



Where ☼ denotes an equilibrium point.

(b) $(1,1)$ $\Delta a = .7 - .014 - .01 > 0$

$\Delta b = .3 - .01 - .02 > 0$

both increasing

In moving from I to II crossed $\Delta b = 0$

So $\Delta b < 0$ in II