10-18

Warm up: Read Problem on other screen

- Get over how silly it is
- Find the constraints and objective function.

- v - # violinists
- b - # bassonists

- Each violinist plays 2 notes sings 1 note
- Each bassonist plays 1 note sings 3 notes

- Want at least 200 instrument notes
- at least 300 soprano notes
- no more than 3 times as many bassonists as violins.
- Violins cost $200 per performance
- Bassonists cost $400 " "

constraints

- $2v + b \geq 200$
- $v + 3b \geq 300$
- $b \leq 3v$
- $b \geq 0, \quad v \geq 0$

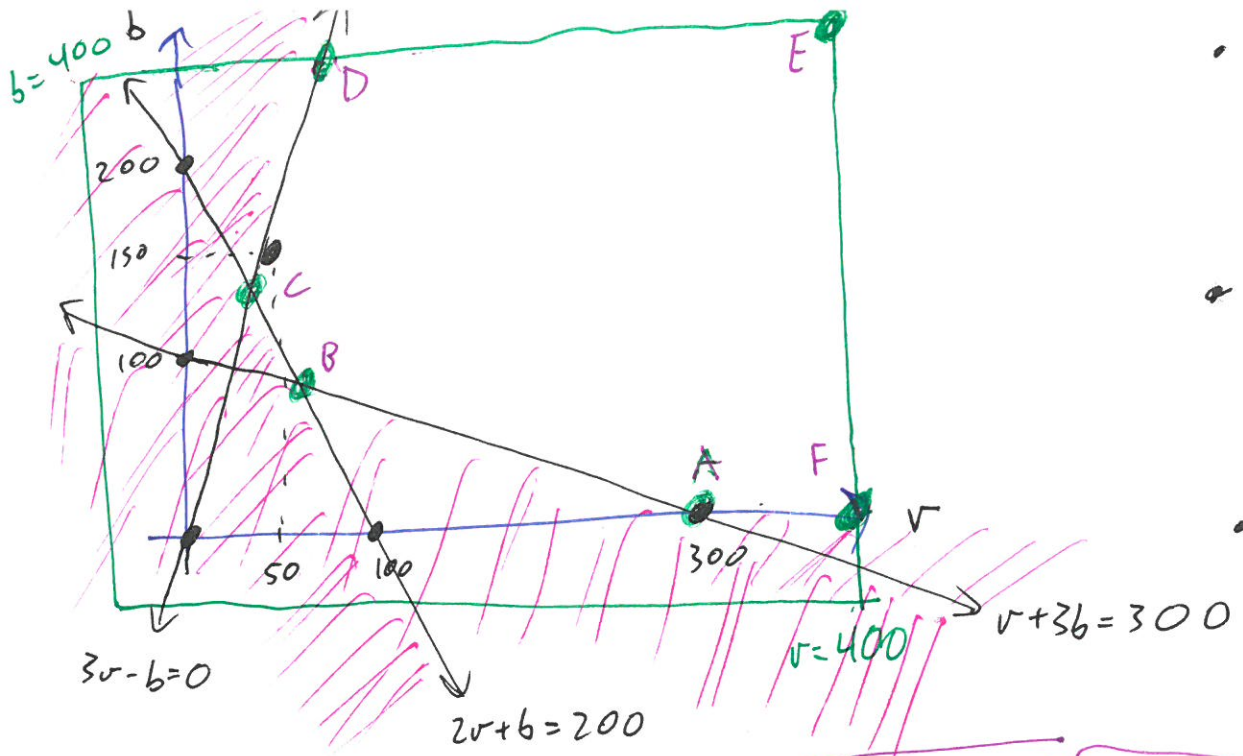
ex if we had 3 violins want no more than 9 bassonists

$b \leq 3 \cdot (3) \qquad b \leq 9$ ✓

objective function

$C = 200v + 400b$

plot the feasible region



- $2v+b=200$
  (0, 200)
  (100, 0)
- $v+3b=300$
  (0, 100)
  (300, 0)
- $b \leq 3v$
  $3v-b=0$
  (0, 0)
  (50, 150)
  ↑ choose any v

	$C=200v+400b$
A (300, 0)	\$60,000
B (60, 80)	\$44,000 ★
C (40, 120)	\$56,000
D (400, 400/3)	— large
E (400, 400)	— large
F (400, 0)	\$80,000

C: $2v+b=200$
$3v-b=0$
$5v=200$
$v=40$

B: $v+3b=300$
$2v+b=200$
$2v+6b=600$
$5b=400$
$b=80$
$v=60$

optimal solution is
to hire 60 violins
80 bassoons
will cost \$44,000.

Ratios: no more than 30 students per teaching assistant

students - x
TAs - y

1 teaching assistant
max of 30 students

2 TA max 60 students

3 TAs max 90 students

If y=1 ⇒ $x \leq 30$
y=2 $x \leq 60$
y=3 $x \leq 90$

$30x \leq y$ is this correct

plug in any point ex $y=2$

$y=2 \Rightarrow 30x \leq 2 \Rightarrow x \leq \frac{2}{30}$ ✗ no

$x \leq 30y$

$y=2 \quad x \leq 30(2) \Rightarrow x \leq 60$ ✓ looks good.

why does $x \leq y+58$ not work

works for $y=2$

but not $y=1$

Chapter 6

6.1 - Sets and set operations

- Applications to Probability
- Combinitorics - "the theory of counting"

ex How many lottery tickets would you need to buy to guarantee a win?

A set is a collection of items which we will call elements

(will usually use capital letters to denote sets)

ex $A = \{1, 3, 4, 6\}$

A is the set containing 1, 3, 4, and 6

if an element is in a set

if x is in A we will write

$x \in A$

x "is an element of" A

if y is not in A will write

$y \notin A$

y "is not an element of" A

ex $W = \{ NCSU, UNC, Duke \}$

$NCSU \in W$

$ECU \notin W$

If two sets are equal they contain the same elements

ex $A = \{ fall, spring, summer, winter \}$

$B = \{ winter, fall, summer, spring \}$

$A = B$ order does not matter

duplicates don't matter

$C = \{ 1, 2, 3 \}$

$D = \{ 1, 1, 2, 3 \}$

$C = D$

Some sets can be larger than others

Some sets might contain other sets

ex $A = \{ 1, 2, 3, 4 \}$

$B = \{ 1, 2, 3 \}$

will call B a subset of A

will write $B \subseteq A$

note: $A \subseteq A$

If $F \subseteq E$ and $E \subseteq F$ then $F = E$

Sometimes you might see $A \subset B$

mean $A \subseteq B$ but $A \neq B$ "proper subset"

The empty set is the set that contains no elements will write

$$A = \{\}$$

or $A = \emptyset$

you can have sets of sets

ex/ A is the set containing the set B and C

$A = \{B, C\}$ lets say $B = \{1, 2, 3\}$

$C = \{5\}$

$$A \neq \{1, 2, 3, 5\}$$

$$A = \{\{1, 2, 3\}, \{5\}\}$$

Sets can be <u>finite</u> or <u>infinite</u>

ex/
- the set of all humans born as of now is a finite set.
- the set of all integers is an infinite set

$B = \{\ldots, -2, -1, 0, 1, 2, \ldots\} =$ [redacted]

$B = \mathbb{Z}$ - all the integers

ex/ D is the set of sets with 3 integers between -10 and 10

so $\{2, 1, 4\} \in D$, $\{-8, 10, 5\} \in D$

How many sets does D contain?

☆ D is a finite set.

Later we learn how to answer this question about size.