MA162: Finite mathematics

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Schedule:

- HW 4.1 due Friday Mar 2, 2012
- Exam 2 is Monday, Mar 5, 2012 from 5pm to 7pm in CB106 and CB118

Today we will cover 4.1 in terms of the practice exam.

4.1: Linear programming problems

- An LPP has three parts:
  - The variables (the business decision to be made)
  - The inequalities (the laws, constraints, rules, and regulations)
  - The objective (maximize profit, minimize cost)
- If there are more than two variables, use slack variables and matrices
- Simplex algorithm finds a useful RREF

#4, #8, #9

- Soup Parlour needs to maximize profit
- 3 products: Meaty, Leafy, Soupy
- 3 resources: Chicken stock, Beef stock, Vegetable stock
- Limited demand
- How much of each soup should they make?

	ounces of Chicken stock	ounces of Beef stock	ounces of Vegetable stock	bowls of Demand	Profit
each bowl of Meaty	1	6	1	1200	$1.20
each bowl of Leafy	0	0	8	600	$1.30
each bowl of Soupy	3	2	2	900	$1.50
Available	3400	6800	5014		

#4: Set it up

- Variables:
  - M = # of bowls worth of Meaty soup to make
  - L = # of bowls worth of Leafy soup to make
  - S = # of bowls worth of Soupy soup to make
- Constraints:
  - Resource constraints:
    - Chicken: $1M + 0L + 3S \leq 3400$
    - Beef: $6M + 0L + 2S \leq 6800$
    - Vegetable: $1M + 8L + 2S \leq 5014$
  - Demand constraints:
    - Meaty: $M \leq 1200$
    - Leafy: $L \leq 600$
    - Soupy: $S \leq 900$
- Objective: Maximize profit, $P = 1.20M + 1.30L + 1.50S$

#7 for Soup Parlour

- Write the LPP as a simplex tableau

  (on exam it will be a silly one, today let's do the Soup Parlour)

- Convert inequalities to equalities, using slack variables to take up the slack.
- For resources, these are just "unused resource"
  - C = # of ounces of unused chicken stock
  - B = # of ounces of unused beef stock
  - V = # of ounces of unused vegetable stock
- For demands, these are "unsatisfied customers" (demand without supply)
  - HM = # of hungry Meaty customers
  - HL = # of hungry Leafy customers
  - HS = # of hungry Soupy customers
- See the "Soup Parlor sets production goals" examples on my little webpage

#7: answer for soup parlour

The tabelau for the soup parlour is:

M	L	S	C	B	V	HM	HL	HS	P	RHS
1	0	3	1	0	0	0	0	0	0	3400
6	0	2	0	1	0	0	0	0	0	6800
1	8	2	0	0	1	0	0	0	0	5014
1	0	0	0	0	0	1	0	0	0	1200
0	1	0	0	0	0	0	1	0	0	600
0	0	1	0	0	0	0	0	1	0	900
-1.20	-1.30	-1.50	0	0	0	0	0	0	1	0

- See "Soup Parlor sets production goals" on my webpage
  Click on numbers to choose the pivot row and column
  Green numbers are good

#9: What should the soup parlour do?

- The final tableau

M	L	S	C	B	V	HM	HL	HS	Profit	RHS
1	0	0	-1/8	3/16	0	0	0	0	0	850
0	0	0	-3/8	1/16	0	0	0	1	0	50
0	0	1	3/8	-1/16	0	0	0	0	0	850
0	0	0	1/8	-3/16	0	1	0	0	0	350
0	1	0	-5/64	-1/128	1/8	0	0	0	0	308
0	0	0	5/64	1/128	-1/8	0	1	0	0	292
0	0	0	995/32	775/64	65/4	0	0	0	1	269540

- $M = 850$, $HS = 50$, $S = 850$, $HM = 350$, $L = 308$, $HL = 292$, $P = 269540$, $C = 0$, $B = 0$, $V = 0$
- Make 850 bowls of Meaty soup, 308 bowls of Leafy soup, 850 bowls of Soupy soup
- Left with 0 ounces of Chicken, Beef, and Vegetable
- Left with 350 hungry Meaty customers, 292 hungry Leafy customers, and 50 hungry Soupy customers
- Maximized profit at \$2695.40