1. Each client (Bill and Jim) owns some stocks, and each stock (IBM, Google, Toyota, Texaco) is worth a certain amount each day.

	IBM	Google	Toyota	Texaco
Bill	18	16	12	14
Jim	12	18	11	12

	Today	Yesterday	Day before	...
IBM	3	3.01	2.99	...
Google	4	3.99	3.99	...
Toyota	5	5.01	5.01	...
Texaco	1	1.02	1.03	...

(a) How much is Bill's portfolio worth today?

(b) Make a table whose rows are the clients, whose columns are the days, and whose entries are the values of that client's portfolio on that day.

2. A company turns resources into products, but needs to purchase resources from a store. Three stores offer the company discounted prices, but only if the comany signs an exclusive contract.

	Resource Usage			Resource price		
	Prod X	Prod Y	Prod Z	Store K	Store L	Store M
Res A	1	1	1	$1.00	$0.75	$2.00
Res B	5	4	8	$1.25	$1.50	$1.00
Res C	3	3	3	$1.50	$1.25	$1.75
Res D	1	1	2	$2.00	$1.25	$1.00
Res E	2	1	1	$1.00	$1.50	$2.00
Production Level	10	40	100			

(a) Which store is a cheaper source of the resources needed for product X?

(b) Which store is cheaper for the predicted production level?

3. This table (from the US Census) converts residents from 2011 to 2012

	Northeast	Midwest	South	West
NE	98.92%	0.09%	0.65%	0.33%
MW	0.08%	99.01%	0.56%	0.35%
So	0.16%	0.27%	99.20%	0.37%
We	0.05%	0.28%	0.46%	99.19%

	NE	MW	So	We
2011	18.01%	21.77%	36.91%	23.31%
2012	17.90%	21.74%	36.96%	23.39%

(a) Assume the transition matrix does not change from year to year. Predict the 2021 population distribution.

(b) Check that the population does not change if it starts at:

	NE	MW	So	We
	9.10%	20.63%	39.55%	30.72%

4. Use this RREF to determine marginal utility of each resource type.

$$
\left[\begin{array}{ccc|cccccc|c}
X & Y & Z & A & B & C & D & E & P & RHS \\
1 & 1 & 1 & ① & 0 & 0 & 0 & 0 & 0 & 100 \\
5 & 4 & 8 & 0 & ① & 0 & 0 & 0 & 0 & 600 \\
3 & 3 & 3 & 0 & 0 & ① & 0 & 0 & 0 & 1000 \\
1 & 1 & 2 & 0 & 0 & 0 & ① & 0 & 0 & 150 \\
2 & 1 & 1 & 0 & 0 & 0 & 0 & ① & 0 & 120 \\
-1 & -2 & -3 & 0 & 0 & 0 & 0 & 0 & ① & 0
\end{array}\right]
\rightarrow
\left[\begin{array}{ccc|cccccc|c}
X & Y & Z & A & B & C & D & E & P & RHS \\
3/4 & ① & 0 & 2 & -1/4 & 0 & 0 & 0 & 0 & 75 \\
1/4 & 0 & ① & -1 & 1/4 & 0 & 0 & 0 & 0 & 25 \\
0 & 0 & 0 & -3 & 0 & ① & 0 & 0 & 0 & 700 \\
1/4 & 0 & 0 & 0 & -1/4 & 0 & ① & 0 & 0 & 25 \\
1 & 0 & 0 & -1 & 0 & 0 & 0 & ① & 0 & 20 \\
5/4 & 0 & 0 & 1 & 1/4 & 0 & 0 & 0 & ① & 225
\end{array}\right]
$$

(a) How much extra profit does one gain from one extra unit of resource B?

(b) How much extra resource B can you get before another resource becomes 0 (FREE)?

(c) How much extra profit from A and how much can you get?