14.5 Notes: Transition Matrices

Transition matrices are used to analyze, describe, & predict change.

E.g., manufacturers who conduct market analysis to predict consumer trends over set periods of time use transition matrices to determine the percentage of people who switch brands.

ex 1: Crest and Colgate both manufacture toothpaste. (a) Build a transition matrix that shows the percentages of customers who either stay with the brand they are using or switch brands based on the given information:

* 90% of people who use Crest continue to use Crest while 6% switch to Colgate the next month & 4% switch to some other brand

* 72% of people who use Colgate continue to use Colgate while 11% switch to Crest the next month & 17% switch to some other brand

* 60% of people who use some other brand continue to use some other brand while 21% switch to Crest the next month & 19% switch to Colgate

	To: Crest	Colgate	other
From: Crest			
Colgate			
other			

$= T$ ← transition matrix for consumer buying

(b) Conduct a market survey to collect the current market share in percentages (in this case, we will do a class survey)

	Crest	Colgate	other
Market Share	[		] $= M_0$

← initial market profile

(c) Suppose toothpaste is bought once per month. Predict market share...

i) one month from now: $M_1 = M_0 T =$

ii) two months from now: $M_2 = M_1 T = M_0 T T = M_0 T^2 =$

iii) three months from now: $M_3 = M_0 T^3 =$

iv) 30 months from now: $M_{30} =$ =

v) 40 months from now: $M_{40} =$ =

* Notice M_{30} and M_{40} are almost the same; this is called a "Steady State"

What market conditions must be true for the 30-month and 40-month predictions to be accurate?

Very little change in , very little change in , very little flux in , no , et cetera.

(d) Suppose another class was surveyed and their initial market profile was:

	Crest	Colgate	other	
Market Share	[.75	.15	.10]	= M_0

Find the steady state for this matrix using the same transition matrix.

I.e., we want to find some steady state matrix S such that $\boxed{S = S\,T}$
where $S = M_0\,T^{?}$ ... so multiply by

Idea: Keep multiplying $M_0\,T$ times T until the decimals level out and don't change much, e.g. calculate M_0T^{50}.

S = [ ]

14.4 HW **page 534 # 26a** Manufacturing

	tables	chairs	desks		amnt. of time available
Carpentry	[[120	105	125]	Carpentry	[[20,250]
Assembly	[40	65	110]	Assembly	[12,070]
Finishing	[80	90	125]]	Finishing	[17,000]]

Want to use all available labor. How many t, c, d, should the manager schedule for production each week? I.e., want to find t, c, d.

3x3 **A** **X** = **B** 3x1

$$\begin{bmatrix} 120 & 105 & 125 \\ 40 & 65 & 110 \\ 80 & 90 & 125 \end{bmatrix} \begin{bmatrix} t \\ c \\ d \end{bmatrix} = \begin{bmatrix} 20{,}250 \\ 12{,}070 \\ 17{,}000 \end{bmatrix}$$

$$\mathbf{X = A^{-1}B}$$ ← Do on T.I.

$$X = \begin{bmatrix} t \\ c \\ d \end{bmatrix} = \begin{bmatrix} 25 \\ 150 \\ 12 \end{bmatrix}$$

25 tables, 150 chairs, 12 desks