

PRECALC - BE TUESDAY 1-19-10

① New student at college, choice of 3 MATH courses, 2 science, and 2 humanities. One course per subject, how many course schedules are possible?

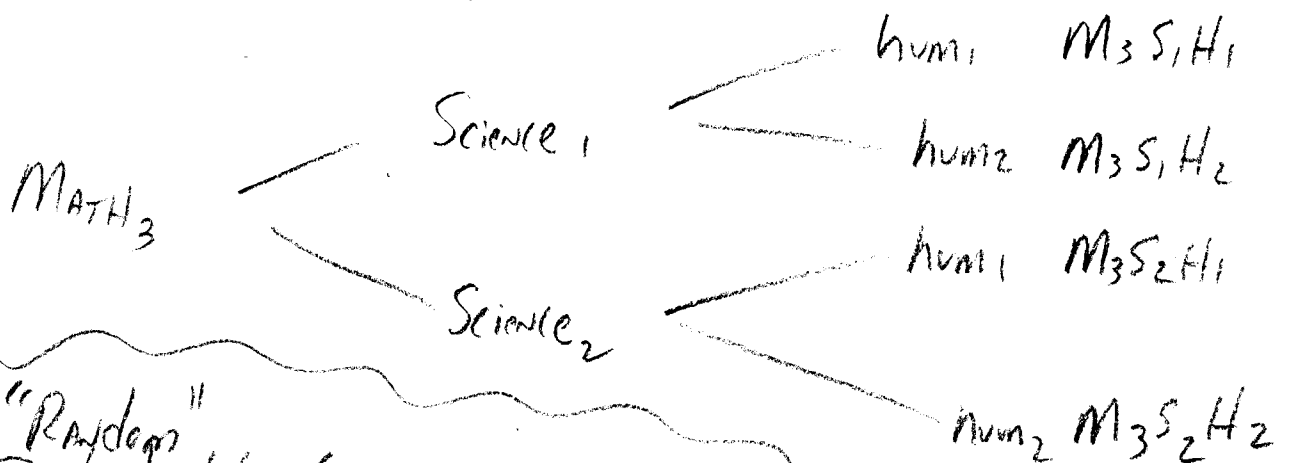
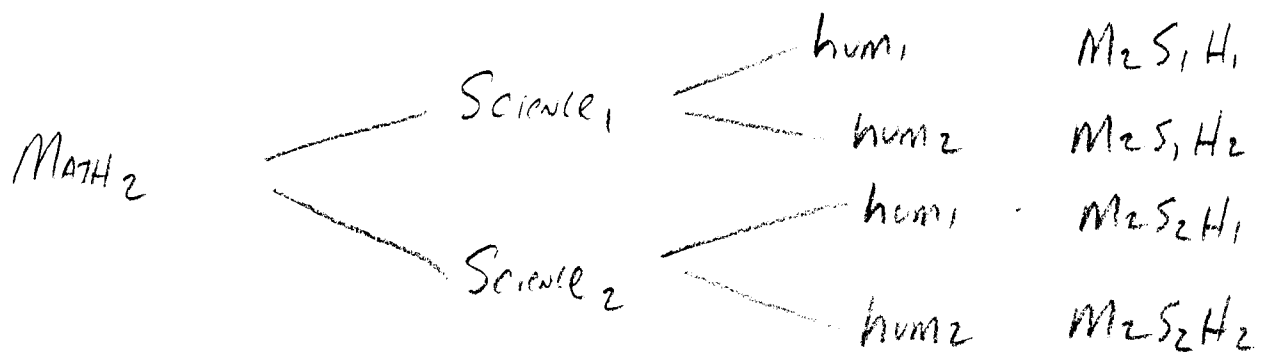
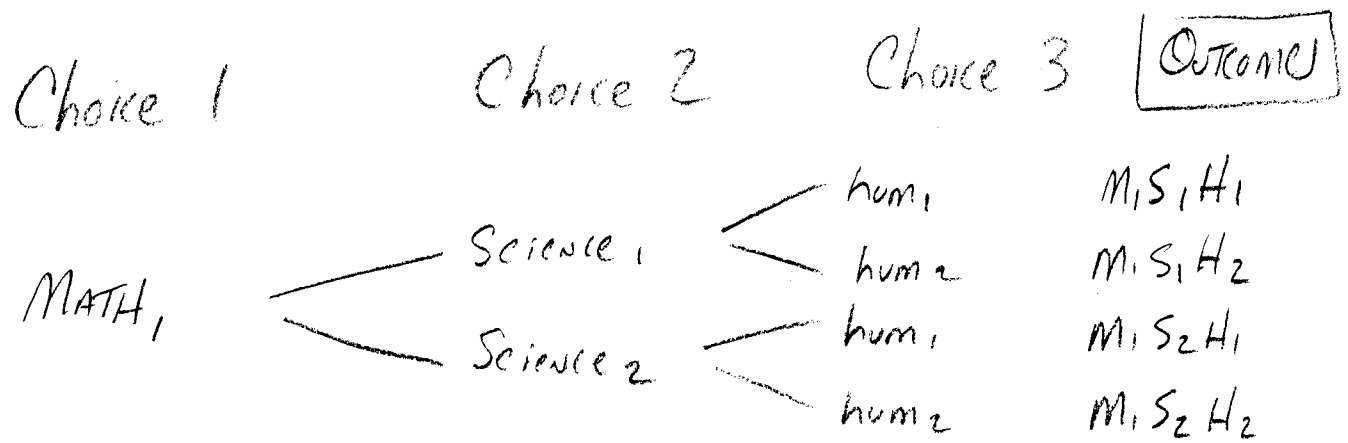
FCP Fundamental Counting Principle

If 2 independent events can occur
(they don't affect each other)

p ways and q ways, the total number of possible events is $p \cdot q$

Total schedules = $3 \cdot 2 \cdot 2 = 12$ schedules
(MATH) (science) (humanities)

A tree diagram, or at least a partial one, can help to understand the arrangement of choices:



"Random"

$$P(\text{Probability}) (M_3S_2H_2) = \frac{1}{12}$$

$$P(M_3S_2H_2) = \frac{1}{12}$$

Independent events — EVENTS THAT DO NOT AFFECT EACH OTHER
 dependent events — EVENTS THAT DO AFFECT EACH OTHER

Ch 13-1 PERMUTATIONS AND COMBINATIONS

↳ Combinatorics ✓

PERMUTATION — AN ARRANGEMENT OF OBJECTS
 where order is important

COMBINATION — AN ARRANGEMENT OF OBJECTS
 where order is NOT important.

PERMUTATION $\Rightarrow$ BOOKS ON A SHELF say, A, B, C, D

How many ways to arrange?

?	?	?	?
—	—	—	—
↑	↑	↑	↑
4 choices	3 choices	2 choices	1 choice

FCP $\Rightarrow 4 \cdot 3 \cdot 2 \cdot 1 = 24$

$4!$ read 4 factorial $= 4 \cdot 3 \cdot 2 \cdot 1 = 24$

Careful: WHAT IS $0!$

For reasons THAT will be clearer later,
it is important to define $0! = 1$.

Books on a shelf $\Rightarrow$ order important
 $\Rightarrow$ lots of Arrangements.

Ⓔ 20 STUDENTS in Precalc class,
Assume "only" 20 chairs.
How many seating charts possible?
Guess? _____

$$\begin{array}{ccccccc} \frac{20}{\uparrow} & , & \frac{19}{\uparrow} & , & \frac{18}{\uparrow} & , & \frac{17}{\uparrow} & \dots \\ \text{CHOICES} & & & & & & & \end{array}$$

$$\begin{aligned} 20! &= 2,432,902,008,000,000,000.0 \\ &\approx 2.4 \times 10^{18} \text{ SEATING charts possible!} \end{aligned}$$

Suppose I only had 4 chairs!
How many ways could I make a seating chart then?

$$\begin{array}{cccc} ? & ? & ? & ? \\ \hline \uparrow & & & \\ 20 & 19 & 18 & 17 \\ \text{choices} & & & \end{array}$$

$$\Rightarrow 20 \cdot 19 \cdot 18 \cdot 17 = 116,280.$$

This is called a permutation of
20 things taken 4 at a time.

ORDER IS IMPORTANT

Fancy formula $\boxed{{}_N P_r = \frac{N!}{(N-r)!}}$

$$\text{EX) } {}_{20}P_4 = \frac{20!}{(20-4)!} = \frac{20!}{16!} = \frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot \cancel{16!}}{\cancel{16!}}$$

$$= 116,280$$

LOOK NOTE: ${}_{20}P_{20} = \frac{20!}{(20-20)!} = \frac{20!}{0!} = \frac{20!}{1} = 20!$

Suppose I have 20 STUDENTS
 And 4 chairs AND I WANT to
 know how many ways the STUDENTS
 can sit - but I don't care about
 order. That is $A, B, C, D = D, C, B, A$

Well - how many Arrangements are
 affected by order is how many
 ways can I arrange 4 objects

$\therefore 4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24 = \text{number}$
 of extra ways if order IS important.

Combination - Arrangement where order is
 NOT important

Reduce $\frac{20!}{16!}$ by $4!$ $\Rightarrow \frac{116,280}{24} = 4845$

$${}_N P_r = \frac{N!}{(N-r)!}$$

ORDER MATTERS,
MOST NUMBER OF ARRANGEMENTS

The PERMUTATION OF N things
taken r AT A TIME.

$${}_N C_r = \frac{N!}{(N-r)! r!}$$

ORDER NOT IMPORTANT,
Reduce number of
Arrangements by $\frac{1}{r!}$

The COMBINATION OF N
things taken r AT A TIME.

Homework: Ch 13-1 PERMUTATIONS &
COMBINATIONS

Pg 843 # 5, 7-14.