COT 3100 Exam 2 Feedback

Question	Avg Perc Sec 2	Avg Perc Sec 202H	Delta
1	31	86	55
2	17	78	61
3	22	67	45
4	23	58	35
5	23	70	47
6	68	94	26
7	52	92	40
8	40	68	28
9	37	75	38

In general, except for questions 6 and 7, I think if the class is more responsible and hard-working, these scores can be improved.

I expect there to be a delta between the large lecture section and the honors section, but my hope is for the delta to be smaller. (Both sections received the same exam.)

The highlights in green represent where the delta, is, on average, lower. The highlights in yellow represent where the delta is larger.

The green questions represent problems that are different than ones I showed you in class, but that follow an extremely similar "algorithm" to what I showed you in class to handle these sorts of problems. This is where the class did the best.

The two questions in yellow represent the two questions which were near carbon copies of questions from the recitation material. Ironically, this material is covered in recitation in the regular course, but I skip it in the honors course and simply tell them to "study it on their own." Their scores and their responses (I graded them), prove that's exactly what they did: they read each of the recitation

problems, maybe tried a few of them, but read over my solutions, so that they knew how to do every single one of those problems and roughly understood why the solutions worked the way that they did.

Moral of the Story

For the final exam, make sure you carefully look over every question from the recitation material.

More generally, make sure you review Number Theory carefully for the final, this is where the class had the weakest results. In particular, try to solve/resolve practice problems from the past, but while doing so, try to identify key concepts and problem solving techniques. Some concepts are somewhat memorized (algorithm for # of times a prime divides into n! or that only perfect squares have an odd number of divisors), and some are just a general pattern of steps to try on a problem.

Yes, time was an issue, but the questions that have the lowest average take 1 or 2 minutes to answer if you've prepared properly.

Counting

Left: Counting, Probability, Relations, Funcs

2w 2w 1w

Primitives of Counting

ADDITION: $+$, if $A \cap B = \emptyset$
then $|A \cup B| = |A| + |B|$

If split stuff into groups so that each item is in EXACTLY ONE group, just add sizes of each group.

SUBTRACTION: $-$, Sometimes easier to subtract from the "whole". $|\mathcal{U} - A| = |\mathcal{U}| - |A|$

"Count the things I DON'T want to count"

MULTIPLICATION: $|A \times B| = |A| \times |B|$

If I am completing a series of k steps where I always have a_1 options for step 1, a_2 options for step 2, ..., a_k options for step k, then I can do ~~the~~ these k steps in

$$\prod_{i=1}^{k} a_i \text{ ways}$$

A valid 7 digit phone # has these rules

(1) each digit is unique
(2) 1st digit can't be 0 or 1.

How many different valid phone numbers are there?

$$\underline{8} \times \underline{9} \times \underline{8} \times \underline{7} \times \underline{6} \times \underline{5} \times \underline{4}$$

choices choices

Common errors:

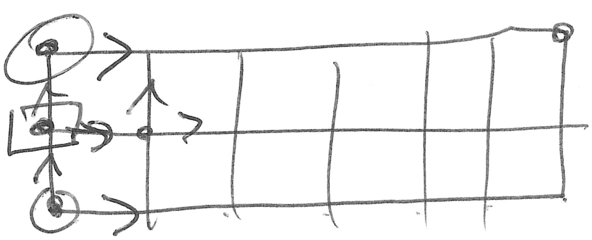
(1) confusing +

	burger	taco	pizza
fries	fb	ft	fp
nachos	nb	nt	np

$2 \times 3 = 6$ value meals

(2) using multiplication when it doesn't apply because what you choose for 1 step changes how many choices you have in a future step.

(6,2)



(0,0)

Can't do $2 \times 2 \times 2$

Depending on what we choose here we have either 1 or 2 options for the next step!

Division: If you count each item k times exactly, just divide by k to get your final answer!

Prove formulas for

(1) Permutations of n distinct items
(2) Permutations of k distinct items out of n distinct items
(3) Permutations of n items where some are duplicates
(4) Combinations of k items out of n.

(1) Permutation
\# ways to order n different items

ABC
ACB
BAC
BCA
CAB
CBA

$$\underline{n} \times \underline{(n-1)} \times \underline{(n-2)} \times (n-3) \cdots \times 1 = n!$$

(2) Perm of k items out of n:

$$_nP_k = \underline{n} \times (n-1) \times (n-2) \times \cdots \underline{(n-k+1)}$$

$$= \frac{n \times (n-1) \times (n-2) \times \cdots (n-k+1) \times (n-k)!}{(n-k)!}$$

$$= \frac{n!}{(n-k)!}$$

(3) Permuting Items w/ repeats

BALLOON with subscripts $L_1 L_2 O_1 O_2$

$$\frac{7!}{2!2!}$$

$BAL_1L_2O_2O_1N$
$BAL_2L_1O_1O_2N$
$BAL_2L_1O_2O_1N$

4 will all count diff but are really the same.

In my 7! each actual perm is counted 4 times $= 2! \times 2!$

n items w/ frequencies $f_1, f_2, f_3 \ldots f_k$

$$\sum_{i=1}^{k} f_i = n$$

$$\# \text{ perm} = \frac{n!}{\prod_{i=1}^{k} f_i!}$$

MISSISSIPPI
4 Is, 4 Ss, 2 Ps, 1 M

$$\frac{11!}{4!4!2!}$$

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(4) Combinations: # of ways to choose k distinct items out of n distinct items (order doesn't matter).

If order mattered ans $= {}_nP_k = n(n-1)\ldots(n-k+1)$

ABCDE, choose 3

fix it: $\dfrac{{}_nP_k}{k!} = \dfrac{n!}{(n-k)!\,k!} = \dbinom{n}{k} = {}_nC_k$

"n choose k"

ABC CBA
ABD same!
ACB
BAC exactly
BCA 3! map to
CAB same combination

ABC	ABD	ABE
ACB	ADB	AEB
BAC	BAD	BAE
BCA	BDA	BEA
CAB	DAB	~~AD~~EAB
CBA	DBA	EBA