#### MA162: Finite mathematics

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#### April 1, 2010

Schedule:

- HW C2 is due Monday, Apr 5th, 2010.
- HW C3 is due Sunday, Apr 11th, 2010.
- Exam 3 is Monday, Apr 12th, 5:00pm-7:00pm.
- All alternate exam takers must signup (on mathclass.org) by April 6th.

Today we will cover 6.3: multiplication.

- 1. 100 coffee drinkers, 54 took sugar, 67 took cream.
- (a) Max that took both is: 54
- (b) Min that took both is: 54 + 67 100 = 21
- (c) If 23 took it black, then 77 took cream or sugar or both, so 10 took sugar only, so 44 took both.

$$77 = 54 + 67 - 44$$

## 6.2: Quiz review

- 100 people ate at least one meal;
  80 ate dinner, 75 ate lunch, 65 ate breakfast
- (a) Max that ate all three is no more than 65

If 65 ate all three, then 10 people ate lunch but not breakfast. 15 people ate dinner but not breakfast. A total of 65 + 10 + 15 = 90 < 100, so 10 people starved!

Actual max is 60. 60 can really be done:

B only	5	BL	0
L only	15	BD	0
D only	20	LD	0
Starve	0	BLD	60

You can use simplex algorithm to eliminate 61.

## 6.3: Quiz review

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- (b) Minimum that ate all three: at least 20.

Only 35 did not eat breakfast, so at least 40 = 75 - 35 ate breakfast and lunch, only 20 of those could have missed dinner, so at least 20 ate all three meals.

Similarly, at least 45 = 80 - 35 ate dinner and breakfast, and 55 = 75 - 20 = 80 - 25 ate dinner and lunch

20 can actually be done, so actual min is 20:

B only	0	BL	20
L only	0	BD	25
D only	0	LD	35
Starve	0	BLD	20

#### 6.2: Quiz review

100 people ate at least one meal;
 80 ate dinner, 75 ate lunch, 65 ate breakfast

(c) 42 ate BL, 47 ate BD, 57 ate LD, how many ate BLD?

 $n(B\cup L\cup D) = n(B)+n(L)+n(D)-n(B\cap L)-n(B\cap D)-n(L\cap D)+n(B\cap L\cap D)$ 

$$100 = 65 + 75 + 80 - 42 - 47 - 57 + n(B \cap L \cap D)$$

 $100 - 65 - 75 - 80 + 42 + 47 + 57 = n(B \cap L \cap D)$ 

 $n(B \cap L \cap D) = 26$ 

# 6.3: Counting with no overlaps

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- Suppose you want to do a critical comparison of hollywood fluff with low budget art film, so you plan on going to one movie at each theater. How many possibilities are there?
- Suppose you are doing a study on primacy and its effect on critical comparisons, so you need to convince a bunch of your film critic friends to go see a movie at each theater, but you care which theater they go to first. How many possibilities are there?

## 6.3: What is multiplication?

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 $\bullet\,$  Each column has 3 squares, there are 5 columns, so  $3\cdot 5=15$ 

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- Suppose you won a contest, and one day this (business) week you can choose one of your meals to be paid for. How many different ways can you choose?
- Five days, three meals a day:



• There are 15 squares to put the check mark.

## 6.3: Drawing the possibilities

 There are two main ways to get to Winchester from Lexington: Winchester Rd (US-60) and I-64.
 From Winchester, there are three main ways to Clay City: KY-89, KY-15, and the Mountain Parkway (KY-402).
 How many different ways are there from Lexington to Clay City using these routes?



### 6.3: Trees for counting

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• This is a decision tree. Note how the decision to be made after I-64 is the same as the decision to be made after US-60. The first choice does not affect the second choice. The choices are **independent**.

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		1	2	3	4	5	6	
	1	11	12	13	14	15	16	-
	2	21	22	<mark>23</mark>	2 <b>4</b>	2 <mark>5</mark>	2 <mark>6</mark>	
• A picture is easier:	3	31	<mark>32</mark>	<mark>33</mark>	34	3 <mark>5</mark>	<mark>36</mark>	36 ways
	4	41	<mark>42</mark>	43	<b>44</b>	<b>45</b>	<mark>46</mark>	
	5	51	<mark>52</mark>	<mark>53</mark>	<b>54</b>	5 <u>5</u>	<mark>56</mark>	
	6	61	<mark>62</mark>	<mark>63</mark>	<mark>64</mark>	<mark>65</mark>	<mark>66</mark>	

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- How many cars are in Kentucky?
- 4 million people, about 4 million vehicles, 2 million of which probably have standard plates

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- $(5)(10)(6) \cdot (4)(9)(5) = 54000.$

• We learned the multiplication principle of counting

 Make sure to complete HWC2 ASAP, and you can begin on HWC3 now