fall '00
Pre-calculus
(note: could be adapted for
Algebra or Advanced Algebra)

Name:
Date:

Contextually found Mathematics: Organizing Goods within a Distribution Center

Background

McLane Company is a large distribution center owned by Wal-Mart that distributes goods and products to convenience stores nationwide. Think of a distribution center as a large warehouse, but unlike a warehouse, a distribution center does not "hold" goods for long periods of time. Instead, the goal is to move goods in from suppliers and out to stores as quickly and efficiently as possible. People in the management at McLane like to say that "the ideal distribution center is empty every night."

To fill orders for stores, McLane needs a systematic way to organize goods and products in the distribution center. Workers at McLane must be able to locate goods quickly and easily to package orders, which are then loaded on trucks to be shipped out. McLane uses codes to identify all possible locations for products in the distribution center, or DC. Each product is assigned a specific location in the DC.

McLane's physical building is large and tall, consisting of many long aisles. Each aisle is divided up into a series of bays, which are like small sections or bookcases. Each bay has some shelves in it, and shelf has a number of slots. McLane had to devise a way that, by examining a specific code, a worker would be able to identify the aisle, bay, shelf, and slot to locate a particular product.

The System... McLane's system is as follows:

- Each slot has a 7-character field, consisting of both letters and numbers.
- The first two characters are letters, and they designate the aisle location.
- The next three characters are numbers to designate the bay location. McLane numbers the bays in order, using every fourth number. For example: 101, 105, 109, 113, etc.
- The next character is a number to indicate shelf location. Most bays have five shelves, with "1" representing the bottom shelf and "5" representing the top shelf.
- The last character is a number that indicates the slot location on the shelf. Most shelves have five slots.

For example, the item "Marks-A-Lot Bulk" might be located in RC65331. This would mean the item is in aisle RC, bay number 653, third shelf, first slot.

A natural question...*How many locations can McLane have in its distribution center with this system?*

1) Sketch a picture of a portion of McLane's floor plan, showing at least one aisle, one bay, and the five shelves and five slots per shelf in each bay.

2) What other questions might you ask in order to answer the natural question?

3) Answer the natural question in multiple ways, if necessary (depending on the answers to the questions in #2.) Explain your process(es) and answer(s).

Deep Thoughts

4) Let's say McLane wants to renumber its bins, but they still plan to use three-digit numbers. How many slot locations will be possible if

a) they use every other number?

b) they use every third number?

c) they use every number?

d) Why is your answer to part (b) <u>not</u> a whole number?

e) If a small distribution center wanted to have only about 1 million possible slot locations, how many numbers should they skip in numbering their bays? (Assume they use the same system as McLane--that is, the only aspect they will change is how many three-digit numbers to skip.)

5) As you have seen in #4, how we count the bays can increase or decrease the total available slots. Find the percent increase each case. Assume that McLane allows repetition of letters when naming aisles.

a) Instead of using every fifth number, use every fourth number:

b) Instead of using every fourth number, use every third number:

c) Instead of using every third number, use every second number:

d) Instead of using every second number, use every number:

e) Describe at least one way you can simplify your calculations for parts (a)-(d) above:

_____

_____

f) Why are the percent increases NOT constant?

_____

_____

6) Let's say McLane does **NOT** repeat letters when naming aisles. (That is, they do not have aisles AA, BB, etc.) What percent increase in available slots will there be if they decide to allow repetition of letters?

a) Answer this question with a specific example, as in #3 and/or #4 above.

Show your work.

b) Will your answer always be the same for a given number of bays, shelves and slots? Prove it or refute it!

7) How will the number of available slots be reduced if two-digit numbers are used to identify bays? Explain your answer.

8) Assume McLane doubles the number of shelves and doubles the number of slots on each shelf.

a) How many times bigger are the total number available slots compared with the "original" number of slots in #3?

b) Predict how many times bigger the number of available slots will be if the number of shelves and number of slots on each shelf are both tripled. Explain your answer.

c) Predict how many times bigger the number of available slots will be if the number of shelves is doubled and the number of slots per shelf is tripled.

d) How many times smaller will the number of available slots be if the number of shelves is reduced to three and the number of slots to four per shelf?

9) Design a numbering scheme for McLane that would yield about 10 million possible slots. (Get as close to 10 million as you can!) Assume that McLane will still have aisles, bays, shelves, and slots, but you may determine restrictions on any or all of these four elements. Write a memo to the management

at McLane explaining how you determined your scheme, and how it could help them expand the capacity of their distribution center.

Evaluation…

	still counting on your fingers		getting the idea...		master of counting principles
1) mathematically sound scheme	1	2	3	4	5
2) very close to 10 million slots	1		2		3
3) clear, thorough, correct explanation of scheme	1	2	3	4	5
4) clear discussion of how your scheme could help McLane	1		2		3
5) clear and professional format and presentation	0		1		2
6) correct spelling, grammar, etc.	0		1		2

Extra Credit: *exceptional work* _____/ 2

TOTAL: _____/ 20