

The Farmer's Daughter

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Once upon a time there was a farmer who had two strong sons and a young daughter. His daughter was known throughout the land as a deep thinker and an excellent problem-solver. Well, one day the farmer decided to take his small farm and divide it into eighteen different fields for each of which he would purchase some livestock. So, while the farmer and his two big strong sons were busy building fences, he gave his daughter the following problem to solve so that when the fencing was completed he would know exactly **how many** of each different kind of livestock he needed to buy, and **where** he should place them.

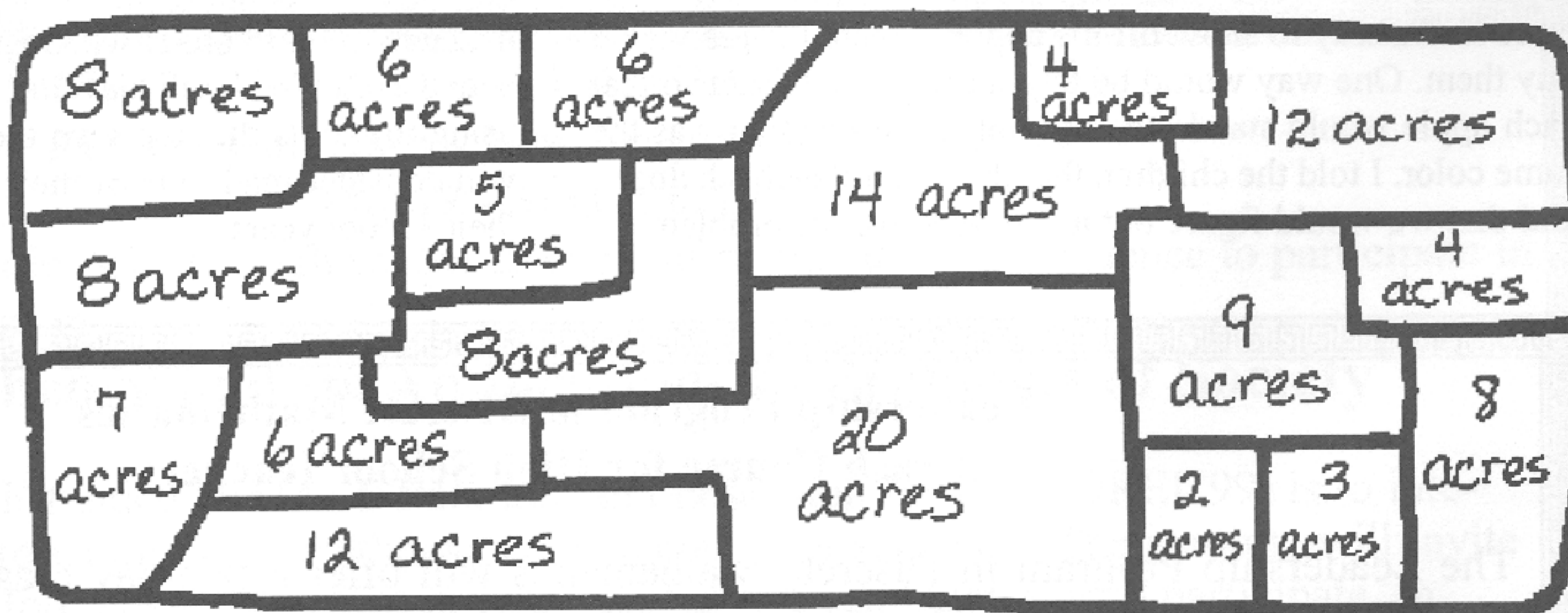
While the farmer enjoys many animals, he wants to limit his farm to as few different animals as possible. Now, everyone knows that a good farmer does not put like animals in pastures that share a common fenceline, for they will surely try to tear down the fence in order to join their friends on the other side. He also had a priority listing of preferred livestock, so that he wanted:

1. As many acres of cows as possible
2. Then as many acres of sheep as possible
3. Then as many acres of horses as possible
4. Then as many acres of goats as possible
5. Finally, as many acres of pigs as possible.

Note that he could actually end up with more sheep than cows, that is okay...as long as cows occupied the most acreage.

The farmer decided that each acre could hold either 8 cows, 20 sheep, 6 horses, 12 goats or 18 pigs. With these rules established, he provided his daughter with a diagram of the farm (see figure).

The daughter was given two weeks to work on this problem. At the end of this two-week period, she was to



present to her father:

1. A plan for which type of animal would be assigned to each of the 18 fields, and how many of each type of animal he should buy.
2. A written explanation as to why her plan works and is the best solution to the problem.

Now, **YOU** are given two weeks to work on this problem!

(This project was given to my 6th grade talented class following a unit on map-coloring. I have never seen students attack a project as they did this one. One thing out of the ordinary that I did was to encourage parent and family involvement. The response from the parents was great! One mother told me that she and her husband worked on this problem for over an hour one evening while their son was not home, and were sure that they had arrived at the best-possible solution. When the son returned, Dad told him that he had better get busy on this problem because it was not as easy as it appeared. The young man sat down and promptly produced an answer that bettered Mom's and Dad's in just five minutes. Mom said it was a "humbling experience!"

The students' tasks were to 1. decide on the smallest number of different animals that are needed to meet all of the requirements, 2. decide how to arrange the animals in the fields so that the preferred animals got more acreage, 3. design a clear way of displaying which animal was to be located in each field, and 4. determine the number of livestock of each type that the farmer should buy.)

A Discrete Challenge

The editors of *In Discrete Mathematics* invite readers and their students to come up with their best solutions to *The Farmer's Daughter* problem. The solution with the most acres of cows will be the winner, with ties broken by the most acres of sheep, then horses, goats, and pigs. The best solution received by April 1, 1999 will appear in the next issue of *In Discrete Mathematics!*

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