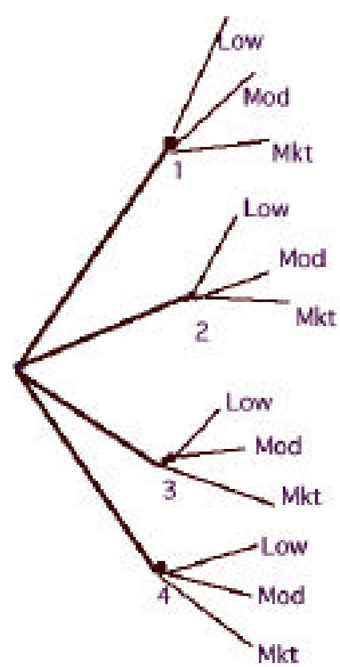
Mathematics 206
Solutions for HWK 16a
Section 6.3 p359

§6.3 p359 Problem 1. Rental Rates. Lynbrook West, an apartment complex financed by the State Housing Finance Agency, consists of one-, two-, and three-, and four-bedroom units. The rental rate for each type of unit–low, moderate, or market–is determined by the income of the tenant. How many different rates are there?

Solution. The wording of the problem could perhaps be better, but the conditions of the problem tell us that there are low-, moderate-, and market-rate one-bedroom apartments, low-, moderate-, and market-rate 2-bedroom apartments, and so forth. So to determine the rent for a particular tenant one needs to learn how many bedrooms (1,2,3, or 4) and then what rate level (low, moderate, or market) the income for that tenant is. Since there are 4 possibilities for the first piece of information and 3 for the second, there are 12 possible rental rates. Symbolically, we have 4 ways to fill in the first slot below and 3 ways to fill in the second, hence 12 ways to fill both, hence 12 possible rental rates.

$$\underbrace{4\ \ choices}_{Nbr\ \ of\ \ Bedrooms} \qquad\qquad \underbrace{3\ \ choices}_{Income\ \ Level}$$

This could also be illustrated with a so-called tree diagram. There are four initial branches corresponding to 1-, 2-, 3-, or 4-bedroom apartments. For each of these branches, there are 3 branches corresponding to the three possible levels of income. So there are 12 paths through the tree, each one corresponding to a particular choice of number of bedrooms and a particular choice of income level. So there are 12 possible rental rates.



§**6.3 p359 Problem 7. Psychology Experiments.** A psychologist has constructed a maze (sketched in the text) for use in an experiment. The maze is constructed so that a rat must pass through a series of one-way doors. How many different paths are there from start to finish?

Solution. As the sketch shows, the rat chooses first from one of two initial doors, then from one of four intermediate doors, then from one of three final doors. So there are $2 \times 4 \times 3 = 24$ possible routes through the maze. Symbolically, we have

$$\underbrace{2\ choices}_{1st\ Door} \quad \underbrace{4\ choices}_{2nd\ Door} \quad \underbrace{3\ choices}_{3rd\ Door}$$

with $2 \times 4 \times 3 = 24$ possible routes.

§**6.3 p359 Problem 11. Social Security Numbers.** A Social Security number has nine digits. How many social Security numbers are possible?

Solution. This time we have nine slots to fill, each of which can be filled with any one of the 10 digits 0,1,2,...,8,9. Since there are ten ways to fill the first slot, then ten ways to fill the second slot, and so forth, with 9 slots to be filled, then the total number of ways to fill all 9 slots is

$$\underbrace{10 \times 10 \times \cdots \times 10}_{9\ factors}$$

Thus there are 10^9 or 1 billion possible Social Security numbers.

§**6.3 p359 Problem 15. Menu Selections.** Two soups, five entreés, and three desserts are listed on the “Special” menu at the Neptune Restaurant. How many different selections consisting of one soup, one entreé, and one dessert can a customer choose from this menu?

Solution. The customer makes one of two possible soup choices, then one of five possible entrećhoices, then one of three possible dessert choices. There are $2 \times 5 \times 3$ possible ways to make all three choices, so 30 possible selections from which the customer chan choose.

§6.3 p359 Problem 19. License Plate Numbers. Over the years the state of California has used different combinations of letters of the alphabet and digits on its automobile license plates.

(a). At one time, license plates were issued that consisted of three letters followed by three digits. How many different license plates can be issued under this arrangement?

Solution. To choose a license plate, one could choose the first letter (26 choices), then the second letter (26 choices), then the third letter (26 choices), then the first digit (10 choices), second digit (10 choices), and third digit (10 choices). So the number of ways to make all 6 choices would be

$$26 \times 26 \times 26 \times 10 \times 10 \times 10$$

or

$$26^3 \times 10^3$$

which gives 17,576,000 possible license plates. (It looks like California ran out of license plate numbers to give out.)

(b). Later on, license plates were issued that consisted of three digits followed by three letters. How many different license plates can be issued under this arrangement?

Solution. The number of possible license plates is the same. This time we're choosing a first digit (10 choices), then a second digit (10 choices), and third digit (10 choices), then a first letter (26 choices), second letter (26 choices) and third letter (26 choices). So there are

$$10 \times 10 \times 10 \times 26 \times 26 \times 26$$

possibilities. (So by now there are something over 35 million possible California plate numbers.)