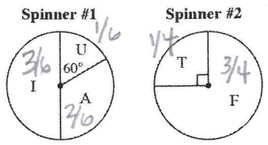
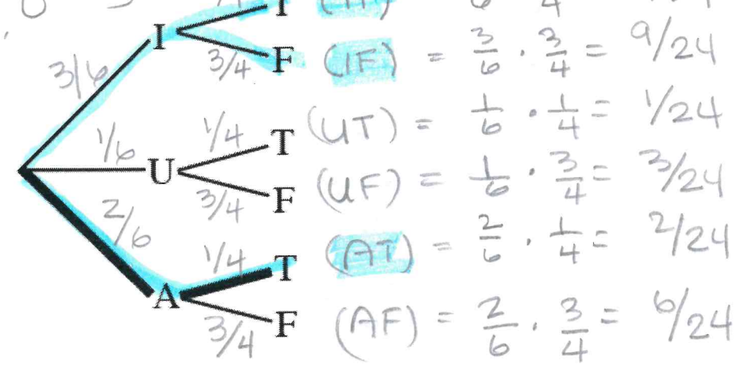
3.1.2 How can I represent it?

Using a Tree Diagram

3-13. Sinclair drew a tree diagram to model the spinner game from problem 3-12. Sabrina says, "*That can't be right. This diagram makes it look like all the words are equally likely.*" What is Sabrina talking about? Why is this tree diagram misleading? What can we do to make it look like the area model?

It is misleading because every branch looks equally likely.





except lets use a common denominator of 6. 1/3 = 2/6

a. Sabrina decides to write numbers on each branch showing the probability that the letter will occur. She writes a "1/3" on the branch for "A", a "1/4" on the branch for each "T", etc. Label the probabilities on each branch.

b. According to the probability area model that you made in problem 3-12, what is the probability that you will spin the word "AT"? Now examine the bolded branch on the tree diagram shown above. How can you use the numbers you have written on the tree diagram to determine the probability of spinning "AT"?

In area model $P(AT) = \frac{2}{24}$ which is $\frac{2}{6} \cdot \frac{1}{4} = \frac{2}{24}$

c. Does this method work for the other combinations of letters? Calculate the probabilities for each of the paths of the tree diagram and at the end of each branch, write its probability. Do your answers match those from problem 3-12?

yes they do.

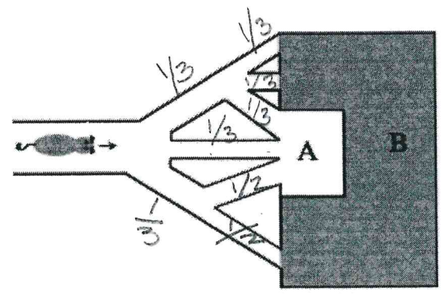
d. Highlight all the branches with letter combinations that make words. Use the numbers written at the end of each branch to compute the total probability that you will spin a word. Does this probability match the probability you found with your area model?

$P(\text{word}) = \frac{3}{24} + \frac{9}{24} + \frac{2}{24} = \frac{14}{24}$ It agrees!

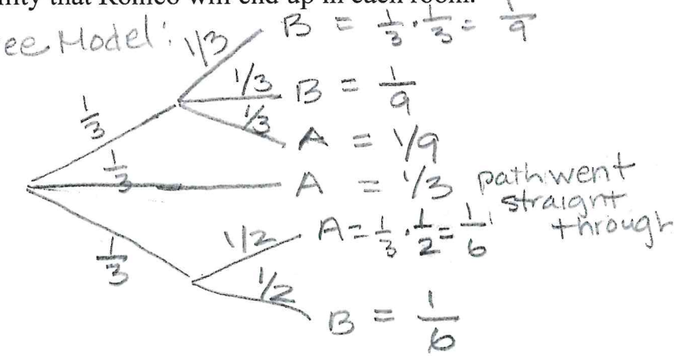
3-14. THE RAT RACE

Ryan has a pet rat Romeo he thinks is the smartest rat in the county. Sammy overheard Ryan at the county fair claiming that Romeo could learn to run a particular maze and find the cheese at the end."*I don't think Romeo is that smart!*" Sammy declares. *"I think the rat just chooses a random path through the maze."* Ryan built a maze with the floor plan shown below. He placed some cheese in an airtight container in room A. Suppose that every time Romeo reaches a split in the maze, he is **equally likely** to choose any of the paths in front of him.

a. Choose a method and calculate the probability that Romeo will end up in each room.



Tree Model:



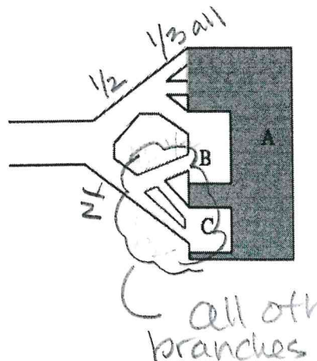
b. If the rat moves through the maze randomly, out of 100 attempts, how many times would you expect Romeo to end up in room A? How many times would you expect him to end up in room B? Explain. Room A: $\frac{1}{9} + \frac{1}{3} + \frac{1}{6} = \frac{2}{18} + \frac{6}{18} + \frac{3}{18} = \frac{11}{18}$ Room B: $\frac{7}{18}$

c. After 100 attempts, Romeo has found the cheese 66 times. *"See how smart Romeo is?"* Ryan asks. "*He clearly learned something and got better at the maze as he went along.*" Sammy isn't so sure. 66 times out of 100 = 66% $\frac{11}{18} \Rightarrow 61.1\%$ could be just coincidence

d. Do you think Romeo learned and improved his ability to return to the same room over time? Or could he just have been moving randomly? Discuss this question with your team.

I think it is too close to tell, 66% ≈ 61% too close

3-15. Always skeptical, Sammy says, "*If Romeo really can learn, he ought to be able to figure out how to run this new maze I've designed.*" Examine Sammy's maze below.



all other branches are

To give Romeo the best chance of finding the cheese, in which room should the cheese be placed? In C

If the cheese is put in room C and Romeo finds the cheese six times out of every ten tries, does he seem to be learning? Explain your conclusion.

Real theoretical probability = $\frac{9}{24}$ = 37.5%

so if he finds it 6 out 10 that is 60% yes, I say he is learning