**Warmup.** The “puzzler” from an October 2006 *Car Talk*. It’s actually related to what we have been talking about in class, you should be able to answer it the way they did. You can find the answer on cartalk.com in the puzzler archives (so there’s no need to hand in your answer to it). The idea here is that each of the four tires needs to be assigned a set of features, and what they’re after is the simplest feature system to use. The way that the question is stated leads you to think of these features as privative features.

I'm going to have winter tires put on my car. I bought four of them. I'm moving soon, and since I'll be taking the car to a different shop to have them changed back next spring, the tires have to be marked so they can be put back where they belong, i.e., where they came from. So the left front has to go to the left front, the right front has to go there, and so on.

When I take them off, I'm going to ask the people at the gas station to mark them with letters.

The question is, what's the smallest number of letters needed to mark my tires to guarantee that all four of them can get correctly installed with no chance of error or ambiguity in the spring?

**Task 1.** This is a problem, like the warmup, that is about features and how to use them to describe things. It’s not about *language*, but the principles behind using features this way isn’t specific to language. It can work for tires, or it can work for black boxes, like the one I’m about to describe.

Suppose that you have a box with a translucent window and a switch that can be moved around. The box is black. After some experimentation and careful observation, you determine that the colors that the box takes on (depending on the position of the switch) are:

- red
- magenta (purplish)
- white
- yellow

Below is a sketch of what this box looks like:

![Box Sketch](image)

The fact that the box is black is metaphorically significant (although I have not represented this in the illustration). Search Wikipedia for “black box.” Here, we care primarily about the output from the black box (the color of the light—or, in part 2, the buzzing sound), not about what’s going on inside, or even really about the input (where
the switch is). It’s pretty obvious what is going on inside: there are three light-emitting objects (e.g., light bulbs). One is red, one is green, and one is blue. Also not a coincidence: search Wikipedia for “rgb” if you like, and click on the “additive color model” link if you aren’t convinced that you can make yellow by combining some mix of red, green, and blue. You might also try putting something yellow on your computer screen and then examining it with a real magnifying glass (or put your eyeball right up to the screen): that yellow is actually made of a very small green dot and a very small red dot, very close together. Maybe a blue dot too unless you picked a very pure and saturated yellow object to examine.

**Part 1.** Below is a non-optimal model characterizing the output from our light box. It describes the features that the box can take on, and lists the feature assignments that correspond to each of the four states. But this is not a good model of the output of this system.

<table>
<thead>
<tr>
<th>Features:</th>
<th>+R, +B, +G</th>
</tr>
</thead>
<tbody>
<tr>
<td>red:</td>
<td>+R, –B, –G</td>
</tr>
<tr>
<td>magenta:</td>
<td>+R, +B, –G</td>
</tr>
<tr>
<td>white:</td>
<td>+R, +B, +G</td>
</tr>
<tr>
<td>yellow:</td>
<td>+R, –B, +G</td>
</tr>
</tbody>
</table>

**Question 1:** Does this model overgenerate or undergenerate?

**Question 2:** What does it predict that is not attested? (*Hint:* One of the predictions is that the box should be able to show cyan, a blue-green color—what are the others?)

**Part 2.** Construct a better theoretical model of this box, by proposing a binary feature system to describe and predict the states this box can take on. To do this, name the binary features you need (and note that the actual names you use doesn’t really matter, though you could use things like R, G, or B), and indicate the features of each of the four observed states. In the same format as the model from part 1.

**Part 3.** Suppose that we observe that this box makes a disconcerting buzzing noise when the color it displays is red or magenta (but not when the color is white or yellow). Describe the situation in which the buzzing noise happens, in terms of your theoretical model (from part 2).

**Part 4.** Construct an alternative model of the box using privative features instead.

**Part 5.** Which of the two models from Part 1 and Part 4 is better at describing the buzzing situation in Part 3—and why (or why not)? (*Hint:* to get started, try to describe the buzzing sound in the model from part 4, like you did for part 3 using the binary feature model.)

**Part 6.** If you found that your model in part 4 was not as good at describing the descriptive generalization about the buzzing, what changes might you make either to the descriptive generalization in Part 3 or the features in Part 4 to make a model with
privative features better able to capture the generalization? (If you found that either was equally good, then you must have already seen what I’m after here, and you probably already said something about it in your answer to part 5—so, in that case, can you think of another way to have made it possible to state a generalization about the buzzing?)

**Task 2.** Here’s something more straightforward. Assign a category (N, V, A, P, C, T, D) to each underlined word below:

1. Pat will take a gigantic step across the yellow line.
2. Tracy should embrace creativity.
3. Chris heard that Robin broke the ancient record.
4. The yinkish dripner blorked into the nindin.