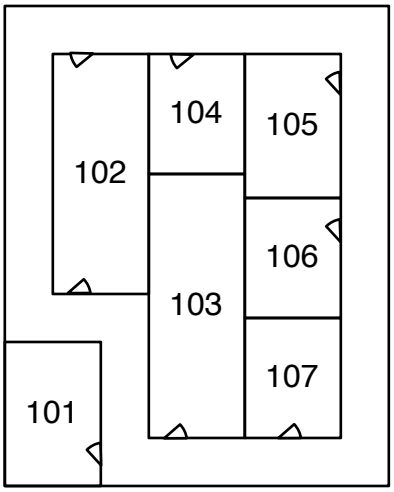
CSC242: Homework 2.1
AIMA Chapter 6.0–6.4

1. What are the three components of a constraint satisfaction problem?
2. What is a answer to a constraint satisfaction problem?
3. Suppose you are running a hotel with seven rooms on one floor:



Three families want to book all seven rooms. However people in the same family don't get along, so they cannot be in adjacent rooms.

(a) Formulate this problem as a constraint satisfaction problem.

(b) How many solutions are there to this CSP?

(c) How many solutions are there if there are four families?

(d) How many solutions are there if there are only two families?

4. Alice, Betty, and Carol are in a book club. They're trying to figure which of five different books they should read next. The books are: *Dreams From My Father* by Barack Obama, *Lord of the Rings* by J.R.R. Tolkein, *Artificial Intelligence: A Modern Approach* by Stuart Russell and Peter Norvig, *Harry Potter and The Sorceror's Stone*, by J.K. Rowling, and *The Fabric of the Cosmos: Space, Time, and the Texture of Reality* by Brian Greene.

   In this book club, they don't all have to read the same book. Alice only likes fiction, while Betty only likes non-fiction. Furthermore, Alice won't read whatever either Betty or Carol are reading, while Betty and Carol always read the same book.

   (a) Formulate this as a constraint satisfaction problem.

   (b) Propagate unary constraints and show the results.

   (c) Solve the CSP using a combination of search and constraint propagation. At each step (assignment or propagation), show the state of the problem. (Hint: You should only need two iterations if you've done it right.)

5. Use the AC-3 algorithm to show that arc consistency can detect the inconsistency of the partial assignment $\{WA = green, V = red\}$ for the Australia map coloring problem.

6. Consider the problem of creating (not solving) crossword puzzles. Assume you are given a rectangular grid with blank and shaded squares, and a list of words. Your goal is to fit the words into the grid satisfying the constraints of a crossword puzzle about shared letters.

   Formulate this precisely as a constraint satisfaction problem. Comment on the strengths or weaknesses of your formulation(s).