

CAP-4630 Homework 2

Deadline: 2:05PM on 10/17 (Tuesday)

Submit code for programming exercise on Moodle and analytical exercises either at start of lecture or Moodle.

1. Exercise 4.1 from textbook. (10 pts)
2. Exercise 5.1 from textbook. (10 pts)
3. Exercise 5.6 from textbook. (10 pts)
4. Exercise 5.7 from textbook. (10 pts)
5. Exercise 5.8 from textbook. (10 pts)
6. Exercise 5.9 from textbook. (10 pts)
7. Exercise 5.14 from textbook. (10 pts)
8. Exercise 5.16 from textbook. (10 pts)
9. Exercise 6.1 from textbook. (10 pts)
10. Exercise 6.2 from textbook. (10 pts)
11. Exercise 6.5 from textbook. (10 pts)
12. Exercise 6.6 from textbook. (10 pts)
13. Exercise 6.7 from textbook. (10 pts)
14. Exercise 6.9 from textbook. (10 pts)
15. Exercise 6.11 from textbook. (10 pts)
16. Exercise 6.12 from textbook. (10 pts)

17. Quizzle (120 pts)

Below are four instances of “quizzle,” a logic puzzle. For each puzzle, you are provided with a backstory and clues, and you must piece together deductions in order to ultimately assign a unique value for each category. We encourage you to visit the site and attempt to solve some puzzles on your own, by going through the clues consecutively and eliminating the set of incompatible combinations of category values.

You will solve each puzzle using two different approaches, and compare their performances. You are free to use any approach/combination of approaches you would like. We suggest that you use a CSP approach and integer linear programming approach (another good option could be logical inference). For these approaches, you can use built-in libraries from Python as the solvers. You would then need to create the models for the problems to be input to the solvers. This would involve describing the variables, the possible values for each variable, and the set of constraints. Note that if you use the two approaches we suggest, then you would just be creating the models, but not implementing solving algorithms yourself. We also encourage you to create your own solving algorithms for extra credit.

For each problem instance answer the following questions:

- (a) Describe the two approaches you are using. What do the variables and values represent? What are the constraints? How many variables and constraints are there?
- (b) What are the resulting outputs of program? What are the running times of the two approaches? Which one is more efficient? Would the same be true for larger instances?

For 20 points extra credit, you can implement a new different algorithm that runs faster than CSP and ILP approaches. You must describe the algorithm, and report the running times. Puzzle instances:

		students				colors			
		Ella	Henrietta	Omar	Valerie	black	blue	pink	silver
distances	15 feet								
	25 feet								
	35 feet								
	45 feet								
colors	black								
	blue								
	pink								
	silver								

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Clues
Notes
Answers

Active Clues

1. Henrietta's design went 35 feet.
2. Henrietta's design was silver.
3. Omar's design went somewhat farther than the silver airplane.
4. Ella's design went 10 feet farther than the black plane.
5. The pink plane went 10 feet farther than the black plane.

Backstory And Goal


Mrs. Drammel's fifth-grade class held a paper airplane contest this afternoon. Using only the clues below, determine the color of each airplane, its maximum throwing distance, and the order in which each was thrown.

Remember, as with all grid-based logic puzzles, no option in any category will ever be used more than once. If you get stuck or run into problems, try the "Clear Errors" button to remove any mistakes that might be present on the grid, or the "Hint" button to see the next logical step in the puzzle.

Figure 1: Quizzle 1 (60 pts).

		boats				captains				locations			
		Daily Ray	Foxy Roxy	Samantha	Watery Pete	Armstrong	Jacobson	Romero	Yang	Arno's Spit	Betty Beach	Rainbow Reef	Trey's Tunnel
manatees	3												
	4												
	5												
	6												
locations	Arno's Spit												
	Betty Beach												
	Rainbow Reef												
	Trey's Tunnel												
captains	Armstrong												
	Jacobson												
	Romero												
	Yang												

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Clues Notes Answers

Active Clues

- The Daily Ray is either the vessel that went to Rainbow Reef or Captain Romero's vessel.
- The vessel that went to Rainbow Reef saw fewer manatees than the Watery Pete.
- The boat that went to Rainbow Reef, Captain Yang's boat, and the Samantha are three different boats.
- The vessel that went to Betty Beach saw 2 more manatees than the boat that went to Rainbow Reef.
- The vessel that saw 5 manatees didn't go to Arno's Spit.
- The boat that saw 3 manatees is either Captain Yang's boat or the Samantha.
- Of the Foxy Roxy and the vessel that went to Betty Beach, one saw 3 manatees and the other was led by Captain Armstrong.
- The Samantha went to Betty Beach.


Backstory And Goal

Minnetonka Manatee Company sent out a number of different boats today on manatee viewing tours. Using only the clues below, match each boat to its captain and determine the total number of manatees seen by each as well as each boat's destination.

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Figure 2: Quizzle 2 (60 pts).

		cars				license plates				states			
		Cavalo	Fierro	Grandero	Injitsu	FRZ-192	GGZ-007	MRT-628	YGA-441	Alaska	Colorado	Hawaii	Louisiana
fines	\$25												
	\$50												
	\$75												
	\$100												
states	Alaska												
	Colorado												
	Hawaii												
	Louisiana												
license plates	FRZ-192												
	GGZ-007												
	MRT-628												
	YGA-441												

The face you'll be wearing... 

Clues Notes Answers

Active Clues

- The car with the YGA-441 plates was fined 25 dollars more than the vehicle from Hawaii.
- The Fierro was fined somewhat less than the automobile with the GGZ-007 plates.
- The four cars are the vehicle from Colorado, the Grandero, the Fierro and the Injitsu.
- The vehicle that received the \$50 fine, the Grandero, and the Injitsu are three different cars.
- The vehicle from Alaska was fined 25 dollars more than the Fierro.
- The Grandero was fined somewhat more than the car with the FRZ-192 plates.
- The vehicle that received the \$100 fine doesn't have the GGZ-007 plates.

Backstory And Goal

Sal, a newly-hired police officer, has written a number of parking violations this week. Help him sort out his paperwork by matching each fine to its associated vehicle, license plate number and state.

Remember, as with all grid-based logic puzzles, no option in any category will ever be used more than once. If you get stuck or run into problems, try the "Clear Errors" button to remove any mistakes that might be present on the grid, or the "Hint" button to see the next logical step in the puzzle.

Figure 3: Quizzle 3 (10 pts of extra credit).

		drugs				conditions				sources			
		Bizolam	Damasol	Favolin	Gravon	dengue fever	diabetes	heart disease	influenza	beetle	bromeliad	frog	mushroom
months	January												
	February												
	March												
	April												
sources	beetle												
	bromeliad												
	frog												
	mushroom												
conditions	dengue fever												
	diabetes												
	heart disease												
	influenza												

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Active Clues

- The drug sourced from a specific type of mushroom treats heart disease.
- The medicine sourced from a specific type of beetle treats dengue fever.
- Of the drug that treats heart disease and the pharmaceutical sourced from a specific type of beetle, one is Damasol and the other was approved in March.
- Favolin was approved 2 months after the drug that treats diabetes.
- The pharmaceutical approved in April, the medicine that treats diabetes, and the medicine sourced from a specific type of bromeliad are three different drugs.
- Gravon is either the drug approved in March or the pharmaceutical sourced from a specific type of bromeliad.
- Favolin isn't sourced from a beetle.

Backstory And Goal

Pravanox Pharmaceuticals has spent decades scouring the world's rainforests for new sources of medical drugs, and this year a number of these new drugs have been officially approved by the FDA. Using only the clues below, match each drug to the condition it treats, the month it was approved, and the source from which its main ingredient is derived.

Remember, as with all grid-based logic puzzles, no option in any category will ever be used more than once. If you get stuck or run into problems, try the "Clear Errors" button to remove any mistakes that might be present on the grid, or the "Hint" button to see the next logical step in the puzzle.

Figure 4: Quizzle 4 (20 pts of extra credit).