

## Five Houses

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Here is another logic puzzle. The language is slightly less inane than for the Math Profs, but the required reasoning is a bit more complicated.

There are 5 houses in a row, numbered 1 through 5 from left to right. Each house has a different color and a different owner. The owners all have different nationality, drink a different beverage, eat different food and have different pets. We are given the following list of facts about these houses and their owners.

1. Eva lives in the red house.
2. Sven keeps dogs.
3. Dana drinks tea.
4. The green house is just to the left of the white house.
5. The owner of the green house drinks coffee.
6. The cookie lover keeps birds.
7. The owner of the yellow house likes pasta.
8. The owner of the center house drinks milk.
9. Norma lives in the first house.
10. The cheese lover has a neighbor who keeps cats.
11. The vegan drinks beer.
12. The horses are next to the pasta lover.
13. Greg likes steak.
14. Norma lives next to the blue house.
15. The cheese lover has a neighbor who drinks water.

**Question:** Which house has a fish as pet?

A few comments:

- Express the given axioms in a more formal way, so it is easier to see exactly what the possibilities are and what information we need to derive.
- Your representation should be as clear and lightweight as possible.
- Then proceed in several rounds, squeezing more and more information out of the axioms.
- In the end, you should have complete information about colors, owners and so forth.
- The solution is unique.

Do not look at the solution below without trying to solve the puzzle first.

There are two types of rules: direct constraints (like rule 1) and implicational constraints (like rule 4). The latter hinge on the house number attribute, so it seems prudent to organize the whole procedure around that: we want to build a  $5 \times 6$  table with house numbers 1, 2, 3, 4, 5 in the first column. Then we try to fill in missing attributes for each house, in the order: color, owner, nationality, beverage, food and pet.

Start with rules 8, 9, then 14 with right neighbor.

1	-	N	-	-	-
2	B	-	-	-	-
3	-	-	M	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Rules 4, 5 force green into house 4, white into 5.

1	-	N	-	-	-
2	B	-	-	-	-
3	-	-	M	-	-
4	G	-	C	-	-
5	W	-	-	-	-

Rule 1 place red, Eva in 3, hence yellow in 1; rule 7 puts pasta into 1; rule 12 horses into 2.

1	Y	N	-	P	-
2	B	-	-	-	H
3	R	E	M	-	-
4	G	-	C	-	-
5	W	-	-	-	-

Rules 3, 12 force water into 1; rule 15 cheese into 2.

1	Y	N	W	P	-
2	B	-	-	C	H
3	R	E	M	-	-
4	G	-	C	-	-
5	W	-	-	-	-

House 5 only one without drink or food, by rule 11 gets vegan and beer; hence house 2 gets Dana and tea by rule 3.

1	Y	N	W	P	-
2	B	D	T	C	H
3	R	E	M	-	-
4	G	-	C	-	-
5	W	-	B	V	-

House 4 only one without owner or food, by rule 13 get Greg and steak; hence house 3 gets cookies; house 5 gets Sven.

1	Y	N	W	P	-
2	B	D	T	C	H
3	R	E	M	K	-
4	G	G	C	S	-
5	W	S	B	V	-

Rules 2 and 6 produce dog and bird.

1	Y	N	W	P	-
2	B	-	T	C	H
3	R	E	M	K	B
4	G	G	C	S	-
5	W	S	B	V	D

Rule 10 forces cat into house 1, hence fish into 4.

1	Y	N	W	P	C
2	B	D	T	C	H
3	R	E	M	K	B
4	G	G	C	S	F
5	W	S	B	V	D

Are there any shortcuts? Don't know.