

## Propositional Logic Exercises

**Exercise 1** *There are five kids in the class. We know the following facts:*

1. *Milhouse loves Lisa.*
2. *If Lisa loves Milhouse, then she doesn't love Nelson.*
3. *Nelson either loves Lisa, or Jenny, but not both.*
4. *Nelson doesn't love the same girl as Bart.*
5. *Nelson and Bart hate each other, and they both don't love Milhouse.*
6. *If somebody likes Jenny, then she likes him back (and doesn't love anyone else).*
7. *Bart loves exactly one girl.*
8. *Lisa doesn't love Bart and vice versa.*
9. *If Nelson loves Lisa, then she loves him back.*

*Who loves Milhouse?*

**Exercise 2** *Tom and Huck find themselves trapped in a dark and cold cave. After a quick search, the boys find three doors: the first one is red, the second one is blue, and the third one is green. Behind one of the doors is a path to freedom, behind the other two doors, however, is Cthulhu. Opening a door to Cthulhu means eternal suffering and damnation for the boys. There is an inscription on each of the door:*

- **RED door:** *Freedom is behind this door!*
- **BLUE door:** *Freedom is not behind this door!*
- **GREEN door:** *Freedom is not behind the blue door!*

*Moreover, the boys know that **at least one** inscription is true, and **at least one** is false. Which door will lead the boys to freedom?*

**Exercise 3** *Jarik is lost in the middle of a dungeon. He enters a room with a locked door and three statues: a wolf, a bear, and a lizard. Each statue has an open mouth and Jarik can see the mouths are full of razor-sharp teeth. There are inscriptions on pedestals of the statues saying where the key to the door is:*

- **Wolf:** *I do not have the key. The key is in the mouth of the bear.*
- **Bear:** *The wolf does not have the key. You will find the key in the lizard's mouth.*
- **Lizard:** *I do not have the key. The wolf has the key.*

*Jarik also knows that one of the pedestals has two true inscriptions, one of the pedestals has two false inscriptions, and the remaining pedestal has one true and one false inscription (but does not know which one is which). He also know that if he enters his hand in a mouth an animal without the key, the statue will bite his hand off. Jarik has two hands. What is the best strategy for Jarik to leave the room through the locked door? (We assume Jarik wants to keep as many hands as possible.)*