

**INTRODUCTION TO COMPUTATIONAL LOGIC**  
**HOMEWORK 2**  
**DUE DATE: OCTOBER 25, 2017**

Consider the following *pigeonhole problem*:

- There are  $n$  pigeons and  $m$  holes.
- Each pigeon has to live in a hole.
- Each hole can have at most one pigeon.

We would like to find a hole for every pigeon. Clearly, the problem is not solvable if  $n > m$ .

Let  $p_{ij}$  be an atom for  $1 \leq i \leq n$  and  $1 \leq j \leq m$ . The atom  $p_{ij}$  is T iff the pigeon  $i$  live in the hole  $j$ . Consider the following clause:

$$p_{i1} \vee p_{i2} \vee \cdots \vee p_{im}.$$

This clause says that pigeon  $i$  lives in a hole. Moreover, consider

$$\bigwedge_{1 \leq i < j \leq n} \neg p_{ik} \vee \neg p_{jk}.$$

This formula says that at most one pigeon lives in hole  $k$ .

Please write a program such that:

- it accepts two positive numbers  $n$  and  $m$  as inputs.
- it outputs a CNF formula in DIMACS SAT format.
- the generated CNF formula specifies the pigeonhole problem with  $n$  pigeons and  $m$  holes.

You can use any programming language of your choice.

Please send me the following files:

- (1) your program source code with instructions on how to use it;
- (2) the output files (in DIMACS SAT format) for
  - $n = 3$  and  $m = 3$ ;
  - $n = 4$  and  $m = 3$ .
- (3) the outputs of MINISAT on the above two input files.