Exercise sheet 2:

Shourya Verma: shourya.verma@stud.uni-heidelberg.de

Marvin Bundschuh: marvin.bundschuh@stud.uni-heidelberg.de

Almoatasem bellah Haggag: almoatasem.haggag@stud.uni-heidelberg.de

2.2: The rounded solution to the LP problem will not be as good as the optimal solution to the ILP problem, because it may not satisfy the integer constraints and may not be as close to the optimal solution to the LP problem as the optimal solution to the ILP problem.

2.3: The ILP in this example has more than one optimal solution that is equally good. The optimal solutions are [1, 1, 0], [1,0,1] , [0, 1 , 1], [0, 0, 1], [0, 1, 0] and [1, 0, 0]. So, there are as many optimal solutions where node i is 0, as there are optimal solutions where i is labelled 1. This leads to a fractional result, where every node-label is equally plausible (so 0.5). When rounding, we have to decide for one of the nodes, although it is impossible to say which label to choose, because they have the same possibility to be right. In short, we haven't won everything by using the ilp relaxation, because at this point randomly guessing is the best possible strategy. In our implementation of lp_to_labelling we just always take the first label with the max_label when there are two equally good labels. Which of course leads us to the solution [0, 0, 0] which is worse than one of the real optimal solutions.

2.4: The Optima of the LP and ILP of the acyclic graph are always the same. The Optima of the LP of the cyclic graph are always better than the ILP optima maybe because LP solver will be able to find the optimal solution to a problem more quickly and efficiently than an ILP solver, because it does not have to enforce the restriction that all decision variables must be integers.

2.5: Not solvable in reasonable time for models 1,2,4,8 that's why we introduce tolerance which can lower the run time. For very large-scale vision problems using general LP and ILP solvers is not very practical, especially if it's a real time problem.