# 02157 Functional programming Mandatory assignment 3 Solver for Propositional Logic

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## 1  Knight-Knave puzzle

### 1.1  Formulation

Three of the island's inhabitants – A, B, and C – were talking together. A said, ,,All of us are knaves." Then B remarked, ,,Exactly one of us is a knight." What are A, B, and C?

### 1.2  Solution

Let p, q, r be the statements that A is a knight, B is a knight and C is a knight respectively Then $\neg p$ represents the proposition that A is a knave and $\neg q$ that B is a knave, and the same for C: $\neg r$. We have two sentences:

1. $s_1 = p \iff (\neg p \wedge \neg q \wedge \neg r)$

2. $s_2 = q \iff (p \wedge \neg q \wedge \neg r) \vee (\neg p \wedge q \wedge \neg r) \vee (\neg p \wedge \neg q \wedge r)$

We can present a solution for that problem as: $s_1 \wedge s_2$ which (after transformations) is equal to: $q \wedge \neg p \wedge \neg r$ Which I computed using ,,toDNFsets" function I wrote and is included in source code. So A and C are knaves and B is a knight. Normally this puzzle is easy because someone saying sentence 1 must be a knave, and then B must be a knight because A is not, and if it was C than B have to be also a knight which is contradictory to sentence 2.