

## Knights and Knaves

1. **{A Knave: B Knight}** Assume what B says is true therefore they must be different kinds of people. When A said we are the same kind of people he was lying so he is a knave. A is the knave and B is the knight. This is the only environment where there is no contradiction.

**{A Knight : B Knight}** Assume was lying therefore they cannot be the same people. What B said is true so that would mean A is a knave and B is a knight but we stated A is a knight so this is a contradiction

**{A knight : B knave}** What A says is true because he is a knight so they must both be the same kind of people. Therefore B must also be a knight but he said we are different people which must be true. A must be a knave which is a contradiction because we stated A is a knight.

**{A Knave : B Knave}** B must be lying because he is a knave so they must be the same kind of people. Therefore A must also be a knave and he was lying so they cannot be the same kind of people which is a contradiction because this environment they are both Knaves.

Alice: Bob is knave and Celia is knight

Bob: (7/8) Celia is a knight then Alice is a Knight

Celia: Neither Alice nor Bob are Knights

	A	B	C
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	1

①  $\Rightarrow A=F, B=F, C=T$  X  
 ②  $\Rightarrow A=F, B=T, C=F$  X  
 ③  $\Rightarrow A=F, B=T, C=T$  X  
 ④  $\Rightarrow A=T, B=F, C=T$  X  
 ⑤  $\Rightarrow A=T, B=F, C=F$  X  
 ⑥  $\Rightarrow A=T, B=T, C=T$  X

2. There is no solution because each environment is contradictory.

3. Assume red is lying which means blue is also lying. Therefore, green would have to be the knight which is impossible because a knight cannot lie. So red is telling the truth so blue is the knight. Since red is a non-knight who told the truth he must be the spy and green must be the knave.

## Song Titles

- a)  $\forall p \exists t \exists q. \text{Loves}(p, q, t)$  - Everybody sometime loves somebody
- b)  $\exists p \exists q \exists t. \text{Loves}(p, q, t)$  - Somebody loves somebody at sometime
- c)  $\exists p \forall t \forall q. \text{Loves}(p, q, t)$  - Someone always loves everyone

d)  $\forall p \exists q \forall t. \text{Loves}(p, q, t)$  - Everybody loves somebody always

$\forall p \exists t \exists q. \text{Loves}(p, q, t)$  is the most reasonable interpretation of Dean Martin's song title

### Negation

- The negation for c is  $\forall p \exists t \exists q, \text{NotLoves}(p, q, t)$  – “everybody sometimes never loves anybody”
- The negation for d is  $\exists p \forall q \exists t, \text{NotLoves}(p, q, t)$  – “Somebody doesn't love someone always”