# The language of ‘if’ and ‘not’

| University of Edinburgh | PHIL08004 |

$$\neg((P \to Q) \to \neg R)$$

## Puzzle 4: The Guards

- Two doors: A and B
- One leads to Heaven; one leads to Hell
- Two guards: guard of A and guard of B
- One lies and one tells the truth
- One yes/no question to ask
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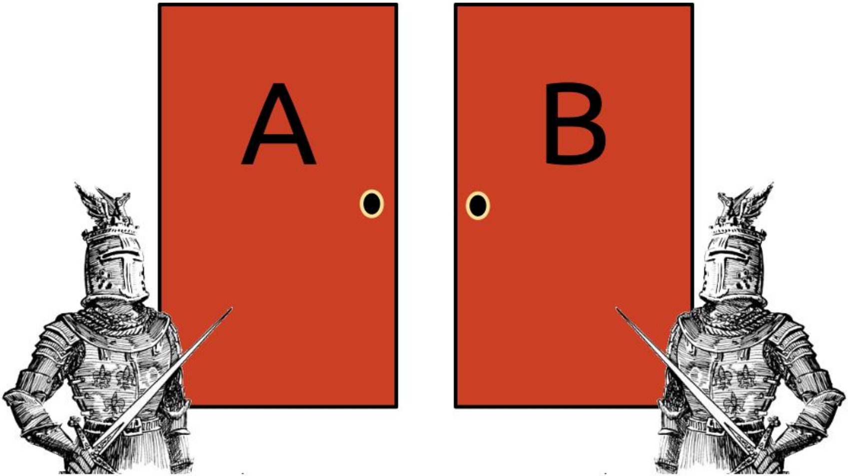
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## Solution

- Ask guard A the following:
  - **If I asked guard B whether his door leads to heaven would he say 'yes'?**
- **YES**
  - A is telling truth: B would say 'yes' and B is lying, so its door A.
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- **NO**
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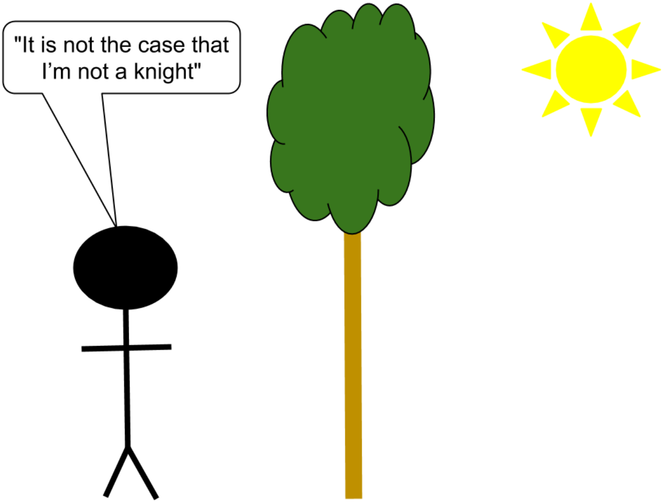
## Not Not Knight

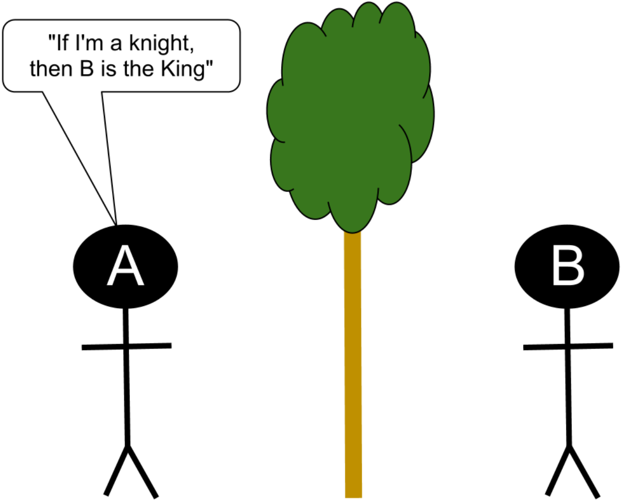
**Puzzle 5.** You come across an inhabitant who makes the following statement "It is not the case that I am not a knight."

Can you determine whether the inhabitant is a knight or a knave?


"It is not the case that I'm not a knight"

**Puzzle 6.** Assume that there is a King of the Island of Knights and Knaves. Who is the King? You come across two inhabitants A and B and A makes the following statement: "If I'm a knight, then B is the King".

Is B the King?


"If I'm a knight,
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A
B

A: If I'm a knight, then B is the King

- Assume A is a knave
- So what A said is false
- So: A is a knight but B is not the King
  - Contradiction!
- So A is a knight
- And, so **B is the King**

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- Basic symbols:
  - Sentence letters: $P, \ldots, Z$
    - (including numerical subscripts, e.g. $P_4$, $Q_{23}$, etc.)
  - Connectives: $\neg$, $\rightarrow$
  - Punctuation: ),(
- Formation rules:
  - Any sentence letter is a sentence
  - If $\Box$ is a sentence, then $\neg\Box$ is a sentence
  - If $\Box$ and $\bigcirc$ are a sentences, then $(\Box \rightarrow \bigcirc)$ is a sentence
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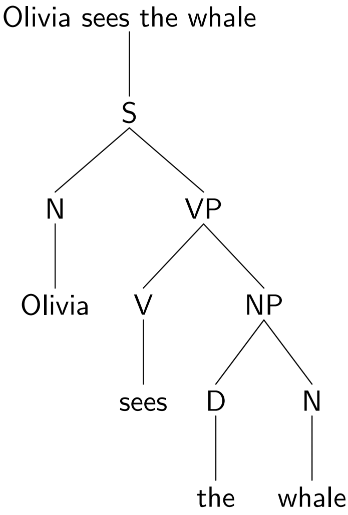
## Parse trees for natural language



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- Indicate how a sentence is constructed out of its constituents.
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- Indicate how a sentence is constructed out of its constituents.
- First locate the **main connective**—this is the last connective introduced when constructing the sentence.

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- Draw branching lines below the main conditional sign and write the antecedent and consequent

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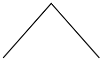

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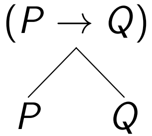


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## Parse trees for $\mathcal{L}_1$

If the sentence is a negation, the main connective is the negation sign; draw a vertical line under it and write the part of the sentence to which the negation sign is applied.

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$$P$$

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$$\neg(P \to Q)$$

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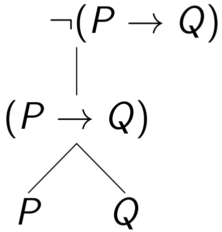

## Parse trees for $\mathcal{L}_1$

$$(S \to (P \to \neg Q))$$

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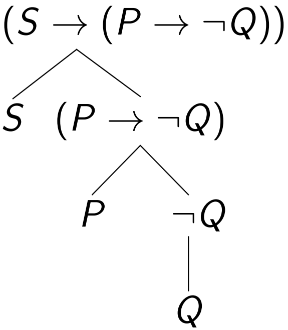

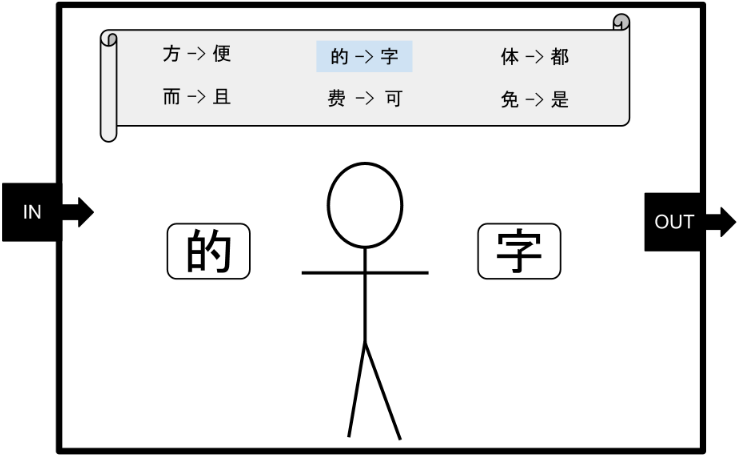
方 -> 便
的 -> 字
体 -> 都
而 -> 且
费 -> 可
免 -> 是
IN
的
字
OUT