HOMEWORK TO SEMINAR 2 (24-25 Sep 2015)

Read the third chapter in Gorham to the section on the paradox on the ravens. Think about the following questions and turn in your answers through KTH Social before the seminar. Also bring a printout to the seminar. These will be collected, read and commented by your teacher and returned at the following seminar. The electronic submission is used to register an entry in Rapp.

1. What is truth?

The purpose of science is to arrive at true statements, but what does that mean? The question is a difficult one. One would like to have a definition of truth that may be used to test all types of statements. But there seems to be no universally accepted definition, despite millennia of philosophy and science.

Here are four statements, P1-P4. In what sense are they true?

P1: The car keys are on the kitchen table.
P2: Every differentiable function is continuous.
P3: Freedom is the most important thing.
P4: One should stick to the truth.

The following are four notions of truth that have occurred in philosophical discussions:

- **Correspondence truth** If P corresponds to reality, then P is true. P1 is true because the keys are actually on the kitchen table.
- **Coherence truth** if P is logically linked to other true statements then P is true. P2 is true since it follows from previous definitions and theorems.
- **Intuitive truth** If I have a strong internal conviction about P then P is true for me. P3 is true because I think freedom is the most important thing.
- **Pragmatic truth** If believing in P results in good consequences then P is true. P4 is true because everyone benefits from people telling the truth.

What kind of truth concept matches each of the following statements best?

(1) The program statement `while (true) {}` gives an infinite loop.
(2) Mergesort has complexity $n \log n$.
(3) Microsoft suffers losses in the consumer market.
(4) Comments make it easier to modify programs.
(5) Agile development provides greater job satisfaction.
(6) P is a strict subset of NP.
(7) Spotify, Skype and MySQL are Swedish programs.

(8) This statement is true!

(9) This statement is false!

For each statement: say which of the four notions of truth you choose and why. Since there is no absolute truth you may not get the same answers as your classmates...

2. When does induction work?

The **Raven Paradox** was proposed in the 1940s by the logician Hempel. It questions the notion that a hypothesis H is supported by an observation that concurs with H, that is, the basis for scientific induction.

Hempel's hypothesis was the following: *All Ravens are black.* An observation of a non-black raven would falsify the hypothesis but should not then each observation of a black raven strengthen it? And observations that do not concern ravens should do neither one nor the other?

The hypothesis may be expressed in predicate logic as follows:

$$H1 : \forall x \ (R(x) \Rightarrow B(x))$$

But there is another, logically equivalent, way of writing this:

$$H2 : \forall x \ (\neg B(x) \Rightarrow \neg R(x))$$

Thus *All non-black objects are non-ravens.* An observation of a non-black raven would still falsify the hypothesis, but now any observation of a non-black non-raven, such as a yellow banana, ought to strengthen it! And sightings of black objects do not seem to matter at all.

Many attempts at explaining the raven paradox may be found on Wikipedia: *Raven paradox.* You will now be asked to try to understand it from a computer science perspective, concerning database search.

(1) An unordered giant database, objects have attributes type and color.

(2) A relational database with tables `species` and `color`.

(3) A raven database and a database of non-black objects, both with ID.

Does the conclusion change for the hypothesis H1: *All children are short*? What is H2? The statement may concern people standing in a large plaza

Bring a printed copy of your homework to the seminar, and be prepared to defend your opinions. Do not forget to also turn your homework in through KTH Social.