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CLAUSAL LOGIC

Avicenna, or more correctly, Ibne Sina, needs no introduction because his philosophical contributions are so vast and so important, that even today, roughly 1000 years after he wrote, scholars are still discovering and benefiting from his works.

Ibne Sina was to Central Asia, what Aristotle was to the Greeks, or Descartes and Leibnitz to Europe. His Flying Man experiment, for instance, is taken to be a different version of proving Descartes's *Cogito Ergo Sum*.

Suppose we say:

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A triangle has three equal sides.
A triangle has three unequal sides.
A triangle has three sides.
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Which of the above sentences is *essencial*? What we mean is, which sentence determines the essence of a triangle? Clearly, the last one, but also, take together, the first two.

However, for a triangle to exist, it does not have to made of three equal sides, or three unequal sides. It can be made from either of those two conditions, since these two conditions satisfy the axiom that a triangle must have three sides.

In like manner, Ibne Sina argued, that a soul may be attached to a body, but the soul does not have to be attached to a body, in order to exist.

Ibne Sina's experiment involves a person unable to have any extremities like hands or feet, and other sense organs like eyes. Would such a person, unable to feel the physical world be self-aware?

Ibne Sina says that he can, since the soul does not need the body to exist, whereas vice versa is true. His proof is based on the existence-essence idea:

A triangle's essence does not depend on its existence.

What is the connection of this philosophical topic to logic? The connection is that Ibne Sina has used a simple inference method that resembles clausal logic. More on this later.

Now let's explore what clausal logic is.

Artificial Intelligence uses knowledge to make inferences (called knowledge representation), in other words, uses logic programming to reason.

Clausal logic is a subset of First-Order Predicate Logic, whose computational syntax determines whether something is true or false, in a specific domain, or in a partial context.

Clausal logic can handle all the computational complexity an AI machine can face. For instance, suppose A, B, C, D, E and F are buttons such that A, B, C are on the same line, while D and E are on the same line. If we define **nearby** as having a distance of no more than one button apart, then A and C can be called nearby buttons, as can A and B, B and C, and D and E.

Also, although D and A are not on the same line, they may be nearby (or not) but our definition of nearby does not cover this (or we do not have such information), so no inference is possible, or we say clausal inferences are strictly made on the strength of assumptions that are based on knowledge.