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Architectural Planning: An Expert System Proof of Concept

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Answer Set Programming (ASP) is a declarative language oriented toward search problems. The language follows a non-monotonic logic and is guided by the three following informal principles:

1. Satisfy the rule of the program and believe in the head of a rule if you believe in its body.
2. Do not believe in contradictions.
3. Believe nothing you are forced to believe.

- ASP is a collection of statements describing objects of a domain and relations between them.
- Its semantics defines the notion of an answer set—a possible set of beliefs of an agent associated with the program.
- The valid consequences of the program are the statements that are true in all such sets of beliefs.

Some of the basic lingo that are essential to writing a program in ASP:
- **Terms**—Terms are either variables or object constants.
- **Predicate**—Confirmation for a particular property between objects or relations between objects or relations between relations.
- **Atomic Statement**—An expression of the form \( p(t_1, \ldots, t_n) \) where \( p \) is a predicate symbol of arity \( n \) and \( t_1, \ldots, t_n \) are terms. Atomic statements are also referred to as atoms.
- **Literal**—An atom \( p(t_1, \ldots, t_n) \) or its negation \( \neg p(t_1, \ldots, t_n) \). This negation is read as \( p(t_1, \ldots, t_n) \) is false. When referencing a literal, one simply denotes it as \( l \).
- **Not**—This is a logical connective referred to as default negation. The expression not \( l \) means that it is not believed that \( l \) is true. However, this does not imply that \( l \) is believed to be false. This allows the reasoner to have the option for a statement to be neither true nor false.
- **Rules**—A rule is of the form \( a_0 \leftarrow a_1, \ldots, a_m \). The left-hand side of a rule is called the head whereas the right-hand side is called the body. The head of a rule is satisfied and represented as true only when every atom in the body is evaluated as true.
- **Constraints**—These refer to rules with empty heads. Two literals that are a part of the same constraint cannot be in the same answer set.
- **Facts**—Rules with empty bodies are known as facts.

ASP is quite versatile with applications various fields such as probability, graph theory, and phylogenetic systematics.