**Chapter 7 – 12 Summary**

Logical Agents –

Introduces the Wumpus world , to show the operation of a knowledge-based agent

Logics = formal languages for representing information such that conclusions can be drawn

Knowledge bases consist of sentences.

* They are expressed according to the **syntax** of the representation language, which specifies all the sentences well formed.

A logic must define the **semantics** or meaning of sentences.

* The semantics defines the truth of each sentence with respect to each possible world.

A simple knowledge based agent:

* Represent states, actions, etc.
* Incorporate new percepts
* Update internal representations of the world
* Deduce hidden properties of the world

Entailment – necessary truth of one sentence given another

* Entailment is a relationship between sentences (syntax) that is based on semantics

Propositional Logic states the simplest logic rules showing basic ideas of sentences negation, conjunction, disjunction, implication, and biconditional.

Inference – deriving sentences from other sentences:

Soundness (derivations produce only entailed sentences) & Completeness (derivations can produce all entailed sentences) of algorithms and procedures are checked.

* Sound because it implements directly the definition of entailment
* Complete because it works for any (Knowledge Base) and (some sentence in that KB) and always terminates.

First-Order Logic says almost anything of interest, for which there exists a sound and complete inference procedure

Inference by enumeration – Depth first enumeration of all models is sound and complete

In first-order logic, variable refer to things in the world and you can quantify over them.

FOL – in FOL you can make a general statement about all of 1 type of object, statements that cannot be made in propositional logic , but can be made in FOL.

* In propositional logic , you need a statement for every single object.

FOL syntax –

Term

Constant Symbols, Variables, Function symbol applied to one or more terms:

Sentence

A predicate symbol applied to zero or more terms:

For a variable and sentence, then and are sentences.

Closure under sentential operators:

An interpretation is made up of a set and three\

In FOL , An interpretation is made up of a set and three mappings.

The set is the Universe , U which is a set objects.

* Maps constant symbols to elements of U

This mapping from constant symbols to the elements of U, specify how names are connected to objects in the world.   
The next mapping is from predicate symbols to relations on U.

The last mapping is from function symbols to functions on U.

In FOL, semantics , we can define what is means for something to be true.

Classical Planning:

* Logical Sentences
* Preconditions / outcomes
* Logical sentence (conjunction)
* Constraints on actions

Assumptions in Classical Planning

Percepts:

Perfect perceptions

Complete knowledge agent is omniscient

Actions:

Instantaneous actions

Atomic time

No concurrent actions allowed

Deterministic actions (effects are completely specified)

Environment:

Static environment

Completely observable environment

Agent is the sole cause of change in the world

Planning and Acting in the Real World:

Scheduling : path, knowing when an action starts and ends, knowing its critical path

The use of algorithms to determine slack and min slack for scheduling jobs,

The central idea of aggregation = to group individual objects into quantities when the objects are all indistinguishable with respect to the purpose at hand.

Knowledge Representation:

* A set of ontological commitments
* The ontological commitment of a representation begins at the level of the representation technologies and accumulates layers, to form a frame-like structure.

The syntax of first-order logic is designed to make it easy to say things about objects.

Description logics are notations that are designed to make it easier to describe definitions and properties of categories. Description logic systems evolved from semantic networks.

-Its principles inference tasks are subsumption(checking if one category is a subset of another by comparing their definitions) classification ( checking whether an object belongs to a category), and some systems include consistency ( of a category definition (whether the membership criteria are logically satisfiable).

The way we can think of Knowledge Representation is by looking at it as an intelligent entity that wishes to reason about its world encounters , reasoning is a process that goes on internally.

It’s a surrogate that is inside the reasoner, There must be a form of correspondence specified between the surrogate and its intended referent in the world; the correspondence is the semantics for the representation.

Then fidelity: how close it the surrogate to the real thing? Perfect fidelity is in general impossible, both in practice and in principle.

It is impossible in principle because anything other than the thing itself is necessarily different from the thing itself (in location if nothing else).

Representations function as surrogates for abstract notions like actions, processes, beliefs, categories, etc., allowing them be described inside an entity so that it can reason about them.

* Formal objects can exist inside the machine with perfect fidelity: mathematical entities