# Assignment No: 1B

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Q.1] Explain PEAS descriptors for WUMPUS world.

→ ① Performance measure:
- +100 for grabbing the gold and coming back to the starting position,
- -200 if the player (agent) is killed.
- -1 per action,
- -10 for using the arrow.

② Environment:
- Empty Rooms
- Room with WUMPUS.
- Rooms neighbouring to WUMPUS which are smelly
- Rooms with bottomless pits.
- Rooms neighbouring to bottomless pits which are breezy
- Room with gold which is glittery
- Arrow to shoot the WUMPUS

③ Sensors:
- Camera to get the view
- Odour sensor to smell the stench.
- Audio Sensor to listen to the scream and bump

④ Effectors:
- Motor to move left, right
- Robot arm to grab the gold
- Robot mechanism to shoot the arrow.

The WUMPUS world agent has following characterstics-
1. Fully Observable 2. Deterministic 3. Episodic
4. Static 5. Discrete 6. Single agent.

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Q.2] Explain Various elements of Cognitive System.

→ • Cognitive computing is a new type of computing with the goal of more accurate models of how the human brain/mind senses, reasons, and responds to stimulus.
• Generally, the term cognitive computing is used to refer to new hardware and software that mimic the functioning of the human id brain thereby improving human decision-making.
• Cognitive computing applications link data analysis and adaptive page displays. i.e. Adaptive User Interfaces, to adjust content for a particular type of audience.

Foll. are some features of Cognitive systems.

① Interactive:
They may interact easily with users so that those users can define their needs comfortably. They may also interact with other processors, devices, and cloud services, as well as with people.

② Adaptive:
They may be engineered to feed on dynamic data in real time. They may learn as information changes and as goals and requirements evolve. They may resolve ambiguity and tolerate unpredictability.

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③ Contextual:

They may understand, identify, and extract contextual elements such as meaning, syntax, line location, appropriate domain, regulations, user's profile, process, task and goal. They may draw on multiple sources of information, including both structured and unstructured digital information, as well as sensory inputs like visual, gestural, auditory, or sensor-provided.

④ Iterative and Stateful:

They may aid in defining a problem by asking questions or finding additional source of input if a problem statement is ambiguous or incomplete. They may "remember" previous interactions in a process and return information that is suitable for the specific application at that point in time.

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Q.3] Write note on Language Model.

→ • ~~In case of Probabilis~~
• The goal of a language model is to compute a probability of a token and are useful in many different Natural Language Processing applications.
• Language Model actually a grammar of a language as it gives the probability of or word that will follow.
• For example, they have been used in Twitter Bots for 'robot' accounts to form their own Sentences.

Language Model Definition:

• In case of Probabilistic language modeling the probability of a sentence as sequence of words is calculated:

$$P(W) = P(W_1, W_2, W_3, \ldots W_n)$$

• It can also be used to find the probability of the next word in the sentence:

$$P(W_5 \mid W_1, W_2, W_3, W_4)$$

• A model that computes either of these is called a Language Model.
• There are various Language models:

① Methods using the Markov assumption:

• A process which is stochastic in nature, is said to have the Markov property if the conditional probability distribution of future states of the process depends only upon the present state, not on the sequence of events that happened

in the past. A process with this property, is called a Markov process.

- In other words, the probability of the next word can be estimated given only the previous k number of words.

For example, if k = 1:

P (transparent | its water is so) ≈ P(transparent | so)

or if k = 2:

P(transparent | its water is so) ≈ P(transparent | is so)

- Following is the general equation for the Markov Assumption, k = i:

$P(w_i | w_1 w_2 \dots w_{i-1}) \approx P(w_i | w_{i-k} \dots w_{i-1})$

② N-gram Models:

- From the Markov Assumption, we can formally define N-gram models where k = n-1 as the foll.

$P(w_i | w_1 w_2 \dots w_{i-1}) \approx P(w_i | w_{i-(n-1)} \dots w_{i-1})$

- The simplest versions of this are defined as the Unigram Model (k = 1) and the Bigram Model (k = 2)

③ Unigram Model (k = 1):

$P(w_1 w_2 \dots w_n) \approx \prod_i p(w_i)$

④ Bigram Model (k = 2):

$P(w_i | w_1 w_2 \dots w_{i-1}) \approx P(w_i | w_{i-1})$

Foll. is the maximum likelihood Estimate model to Estimating Bigram Probabilities:

$(w_i | w_{i-1}) = \frac{\text{Count}(w_{i-1} \dots w_i)}{\text{Count}(w_{i-1})}$

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Q.4] Write a short note on Machine Translation.

→ Machine translation is the classic test of language understanding. It consists of both language analysis and language generation. Many machine translation systems have huge commercial use. Following are few of the examples:

- Google Translate goes through 100 billion words per day.
- eBay uses Machine Translation techniques to enable cross-border trade and connect buyers and sellers around the world.
- Facebook uses machine translation to translate text in posts and comments automatically, in order to break language barriers and allow people around the world to communicate with each other.
- Systran became the first software provider to launch a Neural Machine Translation engine in more than 30 languages back in 2016.
- Microsof brings A.I. powered translation to end users and developers on Android, ios, and Amazon Fire, whether or not they have access to the internet.

- In a traditional Machine Translation system, parallel corpus a collection of texts is used each of which, is translated into one or more other languages than the original.

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For example, given the source language. eg. French and the target language. eg. English, multiple Statistical model need to be build, including a probabilistic formulation using the Bayesian rule, a translation model $p(f|e)$ trained on the parallel corpus, and a language model $p(e)$ trained on the English-only-corpus.

- It is obvious that, this approach skips hundreds of important details, requires a lot of human feature engineering, consists of many different and independent machine learning problems. & overall is a very complex system.

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Q.5] Explain the following terms.

→ ① Phonology:

- It is the study of organizing sounds systematically in an NLP (natural language Processing) system.

② Morphology:

- It is a study of construction of words from primitive meaningful units.

③ Lexical Analysis:

Lexicon is the words and phrases in language. Lexicon analysis deals with the recognition & identification of structure of the sentences. It divides the paragraphs in sentences, phrases & words.

④ Syntactic Analysis:

In syntactic analysis the sentences are parsed as noun, verbs, adjectives, and other parts of sentences. In this phase the grammar of the sentence is analyzed in order to get the relationships among different words in the sentence. For example, "mango eats me" will be rejected by syntactic analyzer.

⑤ Word sense disambigution:

While using words that have more than one meaning we have to select the meaning which makes the most sence in context. For example, we are typically given a list of words associated word senses eg from a dictionary or from an online resource such as wordnet.