# AI Assignment No: 1B

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Subject :- AI

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# AI Assignment No: 1B

Q.1. Explain PEAS descriptors for WUMPUS World.

- i. Performance measure:
  - +100 for grabbing the goal and coming back to start.
  - -200 if the player is killed.
  - -1 per action.
  - -10 for using the arrow.
- ii. Environment:-
  - Empty rooms.
  - Room with WUMPUS
  - Rooms neighbouring to WUMPUS which are smelly.
  - Rooms with bottomless pits.
  - Rooms with gold which is glitery
  - Arrows to kill the wumpus.
- iii. Sensors (assuming a robotic agent)
  - Camera to get the view
  - Odour sensor to smell the stench.
  - Audio sensor to listen to the scream and bump.
- iv. Effectors (assuming a robotic agent).
  - Motor to move left right
  - Robot arm to grab the gold
  - Robot mechanism to shot the arrow.
  - The WUMPUS world agent has following characters:

a. Fully observable
b. Deterministics
c. Episodic
d. Static
e. Discrete
f. single agent.

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/or software that mimic the following functioning of human brain thereby improving human decision making cognitive computing applications links data analysis and adaptive page display that is Adaptive user interfaces to adjust content for a particular type of audience.

Following are elements of cognitive system:

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 the 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 behaviours.

3. Contextual :-
They may understand, identify and extract contextual elements such as meaning syntax, location, appropriate domain etc.

4. Iteractive and stateful :-
They may defining a problem by asking questions or finding additional source input if a problem statement is incomplete.

Q.3 Write a note on language model.

- 1. The goal of a language model is to compute a prose probablity of a token. (e.g :- a sentence or sequence of words).
2. language model (LM) actually a grammar of language as it gives the probablity of word that that will follow.
3. In case of (LM) the probablity of a sentence as sequence of words is :- $P(w) = P(w_1, w_2, w_3, \cdots w_n)$
4. It can also be used to find the probablity of the next word in sentences :- $P(w_5 | w_1, w_2, w_3, w_4)$
5. A model that computes either of these is language model.
6. There are various language Model available, a few are :-

a. Methods using Markov assumption :-

- A process which is stochastic in nature, is said to have the Markov property, if the conditional probablity ~~of future state dep~~ distribution of future state of 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 probablity of the next word can be estimated given only the previous k no. 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 the general equation for the Markov Assumption, k=1;
$P(w_i | w_1 w_2 \cdots w_{i-1}) \approx P(w_i | w_{i-k} \cdots w_{i-1})$

b. N-gram Models:-
- From the Markov Assumption, we can formally define N-gram models where k=n-1 of the following:-
$P(w_i | w_1 w_1 \cdots w_{i-1}) \approx P(w_i | w_{i-(n-1)} \cdots w_{i-1})$
- The simplest versions of this are defined as the Unigram Model (k=1) and the Bigram Model (k=2).

c. Unigram model (k=1):-
The Unigram is the simplest type of language model. It evaluates each word or term independently. Unigram models commonly handle language processing tasks such as information retrieval.

$$P(w_1 w_2 \cdots w_n) \approx \prod_{i} P(w_i)$$

c. Bigram Model (K=2):-

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

- These equations can be extended to compute trigrams, 4-grams, 5-grams etc. This is an insufficient model of language because sentences often have long

distance dependencies. for example, the subject of a sentence may be at the start whilst our next word to be predicted occurs more than 10 words later.

- Following the maximum likelihood estimate model to Estimating Bigram Probabilities:

$$P(w_i | w_{i-1}) = \frac{count(w_{i-1} \cdot w_i)}{count(w_{i-1})}$$

Example:-

- Given a corpus with the following three sentences, let's find out probability that "I" starts the sentence. Here "<s" and "/s>" denote the start and end of the sentence respectively.

<s I am Riya /s>
<s Riya I am /s>
<s I do not like green colour /s>

- Therefore, we have:

$$P(I | <s) = \frac{count(s, I)}{count(<s)} = \frac{2}{3}$$

7. Language modelling is of the most important parts of modern Natural language Processing. There are many sorts of applications for language modelling like spell correction, speech recognition, Machine Translation, Sentiment analysis etc.

Q4. Write a note on Machine Translation :-

- Machine Translation :-

1. Machine translation is the classic test of language understanding.

2. It consist of both language analysis and language generation. Many machine translation systems have huge commecial use.

Following are some of these examples :-

a. Google Translate goes through 100 billion words per day.

b. eBay uses Machine Translation techniques to enable cross-border trade and connect buyers and sellers around the world.

c. Facebook uses machine translation to translate text in posts and comments automatically, inorder to break language barrier and allow the people around the world to communicate around the world with each other.

d. Systran became the first software provider to launch a Neural Machine Translation engine in more than 30 language pairs in 2016.

e. Microsoft brings AI-powered translation to end users and developers on Android, iOS, and Amazon Fire, whether or not they have access to internet

3. In a traditional machine Translation system, parallel corpus a collection of texts is used each of which, is translated into one or more other language than the original. for eg : given the source language eg. French and the target language eg :- English, multiple statistical models need to be build, including a probabilistic formulation using the Bayesian rule, a translation model $p(f|e)$ trained on the parallel corpus, and language model $p(e)$ trained on the English-only corpus.

4. It is obvious that, this approach skips hundreds of important details, ngawe a lot

Q.5 Explain the following terms:-

a. Phonology :-

It is the study of organizing sounds systematically in a NLP (Natural Language Processing) system. An example of phonology is the study of movements the body goes through in order to evoke sounds. such as the pronunciation of letter 't' in "bet". where the vocal chords stop vibrating leaving the 't' sound to be a result of the placement of tongue behind the teeth and the flow of air.

b. Morphology :-

morphology is the study of words internal structure of words. morphemes are the minimal unit of words that have a meaning and cannot be subdivided further. An example of morphology is "bare", free morpheme is "bad", and an example of a bound morpheme is "ly". It is bound because although it has meaning it cannot stand alone. It must be attached to another morpheme to produce a word.

c. Lexical Analysis :-

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

d. Syntatic Analysis :-
In syntatic Analysis the sentences are parsed as noun, verbs, adjectives and other parts of sentence. In this phase the grammer of the sentence is analyzed inorder to get the relationship among different words in sentence. for eg :- "mango eats me" will be rejected by syntatic analyzer.

e. Word Sense Disambiguation :-
While using word that have more than one meaning we have to select the meaning which makes the most sense in context. For example, we are typically given a list of words associated word senses eg from a dictionary or from an online source such as word net.