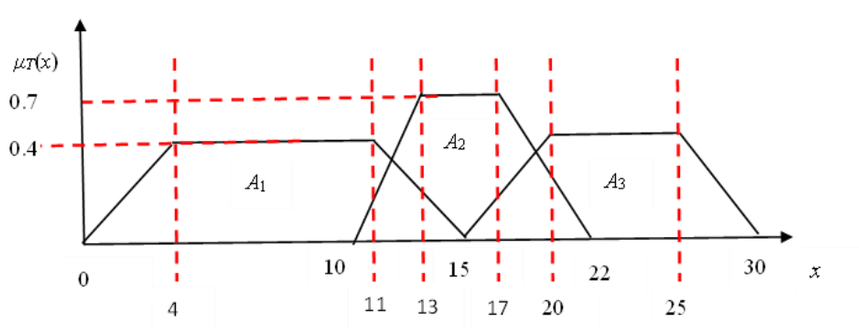
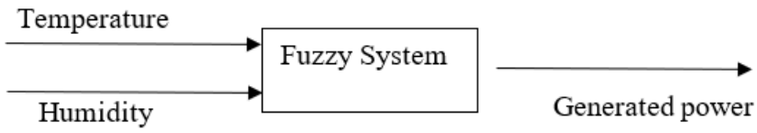
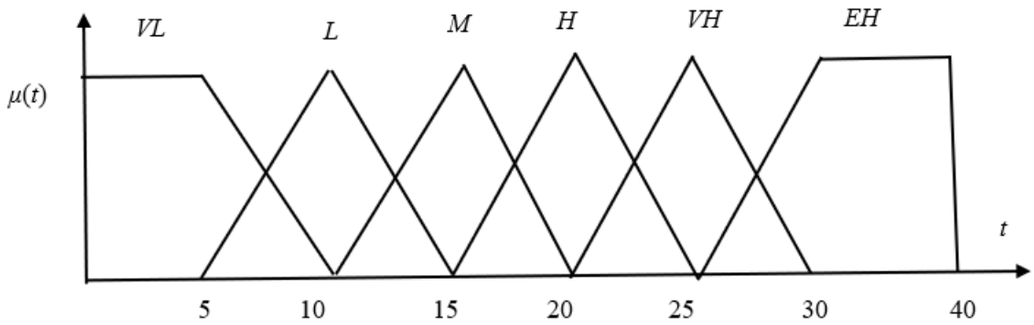
Course Code: CSE 417
Course Title: Artificial Intelligence
(Final Assignment)

1.	(a)	The aorta is a particular kind of artery which has a diameter of 2.5cm. An artery is a kind of blood vessel. An artery always has a muscular wall, and generally has a diameter of 0.4cm. A vein is a kind of blood vessel, but has a fibrous wall. Blood vessels all have tubular form and contain blood. Represent the given knowledge in: i) Semantic net and ii) Frame
	(b)	Tom is a cat. Tom caught a bird. Tom is owned by John. Tom is ginger in color. Cats like cream. The cat sat on the mat. A cat is a mammal. A bird is an animal. All mammals are animals. Mammals have fur. Represent the given knowledge in: i) Semantic net and ii) Frame
	(b)	Given, U = {p, q, r, s}, $\mu_A(p) = 0.2$, $\mu_A(q) = 0.7$, $\mu_A(r) = 0.18$, $\mu_B(s) = 0.15$, $\mu_B(p) = 0.3$, $\mu_B(q) = 0.6$, $\mu_B(r) = 0.15$, $\mu_B(s) = 0.1$. Write the fuzzy sets $A \cup B$, $A \cap B$, A^C and B^C.
	(c)	Differentiate between: i) Fuzzy and crisp. ii) Linguistic variable and linguistic values.
2.	(a)	Describe different steps of Fuzzy Inference System with appropriate block diagram.
	(b)	Determine De-fuzzified value x* of three trapezoidal MFs in figure 2(b) using the following methods: i) Center of sum (COS) method ii) Centroid method iii) Middle of Maxima iv) Weighted average method  Figure 2(b): De-fuzzified value x*

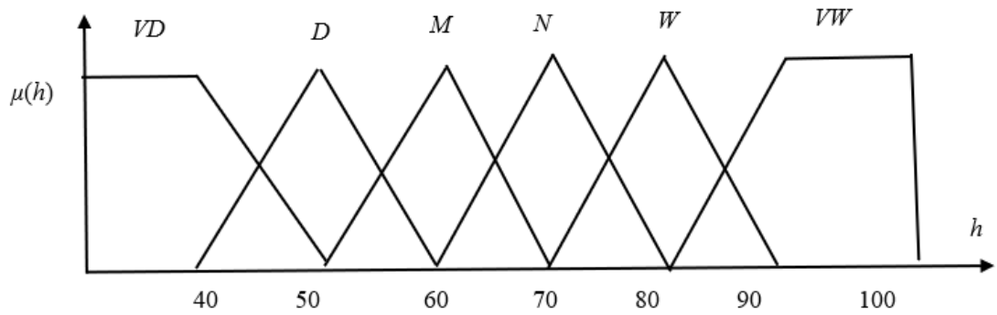
	(c)	Consider the following power generation control system of a generator of a multistoried building. The input and output fuzzy variables, fuzzy values and MFs are shown in fig.4.10.





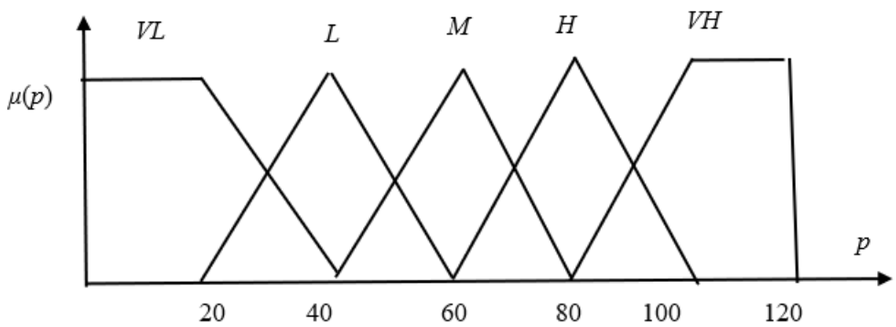
VL→ Very Low, *L* → Low, *M*→ Medium, *H*→ High, *VH*→ Very High, *EH*→ Extreme High

(a) Temperature in ^{0}C



VD→ Very Dry, *D* → Dry, *M*→ Medium, *N*→ Normal, *W*→ Wet, *VW*→ Very Wet

(b) Humidity in %



VL→ Very Low, *L* → Low, *M*→ Medium, *H*→ High, *VH*→ Very High

(c) Power generation in KW

Figure (a),(b) &(c): MFs of input and output fuzzy variables

Fuzzy rules:

Rule-1 If (Temperature is *VL*) and (Humidity is *VD*) then (Generated Power is *VL*)
Rule-2 If (Temperature is *L*) and (Humidity is *D*) then (Generated Power is *L*)
Rule-3 If (Temperature is *M*) and (Humidity is *D*) then (Generated Power is *M*)
Rule-4 If (Temperature is *M*) and (Humidity is *N*) then (Generated Power is *M*)
Rule-5 If (Temperature is *H*) and (Humidity is *W*) then (Generated Power is *H*)
Rule-6 If (Temperature is *VH*) and (Humidity is *W*) then (Generated Power is *H*)
Rule-7 If (Temperature is *VH*) and (Humidity is *VW*) then (Generated Power is *VH*)

Determine *Generated Power* at *Temperature* of 35^{0}C and *Humidity* of 89% using the centroid method.

3.	(a)	Consider, b = 9, d = 7. Count N_{DLS} and N_{IDS} using Iterative deepening.

(b)

Perform BFS or DFS (any one you would prefer) in the following graph considering the adjacency list provided in the right side.

Start State: h
Goal State: a

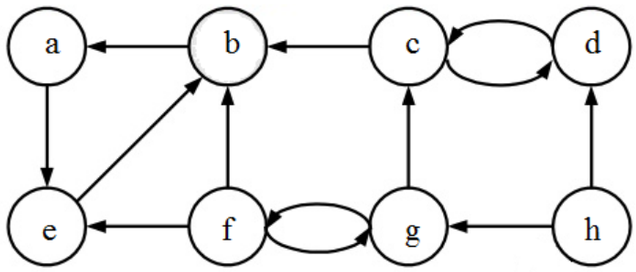


Figure: 4(b) Graph for searching

Adjacency List
a: e
b: a
c: b, d
d: c
e: b
f: b, c, g
g: c, f
h: d, g

(c) Perform iterative deepening in the following graph considering L=3. You do not need to simulate the entire procedure in the exam paper. Rather fillup the given table:

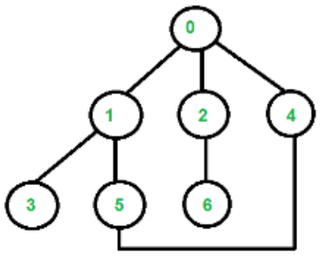


Figure 4(c): Graph for IDFS

Table 4(c): Table to fill out

Depth	Search Order
0	0
1	Find out the visiting order
2	Find out the visiting order
3	Find out the visiting order

(d) Consider the following graph.
Given start state as “a” and goal state “L”. Simulate the entire searching procedure using A* search algorithm.

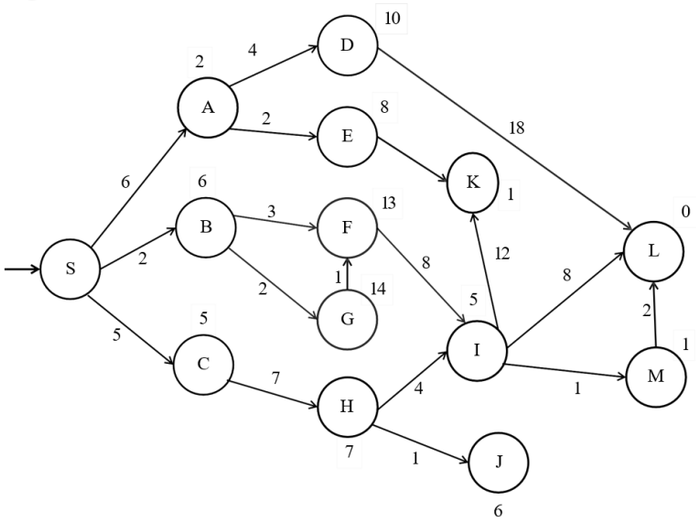
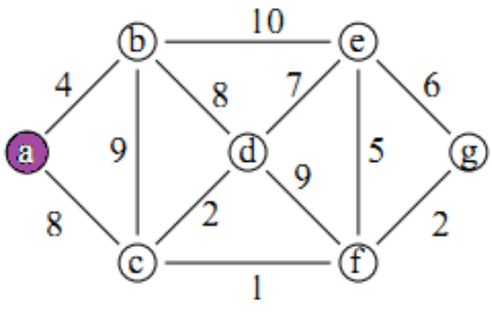


Figure 5(a): Graph for A* search

(e) Consider the following graph.
Given start state as “a” and goal state “g”. Simulate the entire searching procedure using best first search algorithm



4. (a) Solve the constrains satisfiable problem for the given constrains:

i) Variables: can take values from 0-9
ii) No two variables should take same value
iii) The values should be selected such a way that it should comply with arithmetic properties.

Expression:

	T	**W**	**O**
+	**T**	**W**	**O**
F	**O**	**U**	**R**

Find out the value of each variable.

Solve the constrains satisfiable problem for the given constrains:

iv) Variables: can take values from 0-9
v) No two variables should take same value
vi) The values should be selected such a way that it should comply with arithmetic properties.

Expression:

	C	**R**	**O**	**S**	**S**
+	**R**	**O**	**A**	**D**	**S**
D	A	N	G	**E**	**R**

Find out the value of each variable.

(b) In Missionaries and Carnivals Problem, initially there are some missionaries and some carnivals will be at a side of a river. They want to cross the river. But there is only one boat available to cross the river. The capacity of the boat is 2 and no one missionary or no Carnivals can cross the river together. How they will cross the river?
Consider: B: Boat T: Tiger G: Goat Gr: Grass

Solve the problem using mean end analysis.

(c) Every student is sincere
i) All who are sincere and hard worker will succeed in their career.
ii) Meena is hardworker
iii) Meena is student
Question: Will Meena Succeed in her career?
Solve this problem using prolog.

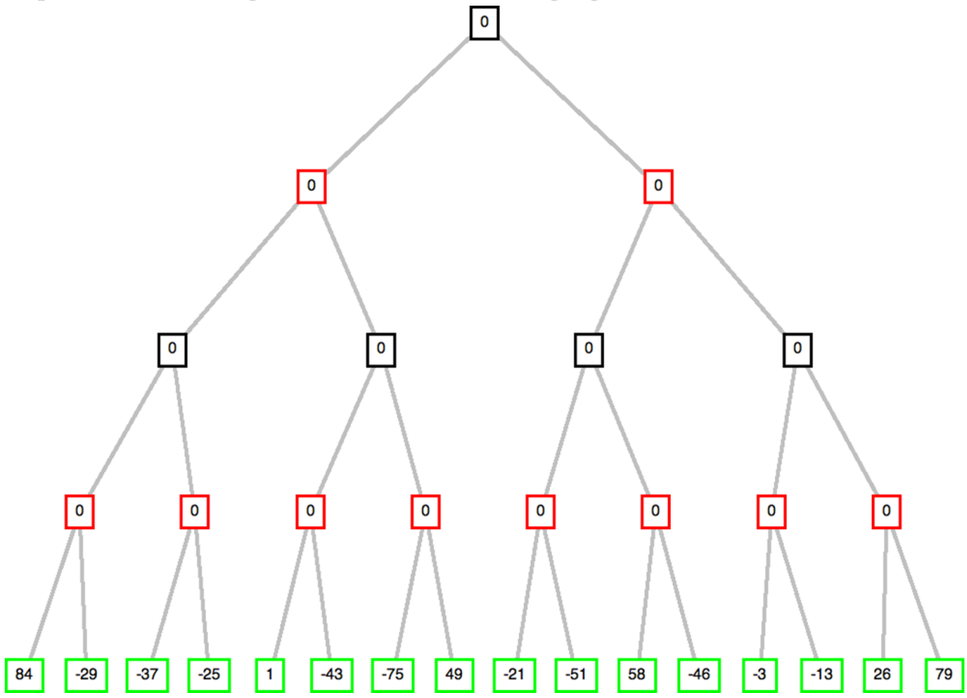
(d) Solve monkey banana problem using prolog.

(e) Solve family tree problem using prolog.

(f)

Symbol	**Meaning**	**Symbol**	**Meaning**
S	Sentence	N	Noun
NP	Noun Phrase	V	Verb
VP	Verb Phrase	P	Preposition
PP	Prepositional Phrase	ADJ	Adjective
Det	Determiner	AUX	Auxiliary Verb

Rules:

		S = NP + VP NP = NP + PP NP = DT + ADJ + NP | N NP = DT + NP | DT + N | N VP = VP + PP | V + NP | V|AUX+VP PP = P + NP Given grammar, construct parse tree for the following sentences: "The boys are playing with football."
	(g)	Explain mini-max algorithm with the following figure: 
	(h)	Database: A B C D E Knowledge Base: Y & D →Z X & B & E→ Y A→X C→L L&M→N Gather all the information using forward chaining.
	(i)	Database: A B C D E Knowledge Base: Y & D →Z X & B & E→ Y A→X C→L L&M→N Infer Goal Z using backward chaining.
	(c)	Explain the Structure of a rule-based expert system with appropriate block diagram.