THAPAR INSTITUTE OF ENGINEERING & TECHONOLOGY
SCHOOL OF MATHEMATICS & COMPUTER APPLICATIONS
End Semester Examination-15th December, 2006
AI & Applications(CA-301) ,MCA-Vth Semester

M.M:36 **Time: 3 Hour**

Note: Attempt any five questions. First five questions will be checked. Attempt all parts of a question at only one place.

1. **(a)** Use binary resolution to prove that "there is a green object" if we are given :-
If pushable objects are blue, then nonpushable ones are green.
All objects are either blue or green but not both.
If there is nonpushable object, then all pushable ones are blue.
Object01 is pushable
Object02 is not pushable **(4.5)**

   (b) Prove that composition of substitution set is associative .Is it commutative also. Give example to support your answer. **(2.7)**

2. **(a)** The following rewrite rules can be used to replace the numeral on the lefthand side with string of numeral on the right.

$6 \to 3,3$ $6 \to 4,2$ $4 \to 3,1$
$4 \to 2,2$ $3 \to 2,1$ $2 \to 1,1$

Consider the problem of using these rules to transform the numeral 6 into a string of 1's.Illustrate how algorithm AO^* works by using it to solve this problem. Assume that the cost of k-connector is k units and that the value of h function at node labeled by numeral 1 is zero and at node labeled by $(n), n \neq 1$ is n. **(4.5)**

   (b) Write an algorithm to perform breath first search of a problem graph. Make sure your algorithm works properly when single node is generated at more than one level. **(2.7)**

3. **(a)** How you will choose better heuristic for finding minimal path among two A^* heuristic h_1, h_2 .Elaborate with an example. **(2.0)**

   (b) consider the sliding puzzle problem consists of two red tiles and two green tiles and an empty space. The puzzle has two legal moves
A tile may move into an adjacent empty location.
A tile can move over an another tile into an empty location.
Apply best first search with data driven approach using heuristic function as the number of tiles out of place. The starting configuration is **(5.2)**

R	G		R	G

The goal configuration is

G	G		R	R

4. **(a)** Convert the facts of following Knowledge Base into conceptual graphs.

$(\forall X) food(X) \to like(john, X)$ $(\forall X)(\forall Y)[eat(X,Y) \wedge not\_killedby(X)] \to food(Y)$
$(\forall X) eat(bill, X) \to eat(sue, X)$ $eat(bill, peanut) \wedge not\_killedby(peanut)$ **(5.0)**

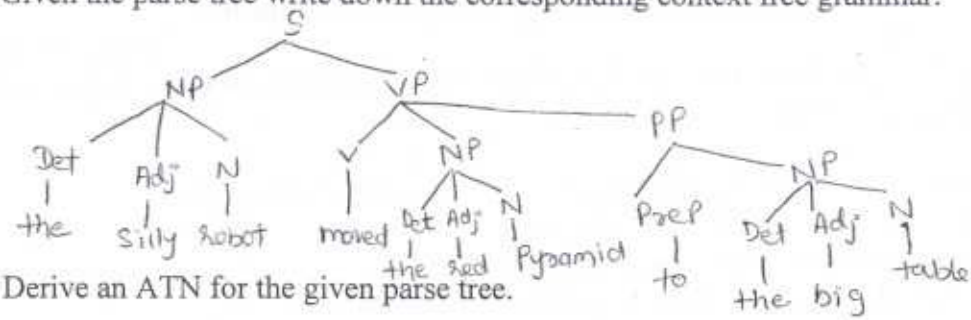
Infer from the derived graphs the fact 'peanut is a food'. What operations on graphs you needed to infer this fact.

   (b) Differentiate between script and frame structure. **(2.2)**

5. **(a)** Both case grammar and conceptual dependency provide representation of sentences in which noun phrase and described in termed of their semantic relationships to the verb. In what ways the two approaches similar. In what ways they are different . Is one a more general version of other. As an example compare the representation of the sentence **(3.0)**
" John break the window with a hammer".

(P.T.O)

(b) Given the parse tree write down the corresponding context free grammar.



Derive an ATN for the given parse tree. **(4.2)**

6. (a) Prove DeMorgan's Laws for fuzzy sets analytically. **(2.5)**

(b) Assume that the variables x, y, and z all take on values in the interval [0,5], and that the following membership functions and rules are defined:

low(t) = 1 - (t / 5)
high(t) = t / 5
rule 1: if x is low and y is low then z is low
rule 2: if x is low and y is high then z is high
rule 3: if x is high and y is low then z is high
rule 4: if x is high and y is high then z is low

Using product inferencing what should be value of z for x=4.2 and y=2.8 .Use Mean of Maxima for defuzzification. **(3.2)**

© Consider the fuzzy set $\tilde{A}$ *and* $\tilde{B}$ defined on interval $[0,6]$ of real number, by the membership function $\mu_{\tilde{A}}(x)=\frac{x}{x+1}$ $\mu_{\tilde{B}}(x)=2^{-x}$ .Determine the expression for (i) $(\tilde{A}-\tilde{B})$ (ii) $(\tilde{A}\cap\tilde{A}^{c})$ (iii) $(\tilde{A}\times\tilde{B})$ **(1.5)**

(a) What is meant by topology of artificial neural network . Give a few basic topological structures of artificial neural network? **(2.2)**

(b) Determine the weights of network with 4 inputs and 2 outputs using perceptron learning law with $f(x)=\frac{1}{1+e^{-x}}$ for the following input-output pairs. $\{([1100],[11]),\ [(0110),(00)]\}$ where $\eta = 0.01$ and weight matrix is $\begin{bmatrix}0.1 & 0.3\\ 0.2 & 0.6\\ 0.7 & 0.9\\ 0.9 & 0.5\end{bmatrix}$.(use initial weights to compute weights in both the cases) . **(3.0)**

© For a 5-unit feedback network the weight matrix is $\begin{bmatrix}0 & 1 & -1 & -1 & -3\\ 1 & 0 & 1 & 1 & -1\\ -1 & 1 & 0 & 3 & 1\\ -1 & 1 & 3 & 0 & 1\\ -3 & -1 & 1 & 1 & 0\end{bmatrix}$,Assuming that the threshold and input of each unit to be zero ,Compute the energy at the state $[-11111]$ **(2.0)**