**Akhbar Alyom Academy**
**Computer Engineering Department**
**Artificial Intelligence**
**Third Year**
**Time: 3 hours** **January 2011**

**Answer All Questions**

**Question 1:**

a) Using a truth table, show that the sentence $((P \wedge Q) \rightarrow R) \equiv (\neg P \vee Q \vee R)$ is true or false.

b) A new operator, $\oplus$may be defined by the following truth table:

| P | Q | P ⊗Q |
|---|---|---|
| T | T | F |
| T | F | T |
| F | T | T |
| F | F | F |

Create a propositional calculus expression using only $\wedge$, $\vee$, and $\neg$ that is equivalent to P ⊗Q. Prove their equivalence using truth tables.

**Question 2:**

a) Attempt to unify the following pairs of expressions. Either show their most general unifiers or explain why they will not unify.
   i) ancestor(A,B) and ancestor(aly,father(aly)).
   ii) q(A,A) and q(x,y).
   iii) q(A,B) and q(x,C).
   iv) p(A) and $\neg$ p(x).
   v) ancestor(A,father(A)) and ancestor(kareem,hassan).

b) What are the stem and the root of the following words?
**, , readable, , Direction, , Rechargeable, Books,**

**Question 3:**

a) Compare between the Knowledge acquisition and Knowledge elicitation.
b) List some of difficulties in knowledge elicitation.
c) Explain the Spiral Model For Expert System Development.
d) Represent the following statements in Semantic Net representation
   All Insects are Invertebrates.
   Bee is an Insect, and Insect is an Invertebrates.
   Invertebrates have no Backbone.
   All Invertebrates eat Anemones.
   Bees hibernate from fall to winter.

**Question 4:**

Build a finite state acceptor that recognizes the following strings of two characters {a,b}:
a) That end in "aaa".
b) That contain "bbb" but not more than three consecutive "b"s.
c) That contain "abb" but not contain more than two consecutive "b"s.
d) That end in "abb".
e) That contain "abb".

**Question 5:**

Consider the following rules:
Rule1: if the stem shape is spindly, and the soil salinity is high,
then the disorder is Powdery Mildew.
Rule2: if the stem shape is not spindly, and the leaf status is not curly up,
then the disorder is Downy Mildew.
Rule3: if the stem shape is not spindly, and the leaf status is curly up
then the disorder is the Nitrogen Deficiency.
Rule4: if the soil status is smooth, and the soil color is light
then the soil salinity is high.
Suppose the soil status is smooth, and the soil color is light, and the stem shape is spindly, simulate the following:
i. The back chain and its explanation model by the goal "the disorder is X".
ii. The forward chain

**Good Luck**