

BITS PILANI, DUBAI CAMPUS
Dubai International Academic City, Dubai
First Semester 2012-13
Comprehensive Exam (Closed Book)

No. of Questions: 8

No. of Pages : 3

Course Number & Title : EA C461 – Artificial Intelligence Marks : 40 Weightage : 40%

Duration : 3 Hours Date: 3-1-13 Time: 12.30PM – 3.30PM Year : IV year

Note: Answer all questions in sequence.

1. Consider the water jug problem with the following information given

States: Determined by the amount of water in each jug.

State Representation: Two real-valued variables, J_3, J_4 , indicating the amount of water in the two jugs, with the constraints: $0 \leq J_3 \leq 3, 0 \leq J_4 \leq 4$

Initial State Description

$J_3 = 0, J_4 = 0$

Goal State Description:

$J_4 = 2$ Represent the following search state space. 3M

2. Consider the search space below, where S is the start node and $G1, G2,$ and $G3$ satisfy the goal test. Arcs are labeled with the cost of traversing them and the h function's values are reported beside the graph. For each of the following search strategies, indicate which goal state is reached (if any) and list, in order, all the states popped off of the OPEN list. When all else is equal (i.e., to break ties), nodes should be placed in OPEN in alphabetical order.

- | | |
|------------------------|--|
| a. Breadth First | e. Best-first (using $f = h$) |
| b. Depth First | f. Best-first (using $f = g + h$) |
| c. Iterative Deepening | g. Beam Search (with beam width = 2 and $f = h$) |
| d. Uniform Cost | h. Hill Climbing (using the h function only) 8M |

P. T. O.

- o P has parents $A, F, H,$ and J
- o S has parents $A, C, D, J,$ and P
- o Z has parent Y

Draw this Bayesian network and next to each node report how many cells are needed to store that node's *conditional probability table* (CPT). Explain your answer (you need not explain your answer within your drawing of the Bayesian network - it is fine to place your explanation below your drawing). Finally, report the total number of cells needed to store this Bayesian network (be sure to count the memory needed to store the *parent* links - assume each link uses the same number of bytes as one cell in a probability table, i.e, each parent link counts 1). (1 + 1 + 3M)

6. a. The sample space S is described as integers from 1 to 15 and is partitioned as

E1: integers from 1 to 8

E2: integers from 9 to 15

If E is the event "Even Number" then the probabilities for the situation $P(E1/E)$ can be described in two different using Bayes theorem. Give both the expressions, explain the formula in plain English and calculate the value of $P(E1/E)$ using both methods. 4M

b. Given the following conditional probability table

	Toothache	\neg Toothache
Cavity	0.04	0.06
\neg Cavity	0.01	0.89

Calculate the following

- i) $P(\text{Toothache})$
- ii) $P(\text{Toothache} \vee \text{Cavity})$ 2M

7. a. What is competitive learning in Neural networks ? How and where is it used ? Give the algorithm which explains the working of the Competitive learning algorithm.

b. Explain how the neural network can be trained for character recognition.

c. Usually a feed forward neural network is trained with the back propagation algorithm, how would you train the same neural network with Genetic algorithms. (3+2+2M)

8. a. What is the significance of an hypothesis in learning? How and why is the hypothesis refined?

b. What is meant by ensemble learning ?

c. Explain with examples lists, atoms, symbolic expressions used in LISP (2 + 1 + 1M)

*****ALL THE BEST*****

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First Semester 2012-13
Test – 2 (Closed Book)

No. of Questions: 5

No. of Pages : 2

Course Number& Title : EA C461 – Artificial Intelligence Marks : 20 Weightage : 20%

Duration : 50 minutes Date: 9- 12-2012 Time:155PM – 2.40PM Year : IV year

Note : Answer All Questions

Only prescribed textbook, reference book and hand written class notes are Permitted.

Calculators permitted

1. Consider five facts about a lecture to be given by Manuela. Remember that the possibility of the faculty being late is higher in bad weather.

T: The lecture started by 10:35

L: The lecturer arrives late

R: The lecture concerns robots

M: The lecturer is Manuela

S: It is sunny

Draw a Bayesian network to represent these facts and give the CPT with fictitious values. 4M

2. After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for a serious disease and that the test is 99% accurate. The good news is that this is a rare disease, striking only 1 in 10,000 people of your age. Why is it good news that the disease is rare ? What are the chances that you actually have the disease? 4M

P. T. O.

3. a. Draw the neural network representation for a network with 3 units in the input layer, two layers of hidden layer where each layer contains 3 nodes and ^{two} three nodes in the output layer. The weight matrices are as specified below. Remember to consider the bias input. 3M + 3 M

$$\begin{bmatrix} 0.1 & -0.3 & -0.7 \\ 0.2 & 0.7 & -0.6 \\ 0.9 & 0.6 & 0.4 \\ -1.6 & 0.23 & 0.35 \end{bmatrix}$$

I/P to hidden layer

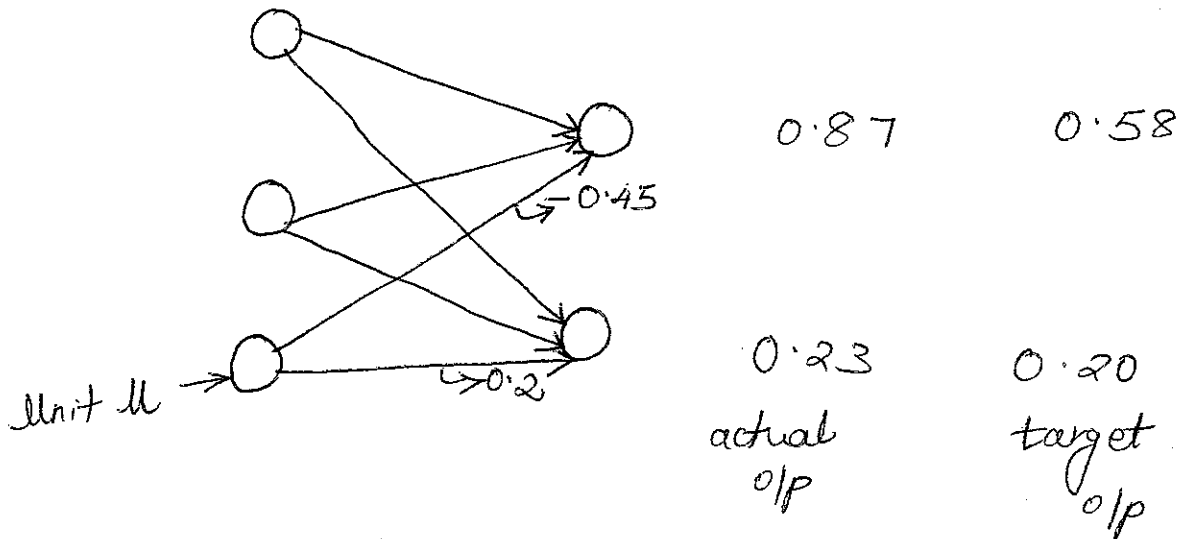
$$\begin{bmatrix} 0.23 & 0.35 & -0.76 \\ 0.90 & -0.23 & -0.65 \\ 0.1 & -0.45 & -0.12 \\ 0.7 & 0.65 & 0.31 \end{bmatrix}$$

hidden layer 1 to
hidden layer 2

$$\begin{bmatrix} -0.1 & 0.9 \\ 0.35 & 0.40 \\ 0.12 & 0.45 \\ 0.43 & -0.80 \end{bmatrix}$$

hidden layer 2 to O/P layer

b. Consider the given figure which shows a hidden layer and the output layer of a feed forward network. Calculate the error for the hidden unit U given that its activation for the pattern being processed is currently 0.64.



4. Represent the following facts using a semantic network. A bluebird is a small blue colored bird and a bird is a feathered flying vertebrate. From this figure how would you deduce information about the movement of the bluebird. 4M

5. a. What is the significance of Relational probability models
 b. Define a Polytrees and explain its importance 1 + 1 M

*****ALL THE BEST*****

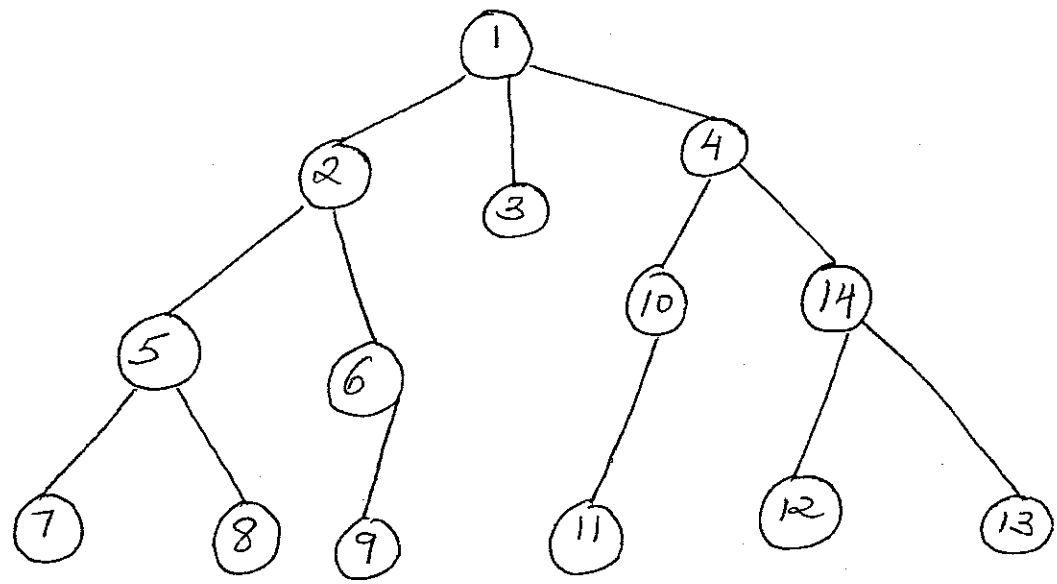
BITS PILANI, DUBAI CAMPUS
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First Semester 2012-13
Test – 1(Closed Book)

No. of Questions: 5
No. of Pages : 2

Course Number & Title : EA C461 – Artificial Intelligence Marks : 25 Weightage : 25%
 Duration : 50 minutes Date: 16- 10-2012 Time:11.10 AM – 12.00PM Year : IV year

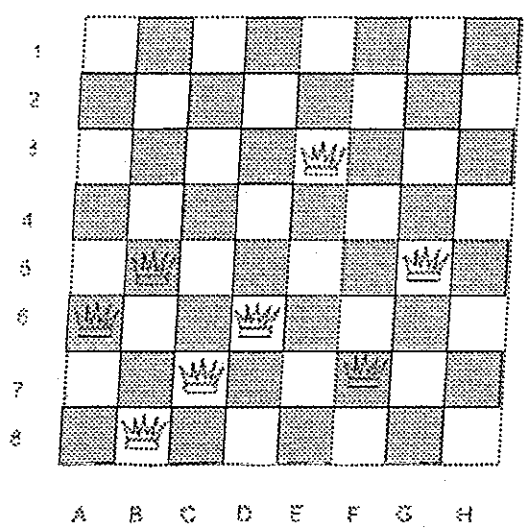
Note : Answer All Questions

1. In the given figure give the sequence in which the nodes are explored using
 i) Breadth first search ii) Depth first search iii) Iterative deepening search. (1 + 1 + 1M)



2.

2. Suppose you are using a gradient descent search with the evaluation function “number of queens which are threatened by another queen” in the 8-queens problem. Suppose that you’re at the following board state:

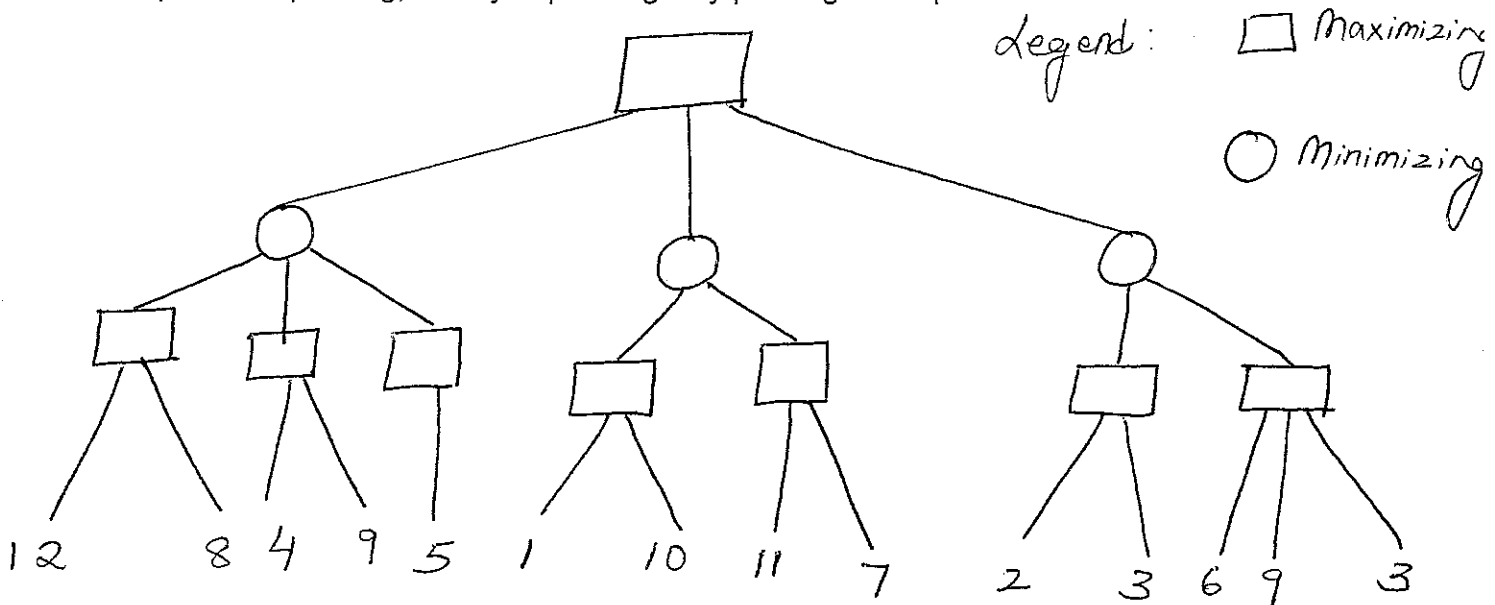


- 2a) What is the current score for the evaluation function?
- 2b) Write down some of the best moves from this position (queens can be moved anywhere).
- 2c) Give an example of an illegal move (in a gradient descent search).
- 2d) What do you do if there are no legal moves?

4M

3. Clearly differentiate between the terms informed search and uninformed search. What type of search is the A* algorithm? Explain the working of the A* search with a detailed algorithm. 5M

4. For the given two ply game tree, clearly indicate the nodes which will be pruned by alpha beta pruning, clearly explaining why pruning takes place. 3M



5. The given statements represent certain facts, represent each of these statements as individual predicate logic statements and answer the question asked using resolution.

Anyone passing his history exams and winning the lottery is happy. But anyone who studies or is lucky can pass all his exams. John did not study but John is lucky. Anyone who is lucky wins the lottery.

Question: Is John happy?

(3 + 3 + 4 M)

*****ALL THE BEST*****

BITS PILANI, DUBAI CAMPUS
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First Semester 2012-13
Quiz – II(Closed Book)

No. of Questions: 4

No. of Pages : 3

Course Number & Title : EA C461 – Artificial Intelligence Marks : 7 Weightage : 7%

Duration : 20 minutes Date: 4- 12-2012 Time:11.30 AM – 11.50AM Year : IV year

NAME: _____ ID NO: _____

1. Give the output of the following statements. (0.25M X 4 = 1M)

a. (`> (* 5 6) (+ 4 5)`)

b. (`member 7 '(1 2 3 4 5)`)

c. (`match '(likes bill ?) '(likes ? wine)`)

d. (`cdr(cons 1 '(2 3 4))`)

2. Distinguish between `setq` and `let` functions in LISP with examples. 1M

Training data

rec	Age	Income	Student	Credit rating	Buys computer
r1	<=30	High	No	Fair	No
r2	<=30	High	No	Excellent	No
r3	31...40	High	No	Fair	Yes
r4	>40	Medium	No	Fair	Yes
r5	>40	Low	Yes	Fair	Yes
r6	>40	Low	Yes	Excellent	No
r7	31...40	Low	Yes	Excellent	Yes
r8	<=30	Medium	No	Fair	No
r9	<=30	Low	Yes	Fair	Yes
r10	>40	Medium	Yes	Fair	Yes
r11	<=30	Medium	Yes	Excellent	Yes
r12	31...40	Medium	No	Excellent	Yes
r13	31...40	High	Yes	Fair	Yes
r14	>40	Medium	No	Excellent	No

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First Semester 2012-13
Quiz – 1(Closed Book)

No. of Questions: 3

No. of Pages : 2

Course Number & Title : EA C461 – Artificial Intelligence Marks : 8 Weightage : 8%

Duration : 20 minutes Date: 30- 10-2012 Time:11.30 AM – 11.50AM Year : IV year

NAME: _____ ID NO: _____

1. Consider a propositional language with two propositional constants - *purple*, and *poisonous* - each indicating the property suggested by its spelling. Using these propositional constants, encode the following English sentences as Propositional Logic sentences. 4 X .5 = 2M
- a. An object is poisonous if it is purple.
- b. An object is poisonous only if it is purple.
- c. An object is poisonous if and only if it is purple.
- d. An object is poisonous unless it is purple.

P.T.O

2. Solve the given propositional logic statements using truth tables and justify whether the statements are valid, tautology or a contradiction. 2 + 2M

a. $(p \Rightarrow q) \wedge (p \Rightarrow \neg q)$

b. $p \wedge (p \Rightarrow \neg q) \wedge q$

3. Represent the following sentences in predicate logic 2M

a. people who like cats are nice but not happy.

b. My cat named Fred likes a dog named Dolly but does not like a dog named Max.