Course Number& Title : EA C461 – Artificial Intelligence
Maximum Marks : 80   Weightage : 40%   Duration : 50 minutes
Date: 1-6-2014   Time:12.30PM – 3.30PM   Year : IV year _____

Note : Answer All Questions

1. Consider the problem of the delivery robot finding a path from location *o103* to location *r123* in the domain depicted in Figure 1 which shows the resulting graph where the nodes represent locations and the arcs represent possible single steps between locations. In this figure, each arc is shown with the associated cost of getting from one location to the next.
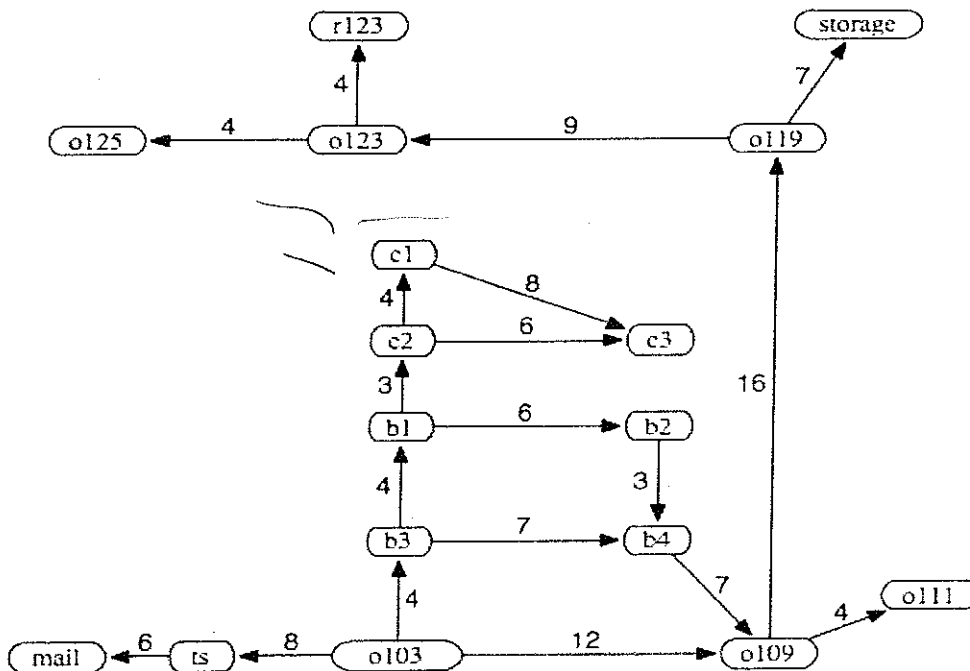
Figure 1

The heuristic values given below estimate the cost of getting from a particular state to the goal state.

h(mail) = 26	h(ts) = 23	h(o103) = 21
h(o109) = 24	h(o111) = 27	h(o119) = 11
h(o123) = 4	h(o125) = 6	h(r123) = 0
h(b1) = 13	h(b2) = 15	h(b3) = 17
h(b4) = 18	h(c1) = 6	h(c2) = 10
h(c3) = 12	h(storage) = 12	

ii) If a program cannot be told a fact, then it cannot learn that fact.   (2+2M)

b. Draw the truth table for a two input X-OR gate and write a wff in propositional logic using connectives ~, V , and Λ which is equivalent to (X1 xor X2).Use metasymbols T and F.   2M

c. Construct truth tables for the following propositional forms. By inspection of the tables indicate if it is a tautology, satisfiable or a contradiction. Use metasymbols T and F.

i) $(p \to q) \leftrightarrow (q \to p)$

ii) $(p \leftrightarrow (q \wedge r))$ (2+2M)

5.a. If E and F are events such that P(E) = ¼ and P(F)=1/2 and P(E & F) =1/8 find

i) P(E or F)   ii) P(not E & not F)   (1+1M)

b. In your local nuclear power station, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean variables A (alarm sounds), FA (alarm is faulty), and FG (gauge is faulty) and the multivalued nodes G (gauge reading) and T (actual core temperature).

i) Draw a Bayesian network for this domain, given that the gauge is more likely to fail when the core temperature gets too high.
ii) Is your network a polytree? Why or why not?
iii) Suppose there are just two possible actual and measured temperatures, normal and high;the probability that the gauge gives the correct temperature is x when it is working, but y when it is faulty. Give the conditional probability table associated with G.
iv) Suppose the alarm works correctly unless it is faulty, in which case it never sounds. Give the conditional probability table associated with A.   (2+1+3+2M)

6.a.   Consider the following sequence of positive and negative training examples describing the concept "pairs of people who live in the same house." Each training example describes an **ordered** pair of people, with each person described by their gender, hair   color (black, brown, or blonde), height (tall, medium, or short), and nationality. (US,French, German, Irish, Indian, Japanese, or Portuguese).

+ ((male brown tall US) (f emale black short US))
+ ((male brown short French)(female black short US))
- ((female brown tall German)(f emale black short Indian))
+ ((male brown tall Irish) (f emale brown short Irish))

Consider a hypothesis space defined over these instances, in which each hypothesis is represented by a pair of 4-tuples, and where each attribute constraint may be a specific value, "?," or "0," .

b. Suppose that the points {(-1,1),(-1 ,-1), (1,-1)} belong to class A and that {(-2,-2),(1,1)(2,2)(4,1)} belong to class B. Show that the classes are not linearly separable.

2M

c.Find the weights of a Hopfield Network to store the pattern [1 -1 -1 1 1]   2M

d. What is the main task performed by the following Neural networks
i) Kohenon NN
ii) Hopfield NN

2M

e. If you were to design a NN for weather forecasting, briefly describe how you would go about designing the network, what would be the input and the output parameters and what would be the role of weights in the network.   2M

9.a. If you had a class at 10 AM in the morning, use a decision tree to model all the different parameters which would help you in making up your decision of whether you would attend class or not.   3M

b. There is a hit and run case which the Mumbai police is trying to solve, the culprit must be either Bansal (B), Joshi (J) or Shinde (S). The mystry is to be solved using Dempster Shafer theory, the event and the mass probability is given below.

Calculate
 i) Belief (B)
 ii) Belief (B,J)
 iii) Plausibility (B,J)   3M

Event	Mass
No-one is guilty	0
B is guilty	0.1
J is guilty	0.2
S is guilty	0.1
either B or J is guilty	0.1
either B or S is guilty	0.1
either S or J is guilty	0.3
One of the 3 is guilty	0.1

c.When would you use a fuzzy controller in a plant. With the help of a figure illustrate the different components which go into making a fuzzy logic controller block.   3M

Course Number& Title : EA C461 – Artificial Intelligence
Maximum Marks : 40   Weightage : 20%   Duration : 50 minutes
Date: 13-4-2014   Time:8.25AM – 9.15AM   Year : IV year

Note : Answer All Questions

1. Consider the following axioms:
   a. All hounds howl at night.
   b. Anyone who has any cats will not have any mice.
   c. Light sleepers do not have anything which howls at night.
   d. John has either a cat or a hound.

   Given the above axioms prove that " If John is a light sleeper, then John does not have any mice" using resolution.   10M

2. While watching a game of Champions League football in a cafe, you observe someone who is clearly supporting Manchester United in the game. What is the probability that they were actually born within 25 miles of Manchester ? Assume that:

   • the probability that a randomly selected person in a typical local bar environment is born within 25 miles of Manchester is 1/20 , and;
   • the chance that a person born within 25 miles of Manchester actually supports United is 7/10 ;
   • the probability that a person not born within 25 miles of Manchester supports United with probability 1/10 .   5M

3. Use a Semantic Network for the following representations :
   a. Jack is a small, overweight American boy.
   b. Tim gave a burger from Burger King to his friend Josh. (2+3M)

1

5. Given the following data about traffic conditions.

Example	Attributes				Target
	Hour	Weather	Accident	Stall	Commute
D1	8 AM	Sunny	No	No	Long
D2	8 AM	Cloudy	No	Yes	Long
D3	10 AM	Sunny	No	No	Short
D4	9 AM	Rainy	Yes	No	Long
D5	9 AM	Sunny	Yes	Yes	Long
D6	10 AM	Sunny	No	No	Short
D7	10 AM	Cloudy	No	No	Short
D8	9 AM	Rainy	No	No	Medium
D9	9 AM	Sunny	Yes	No	Long
D10	10 AM	Cloudy	Yes	Yes	Long
D11	10 AM	Rainy	No	No	Short
D12	8 AM	Cloudy	Yes	No	Long
D13	9 AM	Sunny	No	No	Medium

a. Calculate the Entropy and information of the different attributes

b. Which node would you suggest to be the root node ?

c. Give a possible decision tree for the above data.   (5+2+3M)

BITS PILANI, DUBAI CAMPUS
Dubai International Academic City, Dubai
Second Semester 2013-14
Test – 1(Closed Book)

No. of Questions: 4
No. of Pages   : 2

Course Number& Title : EA C461 – Artificial Intelligence
Marks : 25   **Weightage : 25%**   **Duration : 50 minutes**
**Date: 23-2-2014**   **Time:8.25AM – 9.15AM**   **Year : IV year**

Note : Answer All Questions

1. 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 estimated cost to a goal is reported inside nodes.

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, nodes should be removed from OPEN in alphabetical order.
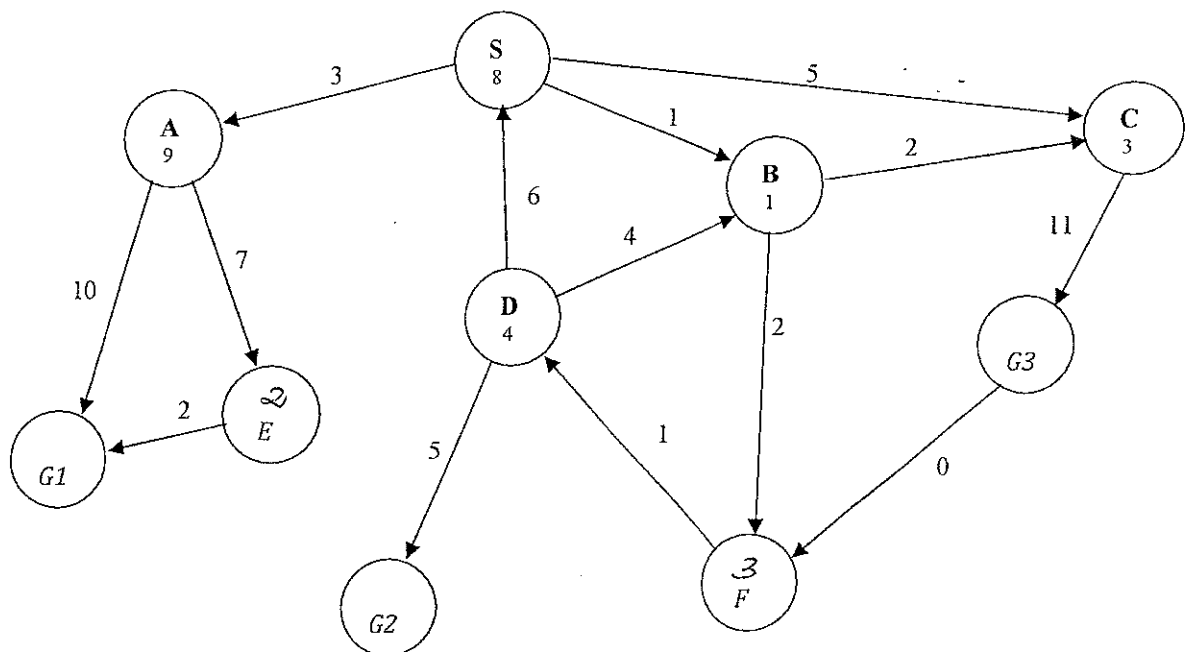
Using   a. Iterative Deepening (without considering cost)
          b. Hill Climbing
          c. A*   5M

BITS PILANI, DUBAI CAMPUS

Dubai International Academic City, Dubai

Second Semester 2013-14

Quiz – 1(Closed Book)

Course Number& Title : EA C461 – Artificial Intelligence

Marks : 16   Weightage : 8%   Duration : 20 minutes

Date: 16-3-2014   Time:8.40AM – 9.00AM   Year : IV year

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1. Convert the following statements to well formed formulas.

a. If it does'nt rain on Sunday, John will go to the mountains.

b. Tweety is a cute, yellow canary.

c. Some people like cheese.

d. If wishes were horses, beggers would fly.

e. If a dog is a good dog and has a master than he will be with his master.

[1+1+1+1+2M]

2. Convert the following statement to the CNF form

$$((P \to Q) \wedge (Q \to R)) \to (P \to R) \qquad 5M$$

3. Represent the following statements in predicate logic. All cats like fish, cats eat everything they like and Ziggy is a cat. Now answer the question " Does Ziggy eat fish ? " using backward chaining.   5M