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1. Single choice

1. a) The knowledge engineer and human expert discuss the knowledge required of the expert system.

2. a) SAP System.

3. d) The soma is modelled by a neuron in an artificial neuron network.

4. a) An artificial neuron network consists a number of neurons.

5. b) The neuron behaviour is determined by the result of the weighted sum and the activation function.

Short Question

2.1. Model based reflex ~~system~~ agents:

=> A model based reflex agent is one that uses which uses it's ~~p~~percept history and it's internal memory to make decisions about an internal "model" of the world around it. Internal memory allows these agents to store some of navigation history ~~and~~ then use semi-subjective history to help understand things about their current environment. Here a percept is a lasting result of something we have perceived. The works of model based reflex agents are;

* It works by finding a rule whose condition matches the current situation.
* It can handle partially observable environments.

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2.1

* updating the state requires information about how the world evolves independently from the agent and how the agent actions affect the world.

So, we can know that these agents simply decide actions based on their current percept and it uses the same process to estimate whether any others ~~cars~~ change to avoid causing a collision.

2.2/ Simulated Annealing :- The name of the algorithm comes from annealing in metallurgy. A tecnique involving heating and controlled cooling of a meterial to increase the size of it's crystals and reduce their defects. Both are attributes of the material that depend on their thermodynamic free energy. Heating and cooling the material affects both the temperature and the thermodynamic free energy or Gibbs energy. Simulated anneling can be used for very hard computational optimization problems where exact algorithms fail; even though it usually achieves an approximate solution to the global

2.2

minimum, it could be enough for many partical problems.

The problems solved by SA are currently formulated by an objective function of many variables, subject to several constraints. In practice, the constraint can be penalized as part of the objective function.

In this algorithm, we define an initial temperature, often set as 1, and a min. temperature on the order of 10^-4. The current temperature is mutiplied by some fraction alpha and thus decreased until it reaches the minimum temperature.

For each distinct temperature value, we run the core optimization routine a fixed number of times. The optimizati-on routine consists of finding a neighboring

2.2

solution and accepting it with probability e^(f(c)-f(n)) where c is the current ~~perturbation~~ solution and n is the neighboring solution.

A neighboring solution is found by applying a slight perturbation to the current solution. This randomness is useful to escape the common pitfall of optimization heuristics- getting trapped in local minima. By potentially accepting a less optimal solution than we have and accepting it with probability inverse to increase in cost, the algorithm is more likely to converge near global optimum. Designing a neighbor function is quite tricky and must be done on a case by case basis, but below are some idas for finding neighbors in locational optimization problems.

2.2

Move all points 0 or 1 units in a random direction.

Shift input elements randomly.

Swap random elements in input sequence

Permute input sequence

Partition input sequence into a random number of segments and permute segments.

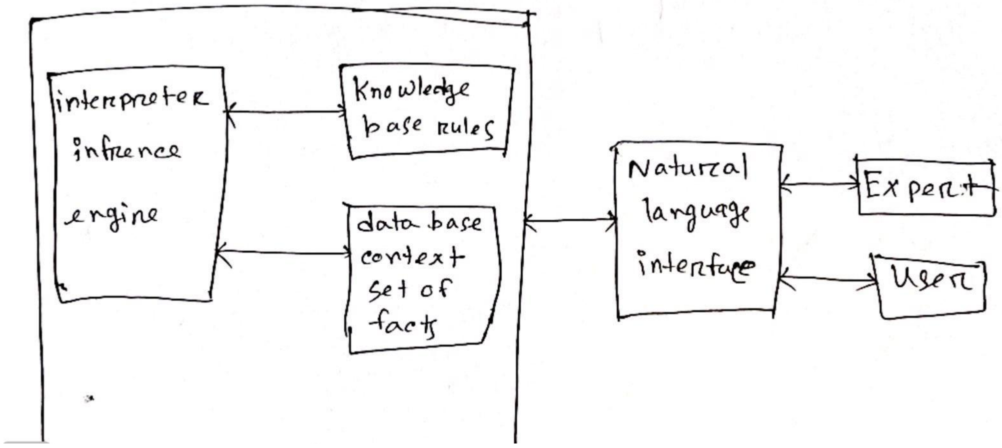
Expert systems: One of the largest area of applications of artificial intelligence is in expert systems or knowledge based systems as they are often known. This type of system seeks to exploit the specialised skills or info held by of a group of people on specific areas. It can be thought of as a computerised consulting service. It can also be called an information guidance system. Such systems are used ~~ofor~~ prospecting medical diagonis or as educational aids. They are also used in engineering and manufacture in the control of robots where they inter-relate with vision systems. The initial attempts to appy artificial intelligence to generalised problems made limited progress as we have seen but it was soon realized that more significiant process could be made if the field was restricted

Structure:

The internal structure of an expert system can be considered to consist of three parts

① the knowledge base;
② the database;
③ the rule interpreter.

This is analogous to the production system where we have the set of productions; the set of facts held as working memory and a rule interpreter.



2.4

The list of the main research areas of artificial intelligence are:

1. Expert systems: Exaples - flight-tracking systems, Clinical systems.

2. Natural Language processing: Examplex - Google now feature, speech recognition, Automatic voice output.

3. Neural Networks: Examples - Pattern recognition system such as face recognition, character recognition, hand writing recognation.

2.4

4. Robotics : ~~Expample~~ Examples – Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving etc.

5. Fuzzy logic systems : Examples – consumer electronics, automobiles etc.

2.5

PEAS of this Wumpus world:

The precise definition of the task environment is given by the PEAS description: performance measure +1000 for climbing out of the cave with the gold, -1000 for failling into a pit or being eaten by the wumpus, -1 for each action taken and -10 for using the arrow.

The wumpus world is a simple world example to illustrate of a knowledge based agent and to represent knowledge representation. It was inspired by a video game Hunt the Wumpus by Gregory Yob in 1973.

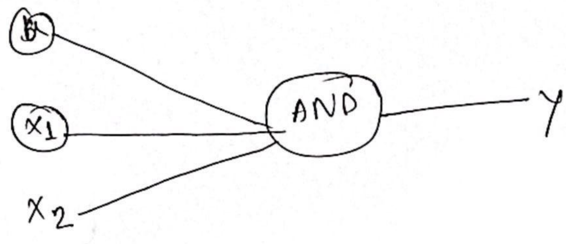
2.5

The Wumpus world is ~~the~~ a cave which has 4/4 rooms connected with passage ways. So there is total 16 rooms which are connected with each other. We have a knowledge based agent who will go forward in this world. The cave has a room with a beast which is called Wumpus, who eats anyone who enters the room. The Wumpus can be shot by the agent, but the agent has a single arrow. In the Wumpus world, there are some pits rooms which are bottomless, and if agent fall in pits, then he will be stuck there forever. The exciting thing with this cave is that in one room there is a possibility of finding a heap of gold.

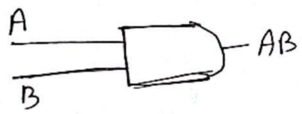
So the agent goal is to find the gold and climb out the cave without fallen into pits or eaten by wumpus. The agent will get a reward if he comes out with gold and he will get a penalty if eaten by wumpus or falls in the pit.

3.1

a) Draw a neural network used to separate and operator:



b)

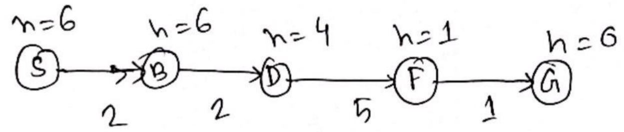


A	B	output
0	0	0
0	1	0
1	0	0
1	1	1

3.2

e) A^* search :

We know : $f(n) = g(n) + h(n)$



$g(n) = 2+2+5+1 = 10$

$h(n) = 0$ (for the goal state)

$\therefore f(n) = g(n) + h(n)$

$= 10 + 0$

$= 0.$

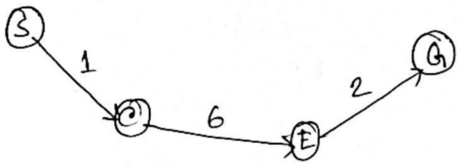
$\therefore$ the final path is : $S \rightarrow B \rightarrow D \rightarrow F \rightarrow G$

$= (2+2+5+1+0)$

$= 10.$

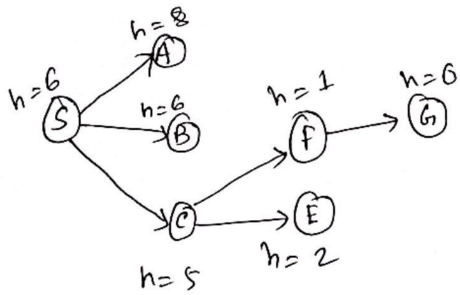
3.2

a) Uniform - cost search : Initial state S and goal state G, final path for this search is below -



path : S → C → E → G = 1+6+2 = 9.

b) Greedy search : final path :



final path is : S → C → F → G.

3.3

for drawing the ~~dest~~ decision tree, first we find the root node, the target class is 'Risk'.

Here,

$$I(h,m,l) = \frac{-h}{h+m+l}\log_2\left(\frac{h}{h+m+l}\right) - \frac{m}{h+m+l}\log_2\left(\frac{m}{n+m+l}\right) - \frac{l}{h+m+l}\log_2\frac{l}{h+m+l}$$

$$E(A) = \sum_{i=1}^{h} \frac{h_i+m_i+l_i}{h+m+l}$$

$$G(A) = I(h,m,l) - E(A)$$

here, $h(6) + m(3) + l(6) = 15$

~~Gain~~

Information gain (risk),

$$I(6,3,6) = \frac{-6}{15}\log_2\left(\frac{6}{15}\right) - \frac{3}{15}\log_2\left(\frac{3}{15}\right) - \frac{6}{15}\log_2\left(\frac{6}{15}\right)$$

$$= 1.5.$$

3.3

Credit history:

I (bad), $I(3,1,1) = \frac{-3}{5}\log_2\left(\frac{3}{5}\right) \log_2\left(\frac{1}{5}\right) - \frac{1}{5}$

$\log\left(\frac{1}{5}\right)$

$= 1.36.$

I (unknown), $I(2,1,2) = \frac{-2}{5}\log_2\left(\frac{2}{5}\right) - \frac{1}{5}$

$\log_2\left(\frac{1}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right)$

$= 1.5$

I (good), $I(1,1,3) = \frac{-1}{5}\log_2\left(\frac{1}{5}\right) - \frac{1}{5}\log_2\left(\frac{1}{5}\right)$

$- \frac{3}{5}\log_2\left(\frac{3}{5}\right)$

$= 1.36.$

Entropy (c.H). E. (c.H) $= \frac{5}{15} \times 1.36 + \frac{5}{15} \times 1.5$

$+ \frac{5}{15} \times 1.36$

$= 1.4.$

gain ~~(c.H)~~ (c.H), g (c.H) $= 1.5 - 1.4 = 0.1.$

3.3

Debt,

I (high), $I(4,1,2) = \frac{-4}{7} \log 2 \left(\frac{4}{7}\right) - \frac{1}{7}$

$\log_2 \left(\frac{1}{2}\right) - \frac{2}{7} \log_2 \left(\frac{2}{7}\right)$

$= 1.37.$

I (low), $I(2,2,4) = \frac{-2}{8} \log_2 \left(\frac{2}{8}\right) - \frac{2}{8} \log_2 \left(\frac{2}{8}\right)$

$- \frac{4}{9} \log_2 \left(\frac{4}{8}\right)$

$= 1.5$

Entropy (Debt) $E(D) = \frac{7}{15} \times 1.37 + \frac{8}{15} \times 1.5$

gain (Debt), $g(d) = 1.5 - 143 = 0.07.$

Collateral :

I (none); $I(6,2,3) = \frac{-6}{11} \log_2 \left(\frac{6}{11}\right) - \frac{2}{11} \log_2 \left(\frac{2}{11}\right).$

$\frac{3}{11} \log_2 \left(\frac{3}{11}\right) = 1.42$

I (adq), $I(0,1,3) = -0 - 0 \frac{1}{4} \log_2 \left(\frac{1}{4}\right) - \frac{3}{4} \log_2 \left(\frac{3}{4}\right)$

$= 0.81.$

3.3

Entropy (c), $E(c) = \frac{6+2+3}{15} \times 1.42 + \frac{0+1+3}{15} \times 0.81$

$= 1.25$

gain (c), $g(c) = 1.5 - 1.25 = 0.25$.

Income :

$I(0\text{-}15\$), I(0,0,4) = -\frac{0}{4}\log_2\left(\frac{0}{4}\right) - \frac{0}{4}\log_1\left(\frac{0}{4}\right) - \frac{0}{4}\log_2\left(\frac{1}{4}\right) = 0$

$I(15-35\$), I(2,2,1) = \frac{-2}{5}\log_2\left(\frac{2}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right) - \frac{1}{5}\log_2\left(\frac{1}{5}\right) = 1.5$

$I(\text{over } 35\$), I(0,1,5) = -0 - \frac{1}{6}\log_2\left(\frac{1}{6}\right)\log_2\left(\frac{5}{6}\right)$

$= 0.64$

Entropy (Income) $E(I) = \frac{4}{15} \times 0 + \frac{5}{15} \times 1.5 + \frac{6}{15} \times 0.6$

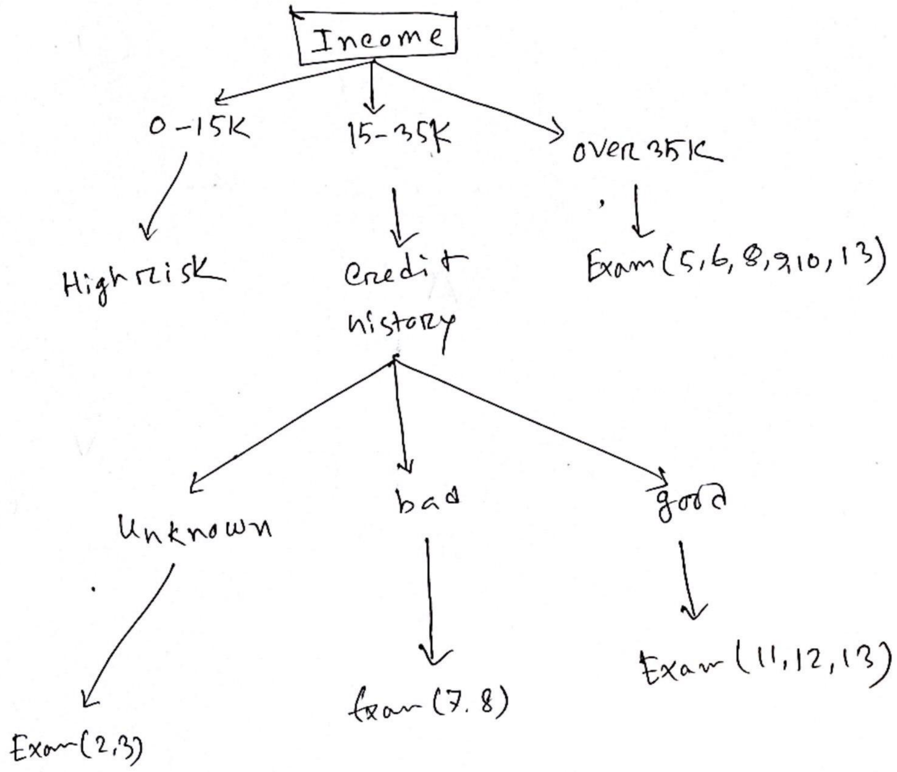
$= 0.75$

3.B

gain (I), $g(I) = 1.5 - 0.75$

$= 0.75$

The gain of 'Income' is highest, so the root node will be 'Income'.



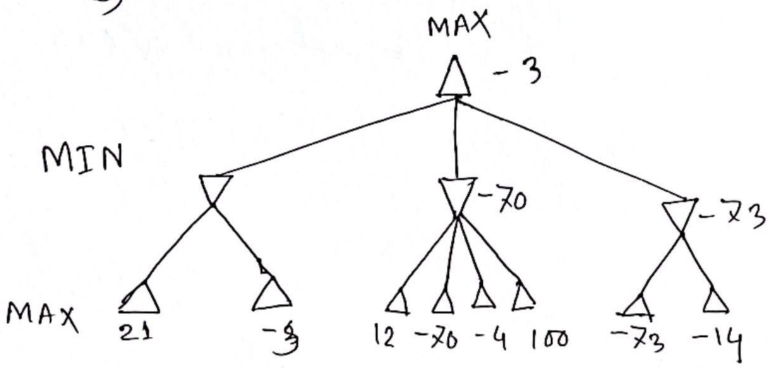
3.4

a) A minimax algorithm is a recursive algorithm for choosing the next move in a n-player game, usually a two-player game. A value is associated with each position or state of the game. The player then makes the move that maximizes the minimum value of the position resulting from opponent's possible following moves.-

Minimax is a kind of backtracking ~~do~~ algorithm that is used in decision making and game theory to find the optional move for a player, assuming that your opponent also plays optimally. It is widely used in two player turn based games such as Tic-Tac-Toe, Backamnon, Mancala, chess etc.

3.4

b)



final value of the game is -3.

c) Yes nodes will be pruned. from the tree (b) we can find three preunning node. they are -4, 100 and -14. So, we can say ~~that~~ there ~~have~~ will be 3 ~~PRUN~~ nodes which be pruned.