~~DUBEY~~

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CLASS:- B.E - 4

ROLL NO:- 04

BATCH:- A.

SUBJECT:- AISC ASSIGNMENT 1.

Answer 1

TRAVEL PLANNER ROBOT.

(a) Percept :- Touch Sensors, Camera, Microphone, Mouse, Keyboard, Screen Display.

(b) Enviornment :- Partial Observable, stochastic, Sequential, Dynamic. Continuous, Single Agent.

(c) Actions :- Gather information about customer requirement, Provide suggestion about destination Mode of transport, hotel accomadation, tours to take.

(d) Performance Measure :- It should be able to choose cost effective and best deals to select hotel, accomadation, car rentals

(e) Agent Architecture :- Utility Based Agent since the planner has to choose and provide best plan in terms of budget, time utilization, comfort.

ROBOT NURSE IN COVID-19 WARD.

(a) Percept :- Camera, Temperature sensors, keyboard, wheels, microphone, screen display, robotic arm.

(b) Enviornment :- Partially observable, stochastic sequential dynamic, continuous, multi-agent.

(c) Actions :- Check patients temperature, alert doctor if temperature is not as per requirement, remind patients medicine, provide daily report of the patient.

(d) Performance Measure :- Accuracy of temperature readings, cost minimization, accuracy of reports, efficiency of alerting the doctor.

(e) Agent Architecture :- Learning Based Agent
Since every patient is different and every patient has a different pattern. So the nurse needs the basic knowledge and then learn more from each patient.

Answer 2

The heuristic function of each node to goal node is

h(A) = 70, h(B) = 40, h(C) = 30, h(D) = 0, h(E) = 70, h(F) = 30
h(G) = 20, h(H) = 90, h(I) = 70, h(J) = 70, h(K) = 50, h(L) = 90
h(M) = 40, h(N) = 30, h(O) = 110, h(P) = 90, h(Q) = 80, h(R) = 50
h(S) = 110, h(T) = 80, h(U) = 110, h(W) = 70, h(X) = 70.

Steps	Fringe	Node Expanded	Path
1	P	—	—
2	Q(93), L(111), U(135)	P	P
3	J(94), K(95), M(96), L(111), U(135)	Q	P
4	K(95), M(96), L(111), I(115), U(135)	J	P-Q
5	M(96), F(98), L(111), I(115), B(118), U(135)	K	P-Q
6	F(98), L(111), I(115), B(118), U(135)	M	P-Q
7	L(111), I(115), B(118), U(135)	F	P-Q-K
8	I(112), B(118), C(122), U(135), O(150)	L	P
9	B(113), C(122), U(135), E(152), O(150), H(152)	I	P-L

10	C(114), U(135), E(152), G(136), H(157)	B	P-L-I
11	D(115), U(135), E(152), O(156), H(157)	C	P-L-I-B

Path :- P-L-I-B-C-D.

∴ The cost of the path found by A* algorithm is 115

The A* algorithm explores the graph in the order
P, Q, J, K, M, F, L, I, B, C, D.

(a) Yes, the A* algorithm finds a path to the goal node
(b) The path node found in the algorithm is
P-L-I-B-C-D.
(c) The cost of the path found is 115.

Answer 3

Soft Computing.

(i) Soft Computing is a collection of all the techniques that help us to construct computationally intelligent system.

(ii) World problems are complex, pervasively imprecise and uncertain and to solve such questions, we require computationally intelligent systems that combine knowledge, techniques and methodologies from various sources.

Soft Computing vs Hard Computing.

	Soft Computing		Hard Computing.
1	Soft Computing techniques are imprecision, approximation & uncertainity tolerant.	1	Hard Computing is a conventional type of computing that requires a precisely stated analytical model.
2	Soft Computing is stochastic and uses multi-valued logic such as fuzzy logic	2	Hard Computing is deterministic and uses two valued logic

	Soft Computing		Hard Computing
3	Soft Computing techniques are model free. They can evolve their own models and programs	3	Hard Computing requires programs to be written.
4	Soft Computing allows parallel computation. ~~eg~~ eg - Neural Network.	4	Hard Computing techniques performs sequential compution.
5	Soft Computing techniques are fault tolerant due to their redundancy, adaptability and reduced precision characteristic.	5	Hard computing techniques are not fault tolerant. The reason is conventional programs and algorithms are built in such a way that errors have serious consequences, unless enough redundancy is added into the system.

Types of Soft Computing Techniques.

(i) Soft Computing is the fusion of different techniques that are designed to model and enable solutions to complex real world problems which are not modeled or too difficult to model mathematically

(ii) Most of the soft computing techniques are based on the some biological inspired methodologies such as human nervous system, genetics, evolution, and its behaviour, etc.

Soft Computing paradigms mainly are

① Neural Network

② Fuzzy Logic

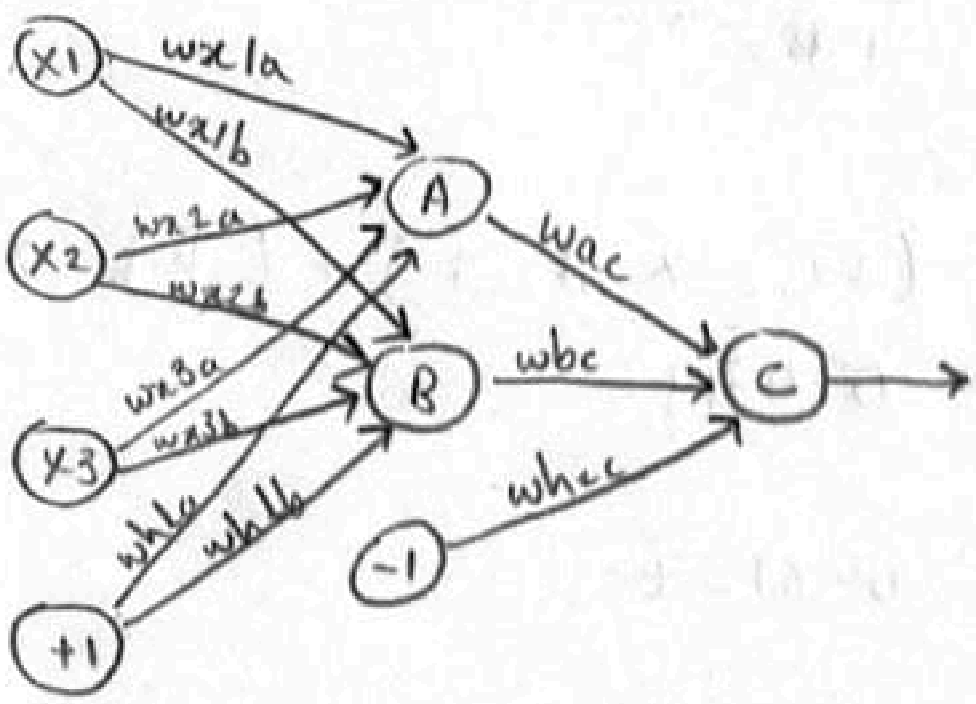
③ Evolutionary Algorithm such as Genetic Algorithm.

① Neural Networks :- An Artificial Neural Network (ANN) inspired by the ~~by~~ biological nervous system basically tries to mimic the working of a human brain. It is composed of a large number of highly connected processing elements called neurons. All these neurons work in parallel to solve a specific problem. eg- forecasting, medical science, etc.

② Fuzzy logic :- Fuzzy logic is an approach to computing based on "degrees of truth" rather than the usual "true or false" boolean logic on which the modern computer is based. Fuzzy logic makes it possible to include vague human assessment in computing problems.
eg - Pattern recognization, decision making, optimization.

③ Genetic Algorithms :- Genetic Algorithm are adaptive heuristic Search algorithms based on the evolutionary idea of natural selection and genetics. GAS are used to find optimal or near-optimal solutions to difficult problems which ~~are~~ otherwise would take a lifetime to solve.

Answer 4



where,

$w_{x1a} = 0.4$ $\quad$ $w_{h1a} = 0.3$

$w_{x1b} = -0.2$ $\quad$ $w_{h1b} = 0.3$

$w_{x2a} = 0.4$ $\quad$ $w_{ac} = 0.4$

$w_{x2b} = -0.2$ $\quad$ $w_{ab} = -0.2$

$w_{x3a} = 0.4$ $\quad$ $w_{h2c} = 0.3$

$w_{x3b} = -0.2$

$x_1 = 0.3$, $x_2 = 0.8$, $x_3 = 0.1$.

Desired Output = 1

Learning Rate $(\alpha) = 0.2$.

Performing forward pass:-

$$A_{in} = (W_{x1a} \times X_1) + (W_{x2a} \times X_2) + (W_{x3a} \times X_3) + W_{h1a}$$
$$= (0.4 \times 0.3) + (0.4 \times 0.8) + (0.4 \times 0.1) + 0.3$$
$$= 0.78$$

$$A_{out} = \frac{1}{1 + e^{-A_{in}}} = 0.6857$$

Similarly for B and C

$$B_{in} = (W_{x1b} \times X_1) + (W_{x2b} \times X_2) + (W_{x3b} \times X_3) + W_{h3b}$$
$$= 0.06$$

$$B_{out} = \frac{1}{1 + e^{-B_{in}}} = 0.5150.$$

$$C_{in} = (W_{ac} \times A_{out}) + (W_{bc} \times B_{out}) + W_{h2c}$$
$$= 0.4713.$$

$$C_{out} = 0.6157$$

d (desired Output) = 1

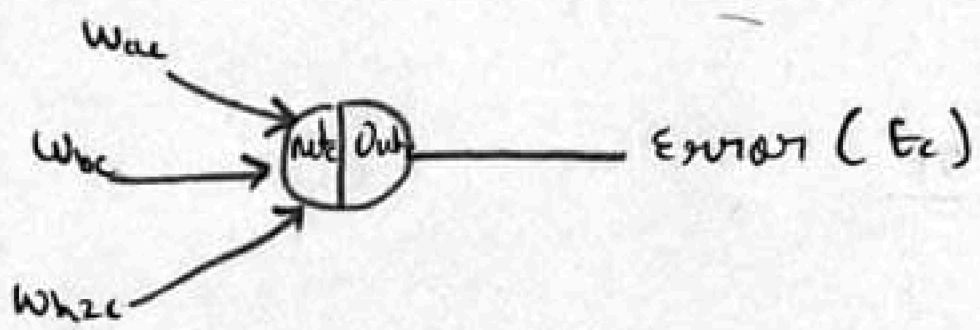
$$E_c = \frac{1}{2}(\text{target} - o/p)^2$$

$$= \frac{1}{2}(1 - 0.6157)^2$$

$$= 0.0738$$

$\therefore$ $\underline{E_{total} = E_c = 0.0738}$

Back Propagation.



$$\delta_c \ (\text{del}_{-c}) = \frac{\partial E_{c\,old}}{\partial Out_c} \times \frac{\partial Out_c}{\partial net_c}$$

$$\frac{\partial E_{c\,old}}{\partial Out_c} = Out_c - target_c = 0.6157 - 1 = \underline{-0.3843}$$

$$\frac{\partial Out_c}{\partial net_c} = Out_c(1 - Out_c) = 0.6157(0.3843) = 0.2366.$$

$$\therefore \ \delta_c = -0.3843 \times 0.2366 = -0.0909.$$

For W_{ac}.

$$\frac{\partial E_{total}}{\partial W_{ac}} = \frac{\partial E_{total}}{\partial out_c} \times \frac{\partial out_c}{\partial net_c} \times \frac{\partial net_c}{\partial W_{ac}} \rightarrow \frac{\partial net_c}{\partial W_{ac}}$$

$$= Out_A$$

$$= 0.6857$$

$$= \delta_c \times Out_A$$

$$= -0.0623$$

$$W_{ac}^* = W_{ac} - \alpha \frac{\partial E_c}{\partial W_{ac}} = 0.4 - (0.2)(-0.0623) = \underline{0.4125}$$

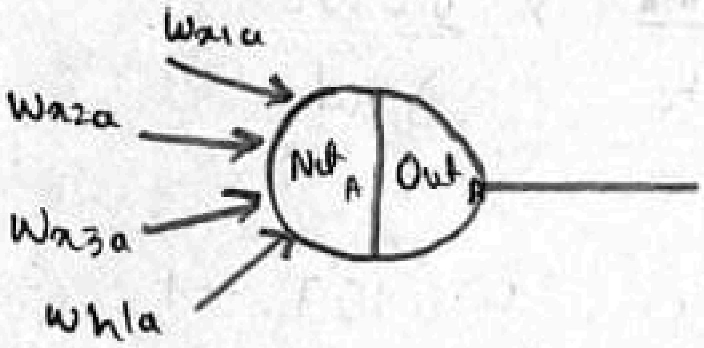
similarly for W_{bc} and W_{h2c}.

$$W_{bc} : \frac{\partial E_{total}}{\partial W_{bc}} = \delta_c \times out_B = -0.0461$$

$$W_{bc}^* = W_{bc} - \alpha \frac{\partial E_c}{\partial W_{Bc}} = -0.2 - (0.2)(-0.0468)$$

$$= \underline{-0.1906}$$

$$W_{h2c}^* = \underline{0.3182}$$



$$\delta_a\ (del\_a) = \frac{\partial E_{total}}{\partial Out_A} \times \frac{\partial out_A}{\partial net_A} \rightarrow \frac{\partial out_A}{\partial net_A}$$

$$= Out_A (1 - out_A)$$

$$= \underline{0.2155}$$

$$\frac{\partial E_{total}}{\partial out_A} = \frac{\partial E_c}{\partial out_A} = \delta_c \times \frac{\partial net_c}{\partial out_A} \rightarrow \frac{\partial net_c}{\partial out_A} = W_{Ac} = 0.4$$

$$= (-0.0909) \times (0.4)$$

$$= -0.0364$$

$$\therefore \delta_a = (-0.0364)(0.2155)$$

$$= -0.0078$$

for W_{x1a}

$$\frac{\partial E_{total}}{\partial W_{x1a}} = \frac{\partial E_{total}}{\partial out_A} \times \frac{\partial out_A}{\partial net_A} \times \frac{\partial net_A}{\partial W_{x1a}} \rightarrow \frac{\partial net_A}{\partial W_{x2a}}$$

$= x_1$

$= 0.3$

$= \delta_a \times x_1$

$= -0.0024$

$$W_{x2a}^* = W_{x2a} - \alpha \frac{\partial E_{total}}{\partial W_{x1a}} = 0.4 - (0.2)(-0.0024)$$

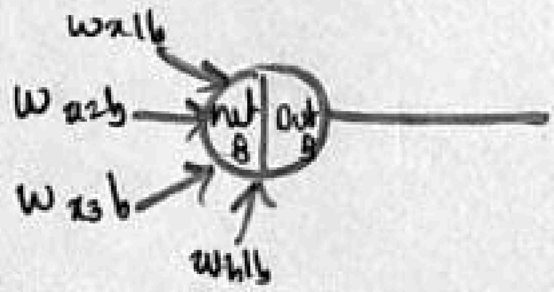
$= \underline{0.4005}$

Similarly we calculate W_{x2a}, W_{x3a}, W_{h2a}

$W_{x2a}^* = 0.4013$

$W_{x3a}^* = 0.4002$

$W_{x2a}^* = 0.3016$



$$\delta b\,(del\_b) = \frac{\partial E_{total}}{\partial out_B} \times \frac{\partial out_B}{\partial net_B} \rightarrow \frac{\partial out_B}{\partial net_B} = out_B(1 - out_B)$$

$= 0.2495$

$$\frac{\partial E_{total}}{\partial out_B} = \delta c = \frac{\partial net_c}{\partial out_B} = (-0.0909) \times (-0.2) = 0.0182$$

$\therefore \delta b = 0.0182 \times 0.2498$

$= \underline{0.0045}$

for w_{x1b}:

$$\frac{\partial E_{total}}{\partial w_{x1b}} = \delta b \times \frac{\partial net_B}{\partial w_{x1b}} = 0.0045 \times x_2 = 0.0014$$

$w_{x1b}^* = -0.2003$

Similarly, $w_{x2b}^* = -0.2007$

$w_{x3b}^* = -0.2001$

$w_{h2b}^* = 0.2991$

(a) del_A = -0.0078 del_B = 0.0045, del_C = -0.0909

(b) $w_{ac} = 0.4125$, $w_{bc} = -0.1906$, $w_{h2c} = 0.3182$.

(c) $w_{x1a} = 0.4005$, $w_{x2a} = 0.4013$, $w_{x3a} = 0.4002$

$w_{h2a} = 0.3016$, $w_{x1b} = -0.2003$, $w_{x2b} = -0.2007$

$w_{x3b} = -0.2001$, $w_{h2b} = 0.2991$.