



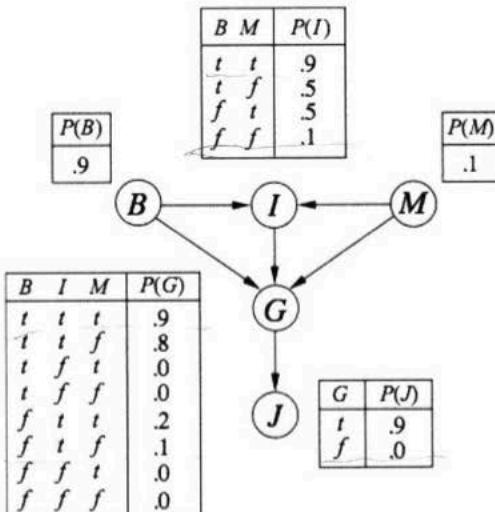
0AE77596-5E05-4D93-8E4A-FA01D2D05885

Q7c

#51

2 of 2

Given this Belief network, answer the questions below:



1. [5pts] Calculate the probability of $P(b, m, i, \neg g, j)$

$$\begin{aligned}P(b, m, i, \neg g, j) &= P(b) P(m) P(i|b, m) P(\neg g|i, b, m) P(j|\neg g) \\&= 0.9 \times 0.1 \times 0.9 \times (1-0.9) \times 0.0 \\&= 0.9 \times 0.1 \times 0.9 \times 0.1 \times 0.0\end{aligned}$$



2. [5pts] Calculate the probability of $P(\neg b, \neg m, i, g, j)$

$$\begin{aligned}P(\neg b, \neg m, i, g, j) &= P(\neg b) P(\neg m) P(i|\neg b, \neg m) P(g|i, \neg b, \neg m) P(j|g) \\&= (1-0.9) \times (1-0.1) \times 0.1 \times 0.1 \times 0.9 \\&= 0.1 \times 0.9 \times 0.1 \times 0.1 \times 0.9\end{aligned}$$





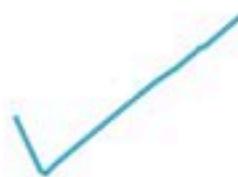
Given these examples from the Restaurant domain, answer the questions below:

Example	Attributes										Target Wait
	Alt	Bar	Fri	Hun	Pat	Price	Rain	Res	Type	Est	
X ₁	T	F	F	T	Some	\$\$\$	F	T	French	0-10	T
X ₂	T	F	F	T	Full	\$	F	F	Thai	30-60	F
X ₃	F	T	F	F	Some	\$	F	F	Burger	0-10	T
X ₄	T	F	T	T	Full	\$	F	F	Thai	10-30	T
X ₅	T	F	T	F	Full	\$\$\$	F	T	French	>60	F
X ₆	F	T	F	T	Some	\$\$	T	T	Italian	0-10	T
X ₇	F	T	F	F	None	\$	T	F	Burger	0-10	F
X ₈	F	F	F	T	Some	\$\$	T	T	Thai	0-10	T
X ₉	F	T	T	F	Full	\$	T	F	Burger	>60	F
X ₁₀	T	T	T	T	Full	\$\$\$	F	T	Italian	10-30	F
X ₁₁	F	F	F	F	None	\$	F	F	Thai	0-10	F
X ₁₂	T	T	T	T	Full	\$	F	F	Burger	30-60	T

- 1) (5pts) Which one of these two attributes, **Est.** or **Type?** would be chosen first by the Decision Tree algorithm? Why?

Est.

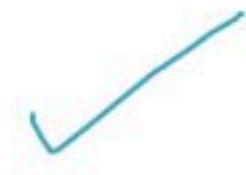
It has more information gain.



- 2) (5pts) For the attribute **Price** determine for each of its values **\$\$\$**, **\$\$**, **\$**, how many positive and negative examples there are in the table . Would the Decision Tree algorithm choose **Price** before **Patrons**? before **Type**?

+	T	F
\$	3	4
\$\$	2	0
\$\$\$	1	2

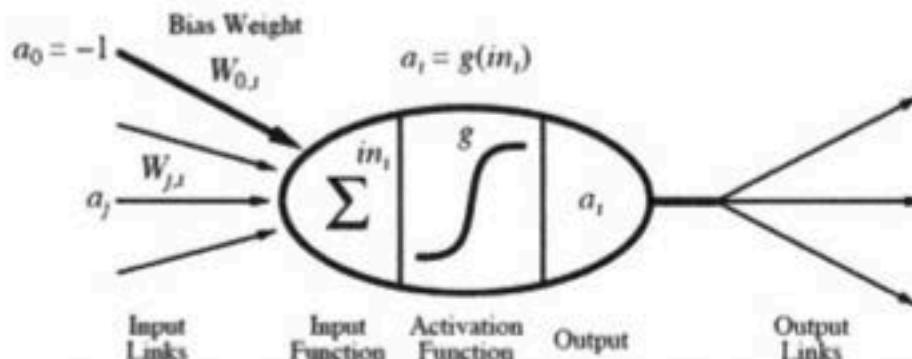
By "Patrons" before "Price" before "Type".



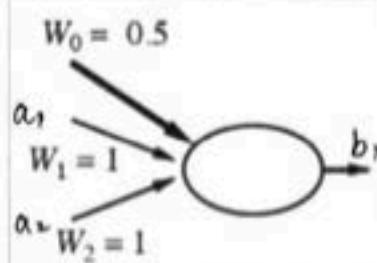


Given this diagram of a perceptron, answer the questions below:

$$a_i \leftarrow g(in_i) = g(\sum_j W_{j,i} a_j)$$



- 1) (5pts) Which boolean function does the below perceptron represent? Explain how.



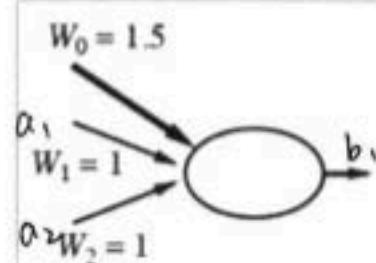
It's an OR function.

Suppose we have action a_1, a_2 as input and b_1 as output

a_1	0	0	1	1
a_2	0	1	0	1
b_1	-0.5	0.5	0.5	1.5
	< 0	> 0	> 0	> 0
	F	T	T	T

If 0 stands for F and 1 stands for T, we have the OR function.

- 2) (5pts) Which boolean function does the below perceptron represent? Explain how.



It's an AND function.

a_1	0	0	1	1
a_2	0	1	0	1
b_1	-1.5	-0.5	-0.5	0.5
	< 0	< 0	< 0	> 0
	F	F	F	T



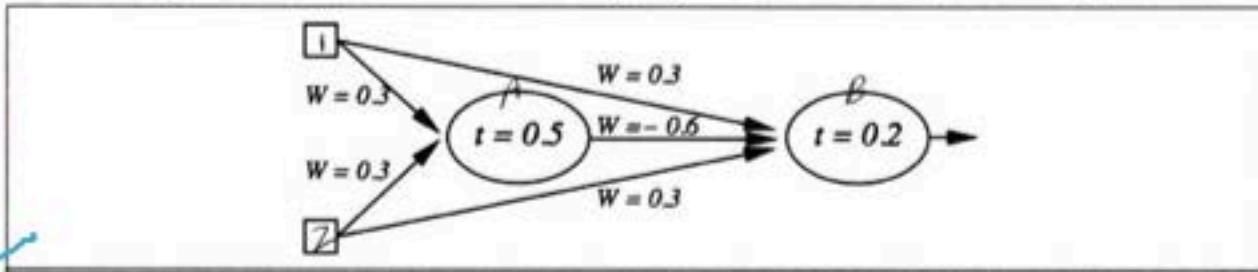
24342043-3A81-42FB-A3A3-E9515E9D8AAA

Q8c

#39

2 of 2

Given this diagram of a Neural Network with two perceptron units A and B, answer the questions below.



1. [2pts] When $\text{input1} = 0$ and $\text{input2} = 0$, what does the Unit A output? What does the Unit B output?

$$0 \times 0.3 + 0 \times 0.3 = 0 \rightarrow \cancel{\text{output A}} \quad 0 < 0.5 \Rightarrow \text{output A} = 0 (\text{F})$$

$$0 \times 0.3 + 0.3 \times 0 = 0.6 \cdot 0 = 0 \quad 0 < 0.2 \Rightarrow \cancel{\text{B}} = 0 (\text{F})$$

2. [2pts] When $\text{input1} = 0$ and $\text{input2} = 1$, what does the Unit A output? What does the Unit B output?

$$0 \times 0.3 + 1 \times 0.3 = 0.3 \quad 0.3 < 0.5 \Rightarrow \text{output A} = 0 (\text{F})$$

$$0 \times 0.3 + 1 \times 0.3 + -0.6 \times 0 = 0.3 \quad 0.3 > 0.2 \Rightarrow \text{output B} = 1 (\text{T})$$

3. [2pts] When $\text{input1} = 1$ and $\text{input2} = 0$, what does the Unit A output? What does the Unit B output?

$$0.3 \times 1 + 0.3 \times 0 = 0.3 \quad 0.3 < 0.5 \Rightarrow \text{output A} = 0 (\text{F})$$

$$0.3 \times 1 + 0 \times 0.3 + 0 \times (-0.6) = 0.3 \quad 0.3 > 0.2 \Rightarrow \text{output B} = 1 (\text{T})$$

4. [2pts] When $\text{input1} = 1$ and $\text{input2} = 1$, what does the Unit A output? What does the Unit B output?

$$0.3 \times 1 + 0.3 \times 1 = 0.6 \quad 0.6 > 0.5 \Rightarrow \text{output A} = 1 (\text{T})$$

$$0.3 \times 1 + 0.3 \times 1 - 0.6 \times 1 = 0 \quad 0 < 0.2 \Rightarrow \text{output B} = 0 (\text{F})$$

5. [2pts] What Boolean function does this Neural Network compute?

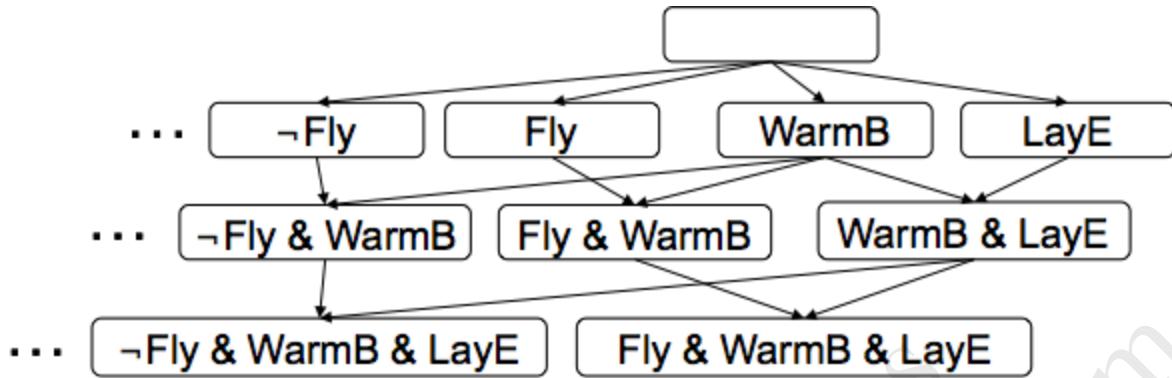
i_1	i_2	O_A	O_B
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

$$\Rightarrow O_A = i_1 \text{ and } i_2$$

$$O_B =$$

$$i_1 \text{ XOR } i_2$$

Given this generality partial order for the bird concept hypotheses answer the questions below:



Write the set of bird hypotheses that are consistent with all the training data after each of the following examples is added to the set T , which is initially empty.

- 1) (2pts) Add to training set T : $f(\text{Robin}: \text{WarmB} \wedge \text{LayE} \wedge \text{Fly}) = \text{Bird}/+$

All consistent bird hypotheses: Any, Fly, WarmB, LayE, Fly&WarmB, Warmb&LayE, Fly&WarmB&LayE,

- 2) (2pts) Add to training set T : $f(\text{Pteranodon}: \text{ColdB} \wedge \text{LayE} \wedge \text{Fly}) = \text{Reptile}/-$

All consistent bird hypotheses: WarmB, Fly&WarmB, Warmb&LayE, Fly&WarmB&LayE

- 3) (2pts) Add to training set T : $f(\text{Bat}: \text{WarmB} \wedge \neg \text{LayE} \wedge \text{Fly}) = \text{Mammal}/-$

All consistent bird hypotheses: Warmb&LayE, Fly&WarmB&LayE

- 4) (2pts) Add to training set T : $f(\text{Ostrich}: \text{WarmB} \wedge \text{LayE} \wedge \neg \text{Fly}) = \text{Bird}/+$

All consistent bird hypotheses: Warmb&LayE

- 5) (2pts) Add to training set T : $f(\text{Platypus}: \text{WarmB} \wedge \text{LayE} \wedge \neg \text{Fly}) = \text{Mammal}/-$

None

Given the grid below answer the questions below:

3	0.812	0.868	0.918	+ 1
2	0.762		0.660	- 1
1	0.705	0.655	0.611	0.388
	1	2	3	4

1) (5pts) What would be the optimal policy for the grid?

1,1 N 2,1 W 3,1 N 4,1 W

1,2 N 3,2 N

1,3 E 2,3 E 3,3 E

2) (5pts) What are the Q-values for the square (3,2) given that the agent is deterministic, i.e.

$Pr(s, a, s') = 1$, $R(3,2)=0$ and $\gamma = .5$

Recall that $Q(a, s) = \sum Pr(s, a, s')[R(s) + \gamma \max Q(a', s')]$ and $Q(a, s) = 0$ at Terminal states (4, 2), (4, 3)

$$Q(N, (3,2)) = 1 * [0 + .5 (Q(E,(3,3))] = .25$$

$$Q(E, (3,2)) = 1 * [-1 + .5 (0)] = -1$$

$$Q(S, (3,2)) = 1 * [0 + .5 (Q(N,(3,1))] = .0625$$

$$Q(E,(3,3)) = 1 * [0 + .5(1 * [1 + 0])] = .5$$

$$Q(N,(3,1)) = 1 * [0 + .5(Q(N,3,2))] = .125$$

Given the grid below answer the following questions:

	0.812	0.868	0.918	+ 1
3	0.762		0.660	- 1
2	0.705	0.655	0.611	0.388
	1	2	3	4

1) (5pts) Is this an optimal policy for the grid? Why or why not?

	→	→	→	+ 1
3	↑		↑	- 1
2	↑	←	←	←
	1	2	3	4

No, at state 3,1 the optimal action is to go N not W, because state (3,2) has a higher utility value than state (2,2)

2) (5pts) What are the Q-values for the square (3,3) given that the agent is deterministic, i.e.

$$Pr(s, a, s') = 1, R(3,2)=0 \text{ and } \gamma = .5$$

Recall that $Q(a, s) = \sum Pr(s, a, s')[R(s) + \gamma \max Q(a', s')] \text{ and } Q(a, s) = 0 \text{ at Terminal states (4, 2), (4, 3)}$

$$Q(E, (3,3)) = 1 * [0 + .5(1 * [1 + 0])] = .5$$

$$Q(W, (3,3)) = 1 * [0 + .5 (Q(E, (3,3)))] = .25$$

$$Q(S, (3,3)) = 1 * [0 + .5 (Q(N, (3,2)))] = .125$$

$$Q(N, (3,2)) = 1 * [0 + .5(Q(E, 3, 3))] = .25$$

Given this hypothesis for the concept Bird, answer the questions below.

Bird = WarmB & LaysE & Flies

1) (2 pts) Given the above hypothesis for the concept **Bird**, chose the best description of the example $f(\text{Robin}: \text{WarmB} \& \text{LayE} \& \text{Fly}) = \text{Bird}$:

- a) True Positive ✓
- b) True Negative
- c) False Positive
- d) False Negative

2) (2 pts) Chose the best description for the example $f(\text{Pteranodon}: \text{ColdB} \& \text{LayE} \& \text{Fly}) = \text{Reptile}$:

- a) True Positive
- b) True Negative ✓
- c) False Positive
- d) False Negative

3) (2 pts) Chose the best description for the example $f(\text{Platypus}: \text{WarmB} \& \text{LayE} \& \neg \text{Fly}) = \text{Mammal}$:

- a) True Positive
- b) True Negative ✓
- c) False Positive
- d) False Negative

4) (2 pts) Chose the best description for the example $f(\text{Ostrich}: \text{WarmB} \& \text{LayE} \& \neg \text{Fly}) = \text{Bird}$:

- a) True Positive
- b) True Negative
- c) False Positive
- d) False Negative

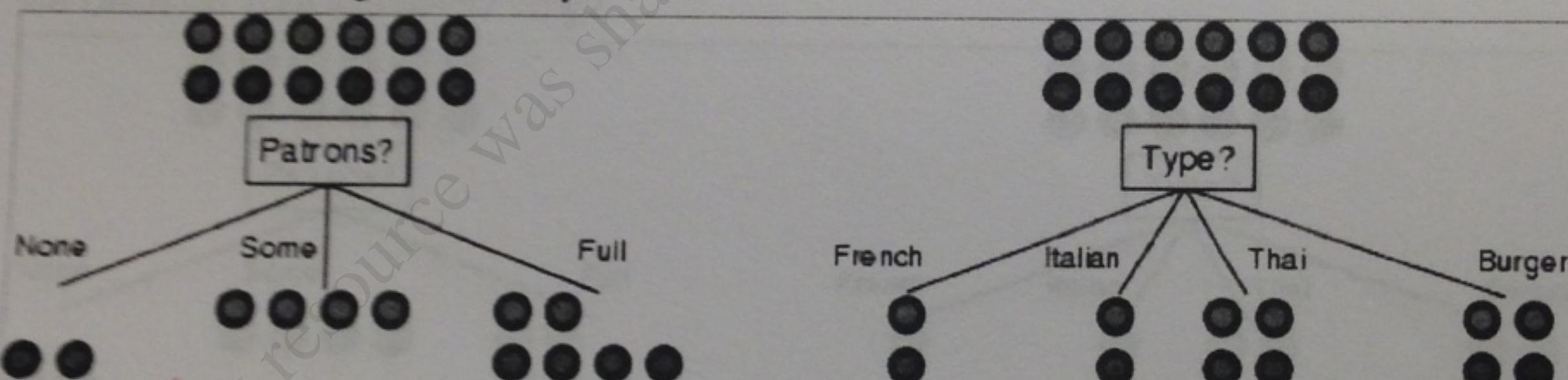
5) (2 pts) Chose the best description for the example $f(\text{Bat}: \text{WarmB} \& \neg \text{LayE} \& \text{Fly}) = \text{Mammal}$:

- a) True Positive
- b) True Negative ✓
- c) False Positive
- d) False Negative

Given these examples from the Restaurant domain, answer the questions below:

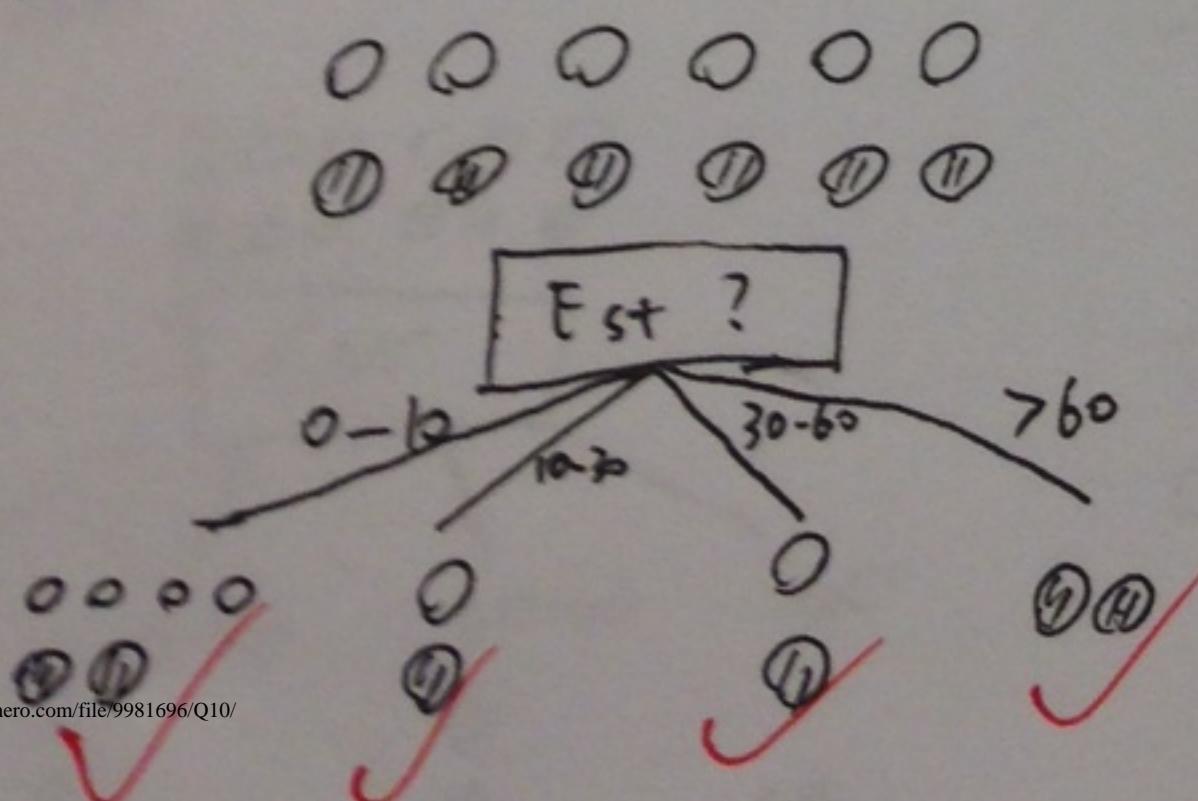
Example	Attributes											Target Wait
	Alt	Bar	Fri	Hun	Pat	Price	Rain	Res	Type	Est		
X ₁	T	F	F	T	Some	\$\$\$	F	T	French	0-10	T	
X ₂	T	F	F	T	Full	\$	F	F	Thai	30-60	F	
X ₃	F	T	F	F	Some	\$	F	F	Burger	0-10	T	
X ₄	T	F	T	T	Full	\$	F	F	Thai	10-30	T	
X ₅	T	F	T	F	Full	\$\$\$	F	T	French	>60	F	
X ₆	F	T	F	T	Some	\$\$	T	T	Italian	0-10	T	
X ₇	F	T	F	F	None	\$	T	F	Burger	0-10	F	
X ₈	F	F	F	T	Some	\$\$	T	T	Thai	0-10	T	
X ₉	F	T	T	F	Full	\$	T	F	Burger	>60	F	
X ₁₀	T	T	T	T	Full	\$\$\$	F	T	Italian	10-30	F	
X ₁₁	F	F	F	F	None	\$	F	F	Thai	0-10	F	
X ₁₂	T	T	T	T	Full	\$	F	F	Burger	30-60	T	

- 1) (5pts) Which one of these two attributes, **Patrons** or **Type?** would be chosen first by the Decision Tree algorithm? Why?



Patrons. Because information remaining after decision with patron is less than that with type. Which means, we need to apply other attributes to decide for all four partitions after type, (French, Italian, Thai & Burger), but we only

- 2) (5pts) Draw a graph similar to the ones in problem 1 for the attribute **Est.** for the wait time estimate. Would the Decision Tree algorithm choose **Est.** before **Patrons?** before **Type?**



After **Patrons**.

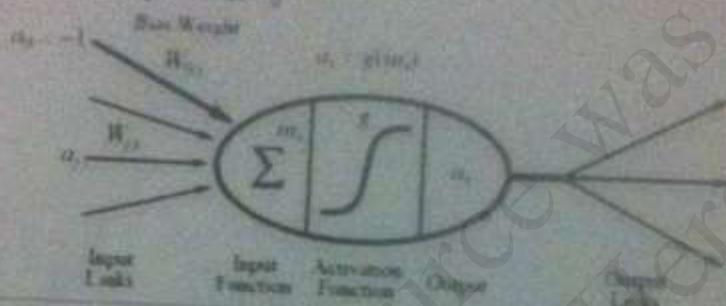
Before **Type**.

Name: Maysad T
Student ID:
Student email:

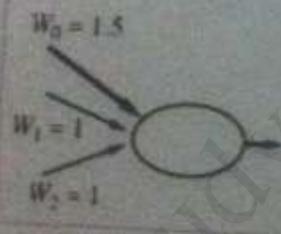
Washington Secondary
CBEST Practice Test
(Q10)

Given this diagram of a perceptron, answer the questions below.

$$a_0 \leftarrow g(m_0) = g\left(\sum_j W_{j,0} a_j\right)$$



1) (5pts) Which boolean function does the below perceptron represent? Explain how.

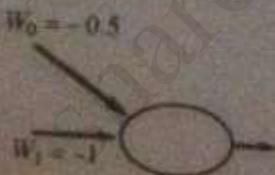


The function is AND.

For inputs a_0, a_1, a_2 : (\rightarrow maps to boolean value)

a_0	a_1	a_2	$\Sigma w_i a_i$	
-1	0	0	0.5 \rightarrow F	
-1	0	1	-0.5 \rightarrow F	
-1	1	0	-0.5 \rightarrow F	
-1	1	1	0.5 \rightarrow T	

2) (5pts) Which boolean function does the below perceptron represent? Explain how.



The function is ~~NOT~~ NOT.

For inputs a_0, a_1 : (\rightarrow maps to boolean value)

a_0	a_1	$\Sigma w_i a_i$	
-1	0	0 \rightarrow F	
-1	1	-1 \rightarrow F	
1	0	-1 \rightarrow F	