Name: _____

Problem	Points	Score
1	40	
2	30	
3	30	
Total	100	

Notes:

(1) The exam is closed books and notes.

(2) Please clearly indicate your answer to the problem.

(3) Note that ungrammatical sentences, incoherent statements, or general illegible scratches will get zero credit.

(4) If I can't read or follow your solution, it is wrong, and no partial credit will be awarded.

(40 pts) Problem No. 1: Derive a gradient descent algorithm to optimize the weights for the following function:

$$f(x) = w_0 + w_1 \log(x_1) + w_2 e^{x_2}$$

Explain your approach fully including any assumptions you make about the loss function, etc.

(30 pts) Problem No. 2: Design a neural network to represent the function shown in the table to the right. Clearly state any assumptions you make. The network need not be fully connected – you can modify the topology as you see fit. Try to make the network as simple as possible. (Hint: Think about the properties of an exclusive or gate.)

A	B	C	F(A,B,C)
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

(30 pts) Problem No. 3: Consider two networks, one which functions as a classical "and" gate, and one which functions as a classical "or" gate:

A	B	F(A,B)
0	0	0
0	1	0
1	0	0
1	1	1

A	B	F(A,B)
0	0	0
0	1	1
1	0	1
1	1	1

Design a second network that combines the outputs from the first two networks, and approximates the table shown. Explain your assumptions and justify your answer.

A	B	C	D	F(A,B,C,D)
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
1	0	0	0	0
1	1	0	0	0
1	1	1	1	1
1	0	0	1	0
0	1	1	1	1
1	1	1	0	1
0	1	1	1	1