Machine Learning - Unit 2 Neural Networks Portion Question Bank

1. With examples and diagrams explain what do you understand by the following:
   - **a)** McCulloch and Pitts Neurons
   - **b)** Perceptron
   - **c)** Perceptron Convergence Theorem
   - **d)** Linear Separability

2. Write and describe the Perceptron Algorithm. What is the difference between the 'Recall' and 'Training' phase?(**Solution**:Refer 02_Perceptron_MKN.pdf & Stephen Marsland Section 3.3.3)

3. Design a Perceptron that produces output of logical OR of their inputs.(**Solution**: Refer 02_Perceptron_MKN.pdf for short explanation. If asked for more marks, refer Stephen Marsland Section 3.3.4 and 3.3.5. Concept expected - **not** the Python Code)

4. The values of x and their corresponding values of y are shown in the table below

x	0	1	2	3	4
y	2	3	5	4	6

   - **a)** Find the least square regression line y = a x + b.
   - **b)** Estimate the value of y when x = 10.

   (**Solution**: Refer https://www.analyzemath.com/statistics/linear_regression.html)

5. For a year, five randomly selected students took a math aptitude test before they began their statistics course. The Statistics Department has three questions.
   - **a)** What linear regression equation best predicts statistics performance, based on math aptitude scores?
   - **b)** If a student made an 80 on the aptitude test, what grade would we expect her to make in statistics?
   - **c)** How well does the regression equation fit the data?

Student	x_i	y_i
1	95	85
2	85	95
3	80	70
4	70	65
5	60	70

   (**Solution**: Refer https://stattrek.com/regression/regression-example.aspx)

6. State Hebb's rule. Explain how Hebb's rule improves the performance of McCulloch and Pitts Neurons.(**Solution**: Refer Stephen Marsland Section 3.1.1)

7. What is Linear Regression? List the critical assumptions of Linear Regression. Mention few applications of Linear Regression.(**Solution**: Refer 03_Perceptrons - Putting it all together_MKN.pdf).

8. What do you understand by 'Perceptron Activation Function'? What is its purpose? What are

the types? (**Solution**: Refer 03_Perceptrons - Putting it all together_MKN.pdf).

9. What do you understand by the following terms w.r.t Perceptron?
   - **a)** Learning Rate
   - **b)** Bias
   - **c)** Perceptron Convergence Theorem (**Solution**:Refer 02_Perceptron_MKN.pdf)

10. What do you understand by the term 'Linear Separability'? Illustrate a few graphs which depicts linear and Non-Linear Separability. (**Solution**:Refer 02_Perceptron_MKN.pdf and Stephen Marsland Section 3.4)

11. What is the problem pointed out by Minsky and Papert regarding 'Linear Separability' and XOR Function? Give a brief overview of how it can be solved. (**Solution**:Refer 02_Perceptron_MKN.pdf and Stephen Marsland Section 3.4.2)

12. " 'Least Square Error' is a Cost Function used by the Perceptron to minimise the error". Justify this statement with an appropriate example. (**Solution**:Refer 02_Perceptron_MKN.pdf)