Prerequisite Exam

Name: _____, Undergrad or Grad student

1. Regression

x_i	y_i	$(x_i - \underline{x})$	$(y_i - \underline{y})$	$(x_i - \underline{x})^2$	$(y_i - \underline{y})^2$	$(x_i - \underline{x})(y_i - \underline{y})$	
95	85	17	8	289	64	136	
85	95	7	18	49	324	126	
80	70	2	-7	4	49	-14	
70	65	-8	-12	64	144	96	
60	70	-18	-7	324	49	126	

$\underline{x}$ and $\underline{y}$ are the means of all the x_i's and y_i's respectively.

Assume there is a linear relationship between x and y for all i's. Perform linear regression to solve the coefficients b_0 and b_1 to establish the relationship $y = b_0 + b_1 x$.

2. The following is a line model in a two dimensional space.

$x_1 + 2\,x_2 - 1 = 0$

Draw the line in the two dimensional space. Mark the region $x_1 + 2\,x_2 - 1 < 0$.

3. Compute the derivative of a sigmoid function with respect to x.

$y = 1/(1+e^{-x})$

4. The following provides the relationship between (x_1, x_2) and y.

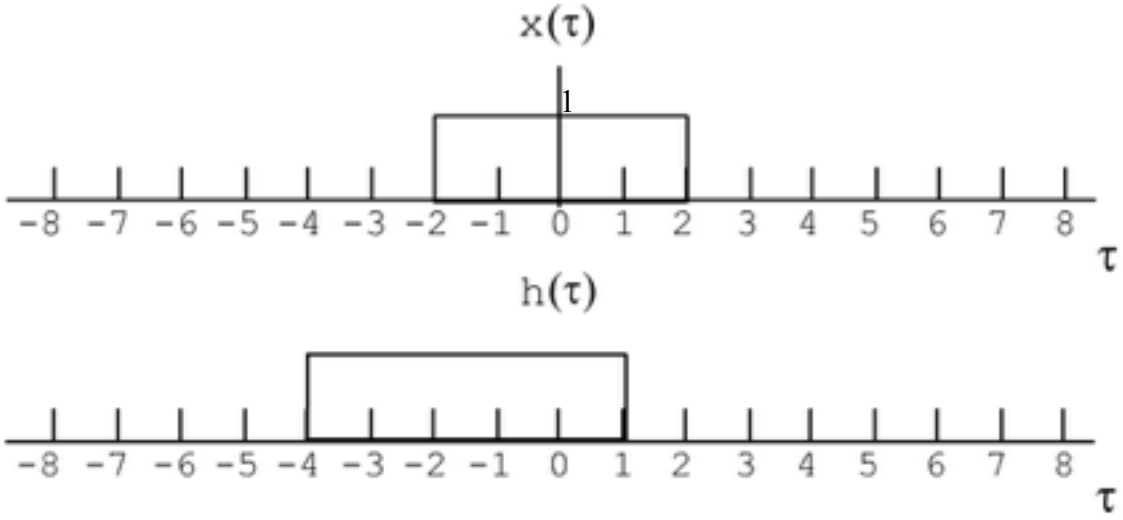
$y = x_1^2+x_2^2+x_1*x_2$

Compute partial derivative of y with respect to x_1

Compute partial derivative of y with respect x_2

partial derivative of y with respect to x_1, then x_2

5. Convolution



Write down the convolution formula of the x(t), h(t).
Compute the convolution when t=0.

6. Write a function to compute the sum of a 1-D array in either Matlab or Python