Instructions:

There are a total of 5 (five) multi-part questions, with point values noted for each question.

Please show your calculations, or the details of your program(s), for each problem. Your program(s) should be commented so that each step is clearly explained.

Combine all of your answers/files into a single zipped file and post the zipped file to CANVAS.

Problems #1 and #2

Using an "Addiction" dataset, a researcher has prepared the following table of patient counts:

Ethnicity	Age Category	Alcohol	Cocaine	Heroin	Row Total
Black	Old	30	48	17	95
	Young	25	72	13	110
Hispanic	Old	7	0	5	12
	Young	8	7	19	34
White	Old	60	2	17	79
	Young	26	10	34	70
Column Total		156	139	105	400

Use the table above and Excel to classify patient addiction type (alcohol, cocaine, heroin) using Ethnicity and Age Category:

a. **Construct a classification and regression tree (CART) (two levels only).** (20 Points)
b. **Construct a C4.5 decision tree (two levels only).** (20 Points)

Problem #3

Use R/python to cluster (Algorithm=K-means; K=2) the seven (7) already normalized points in the accompanying table and answer a and b below: (20 points)

	X	Y	Z
a	1	1	1
b	5	3	4
c	4	4	5
d	4	3	4
e	1	2	1
f	4	4	4
g	2	1	2

a. **What are the members of each cluster?**
b. **What are the coordinates for the cluster centers?**

Problem #4

Use R/python and the above table (problem #3) to cluster (Algorithm=hierarchical; two clusters) the seven (7) already normalized points in the accompanying table and answer a and b below: (20 points)

a. **What are the members of each cluster?**
b. **What are the coordinates for the cluster centers?**

Problem #5

Using data in the table below, construct a Neural Network with one Output Layer (z) and one Hidden Layer (A and B). (20 points)

a. **Calculate the predicted outcome if the inputs to the input nodes are (x=1, Node 1=.4, Node 2=.7 Node 3= .7 and Node 4=.2).**
b. **Adjust the weight if the actual output is 0.8500**

From	To	Weight
X	A	0.5
Node 1	A	0.6
Node 2	A	0.8
Node 3	A	0.6
Node 4	A	0.2
x	B	0.7
Node 1	B	0.9
Node 2	B	0.8
Node 3	B	0.4
Node 4	B	0.2
xx	z	0.5
A	z	0.9
B	z	0.9