Problem 1: Number Representation [10 marks]

Please show your work to receive full credit. A conversion table is provided separately. You may use it to help with any calculations. Please note that the additional sheet of paper will NOT be graded.

a. Convert 200 (in decimal) to binary.

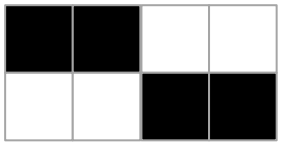
b. Convert 0b10010111 to decimal.

c. Convert 0x82 to decimal.

d. Convert decimal 314 to hexadecimal.

Problem 2: Image Representation: Bitmaps [6 marks]

Consider the following Bitmap Image:



For all colours, please write the representation in hex.

a. Write the standard (non-compressed) representation that we covered in class of the bitmap above

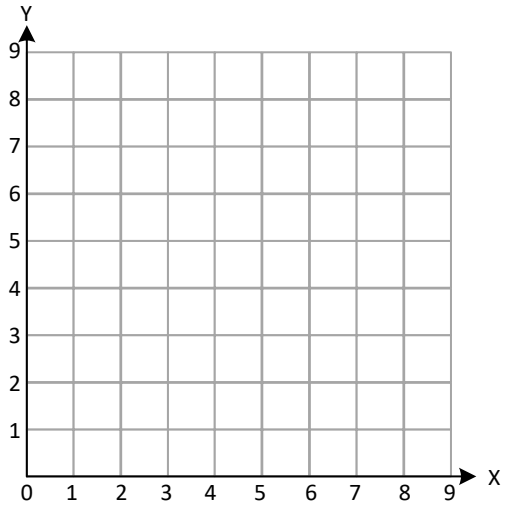
b. Write the lossless compression representation that we covered in class of the bitmap above

Problem 3: Vector graphics [4 marks]

Consider a simple vector representation like the one that we used in the exercise in class – no additional information is provided for thickness, etc.

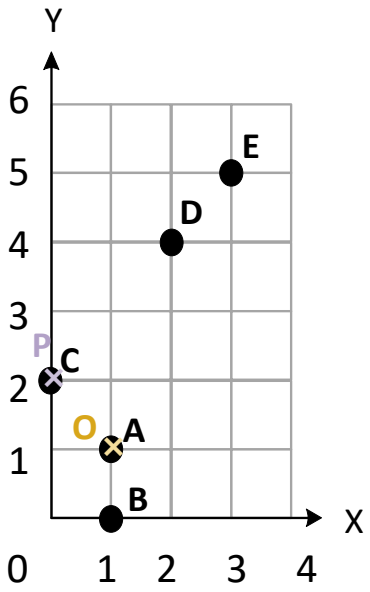
On the following graph, draw what is represented by the following information:

4, 2, 3, 4, 4, 6, 5, 2, 6, 4, 4, 2



Problem 4: Clustering [10 marks]

Consider the following clustering example:



There are five data points: A, B, C, D, and E. You are trying to find two clusters, "O" and "P". Point A has initially been selected as the centroid for cluster O. Point C has initially been selected as the centroid for cluster P.

The following chart contains the distances between various points, which you may find useful in answering the questions in this problem. For any other math that you need to do, you may leave your answer as the expression rather than by doing the calculations, e.g., if your answer is $2^{10} = 1024$, you may leave your answer as 2^{10}

	A	**B**	**C**	**D**	**E**
A	0	1	1.4	3.2	4.5
B	1	0	2.2	4.1	5.4
C	1.4	2.2	0	2.8	4.2
D	3.2	4.1	2.8	0	1.4
E	4.5	5.4	4.2	1.4	0

a. For each point, circle which of the clusters it belongs to. The first row is an example. If non-existent point G belonged to cluster O, you would circle "yes" in the cluster O column as shown.

Point	Cluster O	Cluster P
G	Yes	Yes
A	Yes	Yes
B	Yes	Yes
C	Yes	Yes
D	Yes	Yes
E	Yes	Yes

b. Explain why you made the answer you did in part A using a single sentence to express your reasoning, e.g., "Points A and E belong to cluster O because they are vowels and points B, C, and D belong to cluster P because they are consonants."

c. Choose the new centroids for Clusters O and P:

Cluster O's X value:

Cluster O's Y value:

Cluster P's X value:

Cluster P's Y value:

Problem 5: Decision tree [9 marks]

Consider that you are trying to decide whether or not to come to class. You have the following data that you are trying to learn from

Tiredness	Nearness to exam	Weather	Come to class?
Low	Soon	Sunny	Yes
Medium	Soon	Sunny	Yes
High	Far	Sunny	No
Medium	Far	Sunny	No

Consider adding each of the following rows to your training data separately (i.e., consider only each row at a time – you are not adding row a then row b, etc.)

Circle the attribute name(s) each optimal attribute to split first on for each of the following additions. For example, (and this is not necessarily the right answer) the example below shows how you would answer if Weather and Tiredness were the optimal attributes to split on for part x, your answer should look like this:

x.

Zero	Middling	Rainy	Yes

Tiredness Nearness to exam Weather

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a.

High	Middling	Rainy	No

Tiredness Nearness to exam Weather

b.

High	Soon	Sunny	No

Tiredness Nearness to exam Weather

c.

High	Soon	Snowy	No

Tiredness Nearness to exam Weather