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Question 1:

For the first question, I have taken a neural network with 2 input layers and 1 output layer. In 100 epochs, with learning rate set to 0.08, 100% accuracy was achieved over the training set.

For testing, made vectors: -

```
X_test = [[1,6],[1,9],[2,3],[2,8],[3,4],[3,6],[4,5],[4,6]]
```

```
y_test = [[0],[0],[1],[0],[1],[1],[1],[1]]
```

Using the same parameters, achieved 87.5% accuracy.

Question 2:

For the second question, I have taken a neural network with 2 input layers and 1 output layer. I have then categorized the different classes as 1,2,3,4 and trained the NN over the same for 1,2,3 epochs with a learning rate of 0.9. Achieved 75% accuracy over the training set. For testing purposes, taken:

```
x_test = np.array([[4,5],[6,8],[3,-6],[6,-4] [-4,6],[-5,7], [-5,-8],[-4,-9]])
```

```
y_test = np.array([[1],[1],[2],[2],[3],[3],[4],[4]])
```

LR = 0.009

Epochs = 1

Loss after iteration 1: 4.254297

Training set accuracy = 0.25

Test set accuracy = 0.75

Epochs = 2

Loss after iteration 1: 4.254181

Loss after iteration 2: 4.211331

```
[1, 1, 2, 2, 1, 1, 4, 4]
```

Training set accuracy = 0.75

Test set accuracy = 0.625

Epochs = 3

Loss after iteration 1: 4.250728

Loss after iteration 2: 4.207913

Loss after iteration 3: 4.165663

[1, 1, 2, 2, 3, 3, 4, 4]

Training set accuracy = 1.0

Test set accuracy = 1.0

Varying LR did not have much effect on accuracy. Only the initial loss values were higher for lower LR

Question 3:

Designed the neural network as per given specifications and recorded training and test set accuracies for varying number of nodes in the hidden layer.



