**Question # 04 (Solution)**  
  
Test example: X = (Home Owner = Yes, Marital Status = Single, Annual Income = 120,000)

Step 1: Calculate distances  
We need to calculate the distances between the test example and each training example using the L2 norm (Euclidean distance).

| **Training Example** | **Distance to X = (Yes, Single, 120000)** |
| --- | --- |
| (Yes, Single, 70000) | sqrt((Yes-Yes)^2 + (Single-Single)^2 + (120000-70000)^2) = sqrt(0 + 0 + 25000000) = 5000 |
| (No, Married, 60000) | sqrt((Yes-No)^2 + (Single-Married)^2 + (120000-60000)^2) = sqrt(1 + 1 + 36000000) = 6000 |
| (Yes, Married, 85000) | sqrt((Yes-Yes)^2 + (Single-Married)^2 + (120000-85000)^2) = sqrt(0 + 1 + 90000000) = 9500 |
| (Yes, Single, 80000) | sqrt((Yes-Yes)^2 + (Single-Single)^2 + (120000-80000)^2) = sqrt(0 + 0 + 40000000) = 6000 |
| (No, Single, 75000) | sqrt((Yes-No)^2 + (Single-Single)^2 + (120000-75000)^2) = sqrt(1 + 0 + 22500000) = 4750 |
| (Yes, Married, 70000) | sqrt((Yes-Yes)^2 + (Single-Married)^2 + (120000-70000)^2) = sqrt(0 + 1 + 25000000) = 5000 |
| (No, Single, 100000) | sqrt((Yes-No)^2 + (Single-Single)^2 + (120000-100000)^2) = sqrt(1 + 0 + 4000000) = 2000 |
| (Yes, Married, 110000) | sqrt((Yes-Yes)^2 + (Single-Married)^2 + (120000-110000)^2) = sqrt(0 + 1 + 1000000) = 3000 |
| (Yes, Single, 120000) | sqrt((Yes-Yes)^2 + (Single-Single)^2 + (120000-120000)^2) = sqrt(0 + 0 + 0) = 0 |

Step 2: Select the K nearest neighbors  
Since K = 3, we select the 3 training examples with the smallest distances to the test example.

The 3 nearest neighbors are:

1. (Yes, Single, 120000) - Distance: 0
2. (No, Single, 100000) - Distance: 2000
3. (Yes, Single, 70000) - Distance: 5000

Step 3: Classify the test example  
a) Unweighted majority voting:  
Among the 3 nearest neighbors, there are 2 instances of Defaulted Borrower = No and 1 instance of Defaulted Borrower = Yes. Hence, we predict that the test example X = (Yes, Single, 120,000) belongs to the majority class, which is "No". So, the predicted class label is "No".

b) Distance weighted majority voting:  
We can assign weights to the class labels based on the inverse of the distances. Smaller distances will have larger weights.

For the 3 nearest neighbors:

1. (Yes, Single, 120000) - Distance: 0, Weight: 1/0 = infinity
2. (No, Single, 100000) - Distance: 2000, WeightApologies, there seems to be an incomplete sentence in the previous response. Let's continue from where we left off:

b) Distance weighted majority voting:  
We can assign weights to the class labels based on the inverse of the distances. Smaller distances will have larger weights.

For the 3 nearest neighbors:

1. (Yes, Single, 120000) - Distance: 0, Weight: 1/0 = infinity
2. (No, Single, 100000) - Distance: 2000, Weight: 1/2000
3. (Yes, Single, 70000) - Distance: 5000, Weight: 1/5000

Among the 3 nearest neighbors, we add up the weights for each class label:

* Defaulted Borrower = No: Weight = 1/2000
* Defaulted Borrower = Yes: Weight = 1/5000

Since the weight for "No" is larger, we predict that the test example X = (Yes, Single, 120,000) belongs to the class "No" using distance weighted majority voting.

So, the predicted class label is "No" using both unweighted majority voting and distance weighted majority voting.