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Q1.

Color = Yello, Size = 2lb, Temp = Warm-blooded, Bath = Everyday						
	class	color	size	temp	bath	
P(Cat|New pet)	0.343	0.122	0.25	0.921	0.154	0.0014823141
P(Dog|New pet)	0.451	0.269	0.255	0.898	0.340	0.0094495238
P(Small mammal|New pet)	0.02	0.250	0.286	0.600	0.167	0.0001428571
P(Reptile|New pet)	0.078	0.214	0.077	0.182	0.167	0.0000389610
P(Fish| New pet)	0.049	0.091	0.100	0.250	0.222	0.0000247475
P(Bird|New pet)	0.029	0.111	0.250	0.667	0.286	0.0001534392
P(Other|New pet)	0.029	0.111	0.125	0.333	0.286	0.0000383598
* pick bath 'More frequently than once a month' cause it's closest to Everyday bath						

From the above table, I assume that the pet is a Dog

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Q2.

cats	58.4	251.3	0.232391564
dogs	76.8	251.3	0.305610824
small mammal	6.2	251.3	0.024671707
reptile	6	251.3	0.023875846
fish	76.3	251.3	0.30362117
birds	22.9	251.3	0.091126144
other	4.7	251.3	0.018702746
	251.3		

	class	color	size	temp	bath	
P(Cat|New pet)	0.232391564	0.122	0.25	0.921	0.154	0.00100430696
P(Dog|New pet)	0.305610824	0.269	0.255	0.898	0.340	0.00640327440
P(Small mammal|New pet)	0.024671707	0.250	0.286	0.600	0.167	0.00017622648
P(Reptile|New pet)	0.023875846	0.214	0.077	0.182	0.167	0.00001192600
P(Fish| New pet)	0.30362117	0.091	0.100	0.250	0.222	0.00015334403
P(Bird|New pet)	0.091126144	0.111	0.250	0.667	0.286	0.00048214891
P(Other|New pet)	0.018702746	0.111	0.125	0.333	0.286	0.00002473908

Re-calculate the probability of each Class and plug in the value into the table again. It is still considered a dog.

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Q3.

Color = Yello, Size = 2lb, Temp = Warm-blooded, Bath = Everyday						
	class	color	size	temp	bath	
P(Cat|New pet)	0.343	0.122	1	0.921	0.154	0.0059292563
P(Dog|New pet)	0.451	0.269	1	0.898	0.340	0.0370712088
P(Small mammal|New pet)	0.02	0.250	1	0.600	0.167	0.0005000000
P(Reptile|New pet)	0.078	0.214	1	0.182	0.167	0.0005064935
P(Fish| New pet)	0.049	0.091	1	0.250	0.222	0.0002474747
P(Bird|New pet)	0.029	0.111	1	0.667	0.286	0.0006137566
P(Other|New pet)	0.029	0.111	1	0.333	0.286	0.0003068783
* pick bath 'More frequently than once a month' cause it's closest to Everyday bath						

I think I can just ignore the size probability and treat it like just 1 not to affect other probabilities. The result still is a Dog

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Q4.

Difference: The difference between the two methods lies in the possibility of data separation. If your data is clearly separable with lines, use a hard margin. If there are some data that make finding a linear classifier impossible, it is better to use a soft margin to allow some data points to be misclassified.

Hard margin advantages: No misclassification occurs.

Soft margin advantages: It is applicable even if a linear boundary is not feasible.

Which one and which situation: Use a hard margin when your data is linearly and reliably separable. If there are data points that get in the way of linear classification, use a soft margin.

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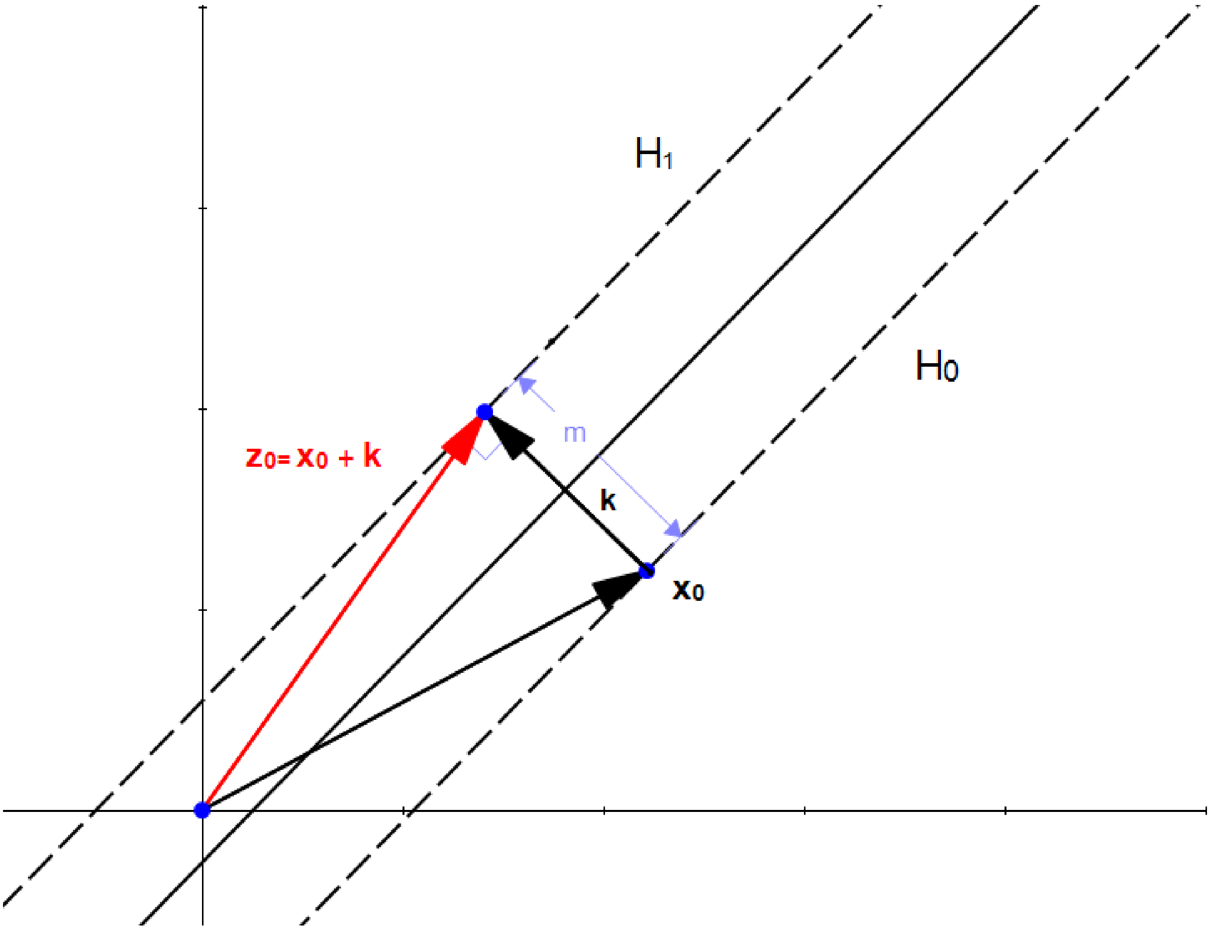
Extra.

If we start from the point x0 and add k we find that the point z0=x0+k is in the hyperplane H1 as shown on figure below.



The fact that z0 is in H1 means that

$$\mathbf{w} \cdot \mathbf{z}_0 + b = 1$$

We can replace z0 by x0+k because that is sum of the vector as we can see above figure.

$$\mathbf{w} \cdot (\mathbf{x}_0 + \mathbf{k}) + b = 1$$

We can now replace k, cause k is

$$\mathbf{k} = m\mathbf{u} = m\frac{\mathbf{w}}{\|\mathbf{w}\|}$$

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$$\mathbf{w} \cdot (\mathbf{x}_0 + m\frac{\mathbf{w}}{\|\mathbf{w}\|}) + b = 1$$

We now expand the equation

$$\mathbf{w} \cdot \mathbf{x}_0 + m\frac{\mathbf{w} \cdot \mathbf{w}}{\|\mathbf{w}\|} + b = 1$$

The dot product of a vector with itself is the square of its norm so :

$$\mathbf{w} \cdot \mathbf{x}_0 + m\frac{\|\mathbf{w}\|^2}{\|\mathbf{w}\|} + b = 1$$

$$\mathbf{w} \cdot \mathbf{x}_0 + m\|\mathbf{w}\| + b = 1$$

$$\mathbf{w} \cdot \mathbf{x}_0 + b = 1 - m\|\mathbf{w}\|$$

We can substitute left side with this

$$\mathbf{w} \cdot \mathbf{x}_0 + b = -1$$

As a result, we can get

$$-1 = 1 - m\|\mathbf{w}\|$$

$$m\|\mathbf{w}\| = 2$$

$$m = \frac{2}{\|\mathbf{w}\|}$$

Finally, we get m in the figure above.

If we want to maximize m, we need to minimize w value.