Homework 2
Dendrogram

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For this homework, i am picking
- Beige
- Bisque
- Royal Blue
- Steel Blue
- Crimson

I suspect the hierarchical structure to be { { Beige, Bisque}, {Royal Blue, Steel Blue}, Crimson }

Here are the RGB values

Color	Hex Code	RGB	Color Sample
Bisque	#FFE4C4	[255, 228, 196]	
Beige	#F5F5DC	[245, 245, 220]	
Royal Blue	#4169E1	[65, 105, 225]	
Steel Blue	#4682B4	[70, 130, 180]	
Crimson	#DC143C	[220, 20, 60]	

We can now start filling the Distance Matrix

Initial State (Before Filling)

	Bisque	Beige	Royal Blue	Steel Blue	Crimson
Bisque	0				
Beige	X	0			
Royal Blue	X	X	0		
Steel Blue	X	X	X	0	
Crimson	X	X	X	X	0

Now we can start computing the Euclidean Distance between the Colors

The Euclidean Distance between Bisque and Beige
Dist(Bisque, Beige) = sqrt(sum((255-245)^2 + (228-245)^2 + (196-220)^2)) is **31.1**

The Euclidean Distance between Bisque and Royal Blue
Dist(Bisque, Royal Blue) = sqrt(sum((255-65)^2 + (228-105)^2 + (196-225)^2)) is **228.2**

The Euclidean Distance between Bisque and Steel Blue

Dist(Bisque, Steel Blue) = sqrt(sum((255-70)^2 + (228-130)^2 + (196-180)^2)) is **210.0**

The Euclidean Distance between Bisque and Crimson
Dist(Bisque, Crimson) = sqrt(sum((255-220)^2 + (228-20)^2 + (196-60)^2)) is **251.0**

The Euclidean Distance between Beige and Royal Blue
Dist(Beige, Royal Blue) = sqrt(sum((245-65)^2 + (245-105)^2 + (220-225)^2)) is **228.1**

The Euclidean Distance between Beige and Steel Blue
Dist(Beige, Steel Blue) = sqrt(sum((245-70)^2 + (245-130)^2 + (220-180)^2)) is **213.2**

The Euclidean Distance between Beige and Crimson
Dist(Beige, Crimson) = sqrt(sum((245-220)^2 + (245-20)^2 + (220-60)^2)) is **277.2**

The Euclidean Distance between Royal Blue and Steel Blue
Dist(Royal Blue, Steel Blue) = sqrt(sum((65-70)^2 + (105-130)^2 + (225-180)^2)) is **51.7**

The Euclidean Distance between Royal Blue and Crimson
Dist(Royal Blue, Crimson) = sqrt(sum((65-220)^2 + (105-20)^2 + (225-60)^2)) is **241.8**

The Euclidean Distance between Steel Blue and Crimson
Dist(Steel Blue, Crimson) = sqrt(sum((70-220)^2 + (130-20)^2 + (180-60)^2)) is **221.4**

Final State After all calculations for round 1

	Bisque	Beige	Royal Blue	Steel Blue	Crimson
Bisque	0	31.1	228.1	210.0	251.0
Beige	X	0	228.1	213.2	277.2
Royal Blue	X	X	0	51.7	241.8
Steel Blue	X	X	X	0	269.2
Crimson	X	X	X	X	0

The smallest non-diagonal value in the table is 31.1. So our first linkage will be 31.1. The link is between Bisque and Beige and is represented by link 1 in Figure 1.

We will now search for the next smallest value in the table and treat the linkage of Bisque and Beige as a single unit. For this homework, we will consider the closest neighbor or min of the two values for a linkage. Other options include farthest neighbor (max of a linkage) or average of the two values.
Repeating this step till we have made all the connections, we get.

Final State After all calculations for round 2

	Bisque and Beige	Royal Blue	Steel Blue	Crimson
Bisque and Beige	0	228.1	210.0	251.0
Royal Blue	X	0	51.7	241.8
Steel Blue	X	X	0	269.2
Crimson	X	X	X	0

The smallest non-diagonal value in the table is 51.7. So our second linkage will be 51.7.The link is between Royal Blue and Steel Blue and is represented by link 2 in Figure 1.

Final State After all calculations for round 3

	Bisque and Beige	Royal Blue and Steel Blue	Crimson
Bisque and Beige	0	228.1	251.0
Royal Blue and Steel Blue	X	0	241.8
Crimson	X	X	0

The smallest non-diagonal value in the table is 228.1. So our third linkage will be 228.1. The link is between {Royal Blue, Steel Blue} and {Bisque, Beige} and is represented by link 3 in Figure 1.

Final State After all calculations for round 4

	Bisque and Beige, Royal Blue and Steel Blue	Crimson
Bisque and Beige, Royal Blue and Steel Blue	0	241.8
Crimson	X	0

The smallest non-diagonal value in the table is 241.8. So our third linkage will be 241.8. The link is between {{Royal Blue, Steel Blue}, {Bisque, Beige}} and Crimson and is represented by link 4 in Figure 1.
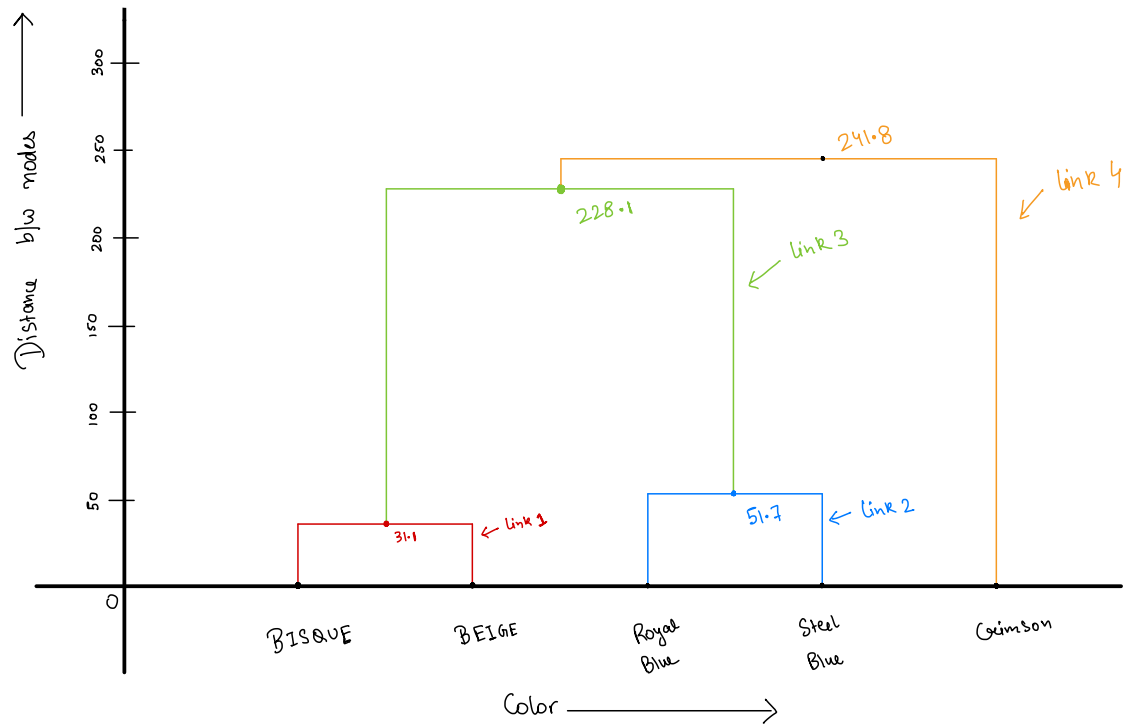
Finally we can draw the Dendrogram as shown in Figure 1.

Figure 1: The final dendrogram