Problem 4.

original → 24 bits per pixel, 8 bits/color

image → Size $N \times N$

M, N, k

for M, each $M \times M$ block can be considered as 1 pixel

Now the resolution is $(\frac{N}{M})^2$ actually

For each block we need to store which cluster it belongs to which takes $\log_2 k$ bits.

And we need to store the color for clusters, $k \times 24$ bits/pixel which is $24k$ bits.

All together $\Rightarrow$ $\frac{24k + \log_2 k \times (\frac{N}{M})^2}{N^2} = \frac{24k}{N^2} + \frac{\log_2 k}{M^2}$ bits/pixel

Compression ratio $= (\frac{24k}{N^2} + \frac{\log_2 k}{M^2}) / 24 = \frac{k}{N^2} + \frac{\log_2 k}{24M^2}$