1. As per the hint, consider a random variable

Note that because for any two elements , we have two random variables and and we also have for any element . That makes for

.

Thus, is the same as .

Markov’s inequality is

We now try to get the expectation of the summation.

Note that

Let’s call . If we set the in Markov’s inequality to , Then

Because .

So

.

And

So

Which finally leads to

QED.