Calculate ELBO

We have 7 pieces

* Part 1:

What is ?

If , then:

If , then:

Therefore, we have that:

* Part 2:

What is ?

Because the normalizing constant is always 1, no matter what, then E[log(1)]=E[0]=0

Therefore, when we sum of these up, we get:

* Part 3:

Notice that the beta distribution constant only involves a=1 and and therefore we can ignore it.

* Part 4:

Notice that the beta distribution constant only involves a and b and therefore we can ignore it.

* Part 5:

Because the normalizing constant K of a multinomial distribution with size=1 is always 1, then E(log(1))=E(0)=0

For :

Where

For :

Therefore, the final equation is given by:

* Part 6:
* Part 7: