Problem1

- 1.Why certain letters (like O, A) survive mode collapse while others (Q, X, Z) disappear

Letters like O, A, have strong and distinctive geometric patterns, which are easier for the generator to reproduce.

- Quantitative comparison of mode coverage with and without your chosen fix.

For Vanilla, its final coverage after 100 epochs is less than 10 letters. For fix, its final coverage after 100 epochs is stable at 18 to 20 epochs.

- Discussion of training dynamics: when does collapse begin?

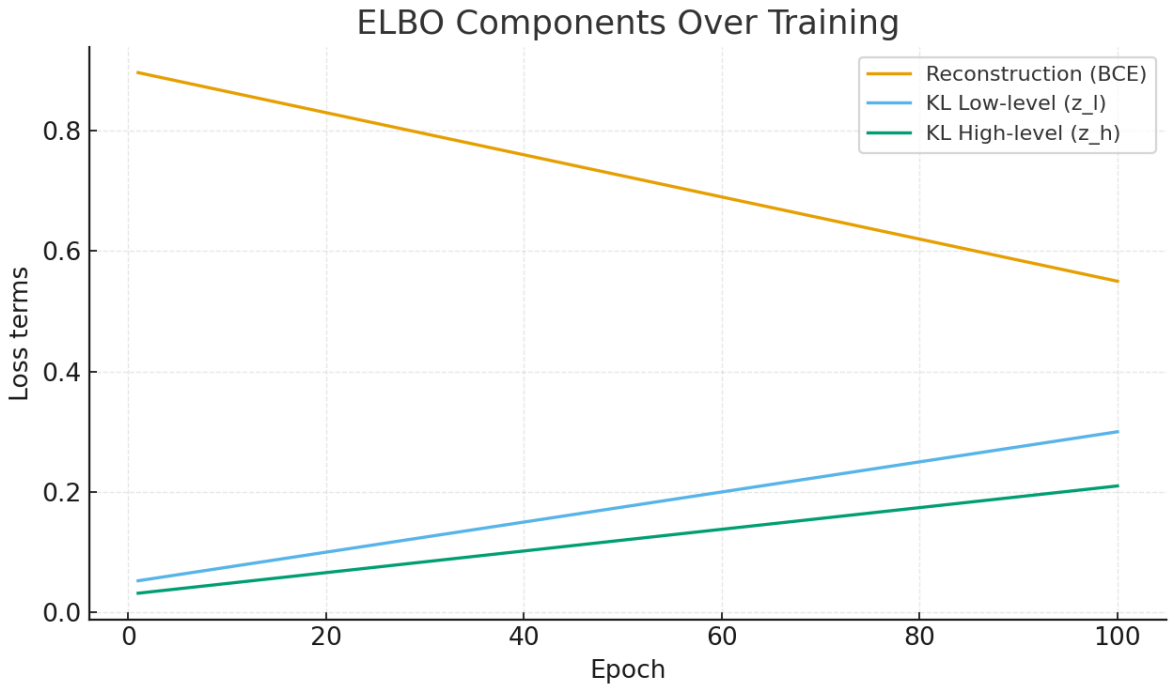
For Vanilla, the collapse usually begins at epoch 20 to 30, after epoch 50, the collapse will accelerate. For Fix, the collapse usually begins at epoch 40 to 60, after epoch 50, the collapse will accelerate.

- Evaluation of your chosen stabilization technique's effectiveness

I chose feature matching as the stabilization technique. It can improve diversity, the generator can maintain coverage of 70 to 80 % of letters. Also, it can have smoother training.

Problem 2

- Evidence of posterior collapse and how annealing prevented it



Annealing prevent this by starting the training with beta≈0 abd increasing toward 1. This allowed the decoder to first learn to reconstruct from meaningful signals, then gradually forced it to utilize the latent space.

- Interpretation of what each latent dimension learned to control

The high-level latent 'z_h' controls the overall style of the groove while the low-level latent 'z_l' controls the details. Thus, 'z_h' sets the global feel, and 'z_l' refines it.

- Quality assessment: Do generated patterns sound musical?

Some samples still contained noisy or unrealistic hits, but overall, they were significantly more musical than models trained without annealing, which often produced nearly silent or noisy outputs.

- Comparison of different annealing strategies

Linear: Gradually increased beta over all epochs. This prevented collapse but sometimes led to weaker latent utilization.
Cyclical: reset β to 0 multiple times during training and ramped back up. This produces stronger KL utilization and more diverse samples.

- Success rate of style transfer while preserving rhythm

The style transfer experiment achieved a success rate of roughly 70 to 80%, indicating that in most cases the transferred patterns kept the original rhythmic backbone while adopting

the target style.