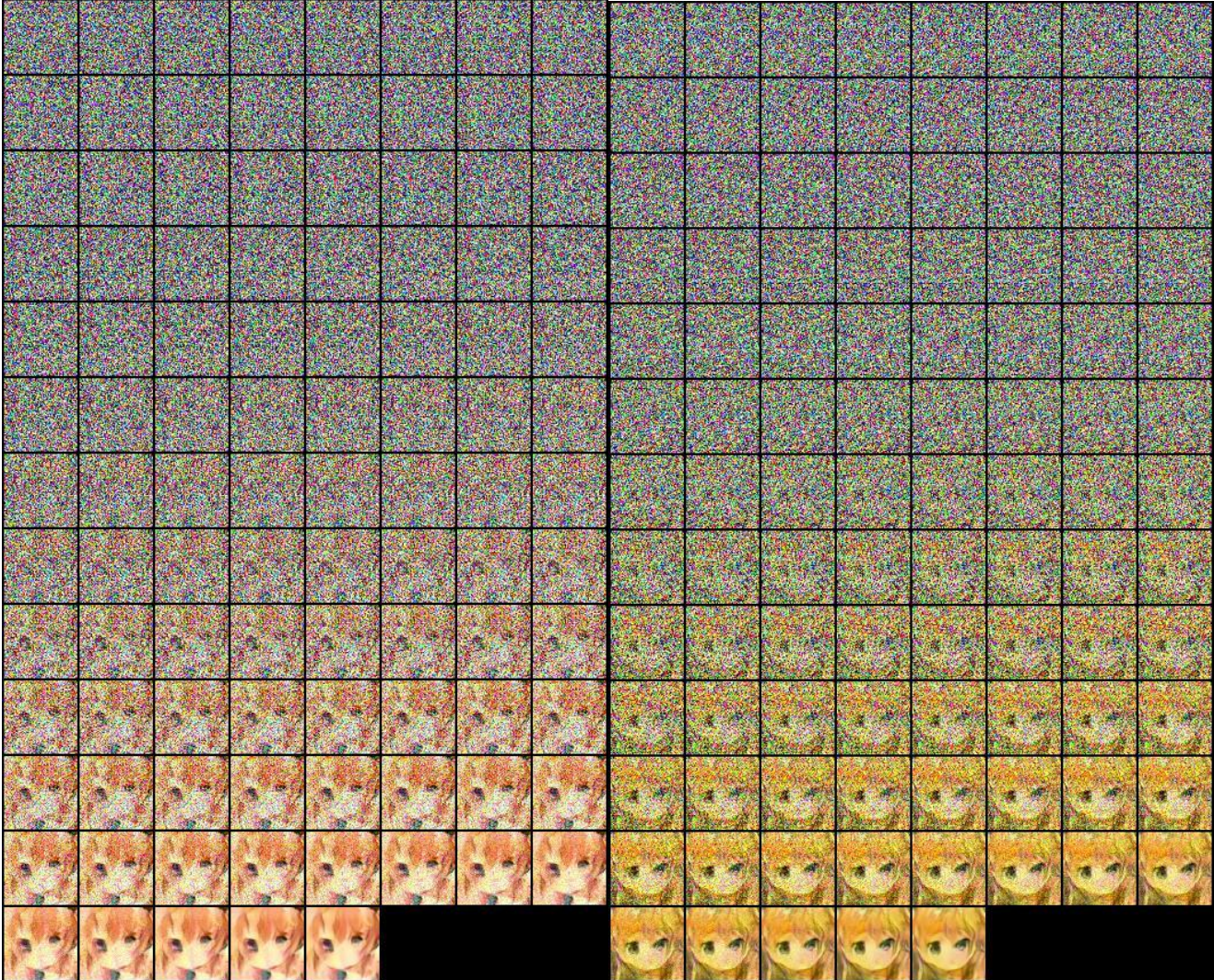
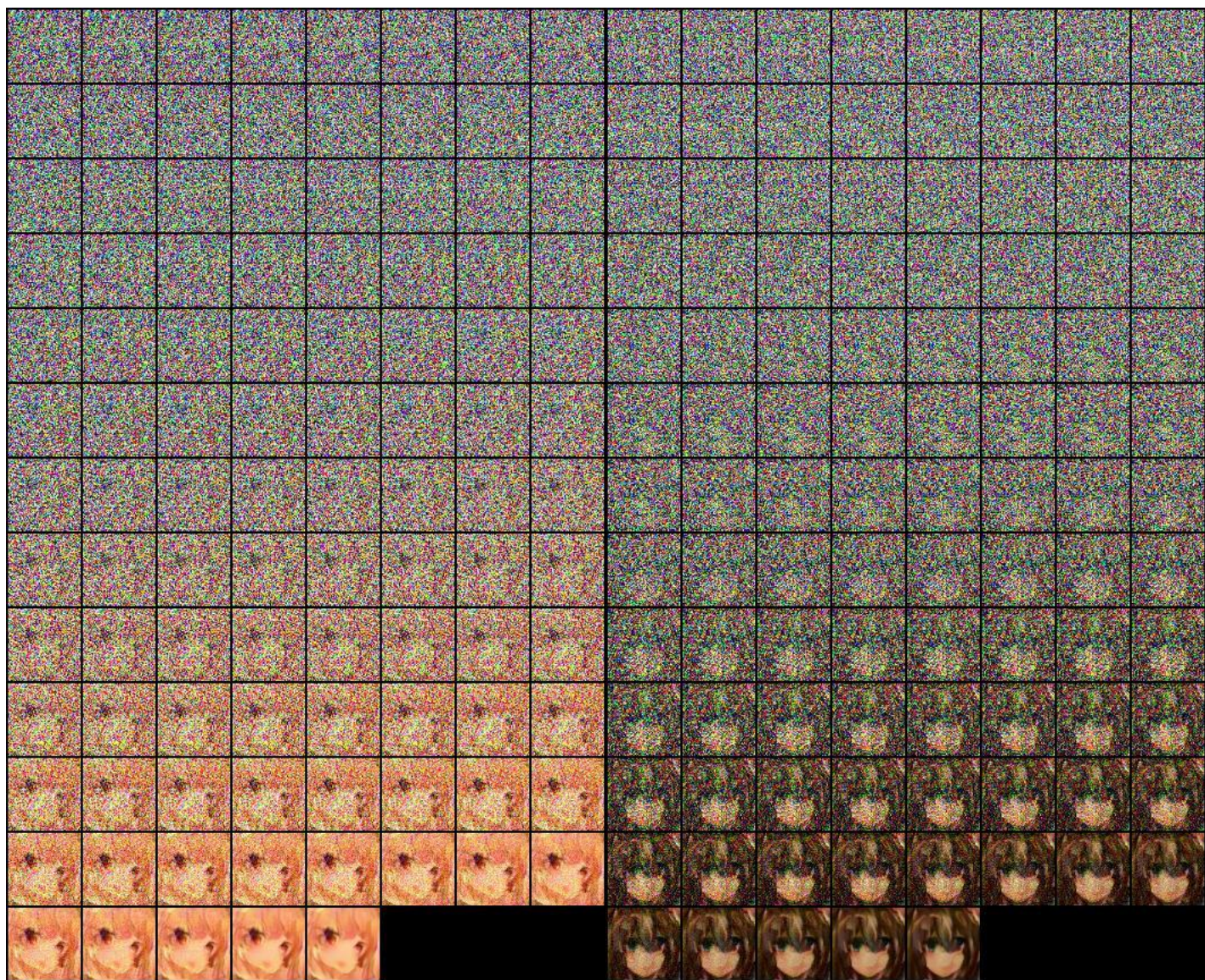
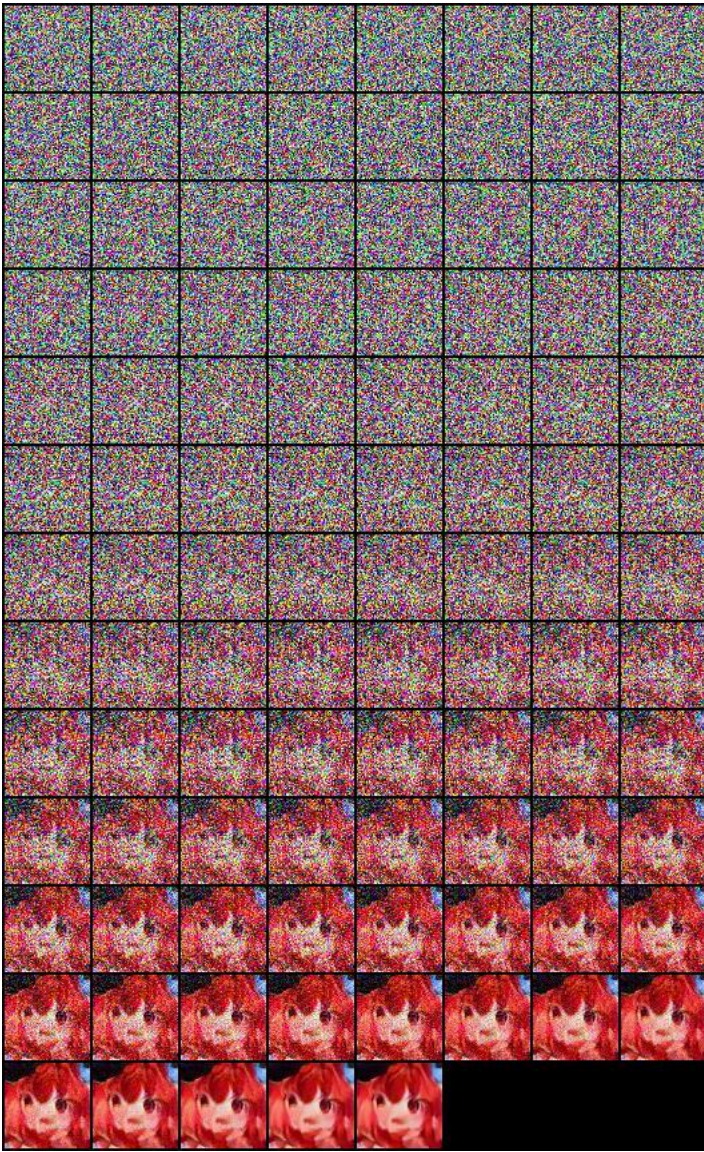


Question 1







Based on the 5 sample above we can see the quality of the sample increase with the time steps, and the features of an image with larger scale appears first than comes the smaller scaled features.

Reference: <https://arxiv.org/pdf/2006.11239.pdf>

Question 2:

The training objective function of both DDPM and DDIM are the same but here DDIM generalizes the forward diffusion process from Markovian (DDPM) to non-Markovian. The inference process of DDPM is far longer because it requires all previous denoising steps. Being modeled as Markov Chains, an image couldn't be generated at timestep t before timestep $t-1$ is generated. Whereas DDIM is able to skip steps during the inference process because of the non-Markovian **which can massively increase the speed** and while maintaining most of the original quality. The DDIM generated image also tend to have more consistency because the generative process of DDIM is deterministic where as DDPM's generative process is not.

Reference:

<https://arxiv.org/pdf/2010.02502.pdf>

<https://strikingloo.github.io/wiki/ddim>

<https://betterprogramming.pub/diffusion-models-ddpms-ddims-and-classifier-free-guidance-e07b297b2869>

https://www.cs.unc.edu/~ronisen/teaching/fall_2022/pdf_lectures/lecture8_diffusion_model.pdf