Question 4:

1. **How does the total mass of the MW and M31 compare in this simulation? What galaxy component dominates this total mass?**

*The total mass of MW is equal to the total mass of M31. In the MW galaxy, the dominating factor is Halo mass, just like M31. However, M31 has a higher Disk and Bulge mass compared to that of the MW.*

**2. How does the stellar mass of the MW and M31 compare? Which galaxy do you expect to be more luminous?**

*From understanding the given data table sets, (1) is the dark matter profiles and thus all halo mass is considered to be dark matter. With this understanding, we see that the MW has more dark matter, thus it will be less luminous then M33. This makes M33 to be the more luminous galaxy.*

**3. How does the total dark matter mass of MW and M31 compare in this simulation**

**(ratio)? Is this surprising, given their difference in stellar mass?**

*The ratio of MW dark matter mass and M31 is about (1.975/1.921) which is approximately 1.028 while there total mass of the galaxy is the same. This is not that surprising since different galaxies have different starting points, thus we can see small perturbations from a “normal” without anything being abnormal.*

**4. What is the ratio of stellar mass to total mass for each galaxy (i.e. the Baryon fraction)? In the Universe, Ωb/Ωm ∼16% of all mass is locked up in baryons (gas & stars) vs. dark matter. How does this ratio compare to the baryon fraction you computed for each galaxy? Given that the total gas mass in the disks of these galaxies is negligible compared to the stellar mass, any ideas for why the universal baryon fraction might differ from that in these galaxies?**

*The baryon fraction shows that there is much more dark matter than stellar mass. While the universe has about 16%, the stellar ratio is much less since the Baryon fraction (which shows total mass over dark matter). Because of this, we see that there is very small stellar mass in comparison to the normal ratio in the universe. One possible reason for why this difference occurs is that we are observing the galaxy at its creation with little time. This means that the stars have yet to evolve, have yet to move, and have yet to disturb the dark matter in the galaxy. As stars evolve, their mass increases, and as they move around, they spread the dark matter and consume more of it. This means that the huge amount of dark matter we see will be absorbed by the stars and turn it into stellar mass as it approaches the universal baryon fraction.*