KEEP THIS QUESTION SHEET. Mark your answers AND the correct ones I will give you at the end of the class on Monday, Dec 4th on this sheet; then use it while studying for the last exam on the 6th. TAKE A SEPARATE PIECE OF PAPER AND PRINT YOUR NAME and your ANSWERS (just T or X for the 8 True/False and A, B, C, D, or E for the four multiple choice questions) NEXT TO THE NUMBER (1–12) FOR EACH QUESTION. Write (LEGIBLY!) a short paragraph for the last question, 13, which is worth 3 points, so the total is 15 (but it will be graded out of 10, providing 5 bonus points). THESE ANSWER SHEETS ARE TO BE HANDED IN AT THE BEGINNING OF CLASS ON MONDAY DEC. 4th. If you cannot be there that day, you must e-mail your answers to me at: wiita@chara.gsu.edu by that time if you expect any credit.

1. Collisions between two comparably sized spiral galaxies usually result in a larger spiral.
2. The Milky Way is now usually classified as a Sc galaxy.
3. The range of masses for elliptical galaxies is greater than the range of masses for spiral galaxies.
4. Hot gas in clusters of galaxies produces X-rays but makes only a very small contribution to the mass in such clusters.
5. Seyfert galaxies are ellipticals with active nuclei.
6. Elliptical galaxies are classified from E0 to E6.
7. Photons left over from the formation of hydrogen atoms in the early universe currently have wavelengths peaking at just a little over 1 mm, which corresponds to about 2.7 K.
8. Only extremely small quantities of any isotopes other than \(^{1}\text{H}\) and \(^{4}\text{He}\) were produced in the primordial nucleosynthesis in the first three minutes after the Big Bang.

9. BL Lacertae objects are
   A. very rapidly variable in both radio, optical and X-ray bands
   B. active galactic nuclei
   C. found to have strong emission lines
   D. both A. and B.
   E. all of A., B. and C.
10. The Schwarzschild radius of a \(10^8\text{M}_\odot\) black hole would be about ______
    A. \(10^{-6}\) pc
    B. \(10^{-5}\) pc
    C. \(10^{-4}\) pc
    D. \(10^{-3}\) pc
    E. \(10^{-2}\) pc
11. If it weren’t for the fact(s) that ______, the night sky would be roughly as bright as the sun.
    A. the universe is expanding, thereby redshifting photons
    B. the age of the universe is finite, thereby imposing a horizon on what we can see
    C. the microwave background photons pervade the universe
    D. Both A and B are needed to explain Olber’s paradox.
    E. All of A, B and C are needed to explain Olber’s paradox.
12. In ranking galactic types by color, which is the correct order, from reddest to bluest?
    A. ellipticals, spirals, irregulars
    B. spirals, irregulars, ellipticals
    C. irregulars, spirals, ellipticals
    D. ellipticals, irregulars, spirals
    E. spirals, ellipticals, irregulars
13. The well-known poet Muriel Rukeyser (1913-1980) wrote in “The Speed of Darkness” that: “The universe is made of stories, not of atoms.” Do you agree or disagree? Write a single paragraph giving your reaction to that line. (3 points)