Introductory Astronomy NAME:

Homework 26: The Discovery of Galaxies: Homeworks and solutions are posted on the course web site. Homeworks are **NOT** handed in and **NOT** marked. But many homework problems ($\sim$ 50–70 %) will turn up on tests.

1. Did you complete reading-homework-self-testing for the Introductory Astronomy Lecture (IAL) by the weekly due date?

   a) YYYessss! b) Jawohl! c) Da! d) Sí, sí. e) OMG no!

2. "Let's play *Jeopardy*! For $100, the answer is: They are large, gravitationally-bound systems of stars that range from dwarf versions that are kiloparsec in size scale to the large ones that are tens of kiloparsecs or even a couple hundred kiloparsecs in size scale."

   What are _____, Alex?

   a) binaries b) open clusters c) globular clusters d) galaxies e) universes

3. Galaxies come in five main types: ellipticals, lenticular, unbarred spirals, barred spirals, and:

   a) globulars. b) irregulars. c) seculars. d) Cepheids. e) Vermeers.

4. "Let's play *Jeopardy*! For $100, the answer is: In the celestial-sphere picture of the sky, this object is luminous band on celestial sphere that straddles a great circle that is at an angle of about 60° to the celestial equator."

   What is the _____, Alex?

   a) Zodiac b) celestial axis c) ecliptic d) Milky Way e) Andromeda Nebula

5. The center of the Milky Way is in:

   a) Orion. b) Sagittarius. c) Virgo. d) Cassiopeia. e) Pegasus.

6. The first three recorded persons, all living in the 18th century, to speculate about the structure of the Milky Way in the context of Newtonian physics were:

   a) Larry, Curly, and Moe. b) Voltaire, Talleyrand, and Robespierre. c) Ben Franklin, Thomas Jefferson, and George Washington. d) Thomas Wright, Goethe, and Frederick the Great. e) Thomas Wright, Immanuel Kant, and J. H. Lambert.

7. "Let's play *Jeopardy*! For $100, the answer is: He/she attempted to map the Milky Way using star counts (or star gauges)."

   Who is _____, Alex?

   a) Nicolaus Copernicus (1473–1543) b) Galileo Galilei (1564–1642)
   c) William Herschel (1738–1822) d) Isaac Newton (1642/3–1727)
   e) Caroline Herschel (1750–1848)

8. "Let's play *Jeopardy*! For $100, the answer is: He/she obtained a roughly correct size estimate for the Milky Way and was the first to roughly correctly locate the center of the Milky Way using Cepheid variable stars in globular clusters in the halo of the Milky Way."

   Who is _____, Alex?

   a) Henrietta Swan Leavitt (1868–1921) b) Heber Curtis (1872–1942)
   c) Edwin Hubble (1889–1953) d) Harlow Shapley (1885–1972)
   e) Stephen Hawking (1942–2018)

9. Clouds in space or, when speaking historically, those objects regarded as cloud-like are called:

   a) shapleys. b) stars. c) galaxies. d) nebulae. e) curtises.

10. The spiral structure of some nebulae was discovered in 1845 using visual astronomy and the largest telescope of its time: the 183-cm diameter Leviathan of Parsonstown located at Birr Castle, Parsonstown, Ireland. Because the spiral nebulae are rather faint, it takes a large telescope to make out the spiral structure visually. With long-exposure photography, it is relatively easy to discover spiral structure, but astrophotography took a rather long ramp-up time and only detected spiral structure clearly in 1885

more than 40 years after the invention of photography. The discovery of the spiral structure was made by the builder of the Leviathan:

a) the Earl of Rosse (1800–1867). b) John Herschel (1792–1871).
c) Henrietta Swan Leavitt (1868–1921). d) Harlow Shapley (1885–1972).
e) Edwin Hubble (1889–1953).

11. On 1920 April 26, a debate about the nature of the spiral nebulae was held at a meeting of the National Academy of Sciences in Washington, D.C. The debaters both made sound points in the printed presentations that they later made if not on the day of. This debate is called the Great Debate or the:

a) Einstein-de Sitter debate. b) Rosse-Hubble debate. c) Shapley-Hubble debate.
d) Shapley-Curtis debate. e) Kant-Einstein debate.

12. Using Cepheid variable stars as distance indicators and the inverse square law for electromagnetic radiation flux, this famous astronomer was able to prove that M31 (the Andromeda spiral nebulae) was a giant star system (i.e., a galaxy) outside of the Milky Way. His/her name is:

a) Caroline Herschel (1750–1848). b) Henrietta Swan Leavitt (1868–1921).
c) Harlow Shapley (1885–1972). d) Edwin Hubble (1889–1953).
e) Knut Lundmark (1889–1958).

13. Edwin Hubble (1889–1953) was able to prove the extragalactic nature of the spiral nebulae because, among other things, he had available the world's:

a) largest telescope of our day. b) second largest telescope of his day. c) largest telescope of his day. d) smallest telescope of our day. e) largest telescope of Newton's day.