UGS303 Extraterrestrial Life
Review Questions for Fourth Exam
Spring 2014

This test covers Chapters 8 through 10 plus *Contact*. That means it covers the results for the Drake equation, communication, and travel. It will ask you for *your* values for N and r, and for an analysis of the consequences of your numbers. Bring your Drake Equation to the test with only the numbers filled in and turn it in with the test.

A. Evaluation of the Drake Equation

1. Two students have evaluated their Drake Equations. Happy Feller gets $N = 2.5 \times 10^{11}$, while Mr. Average Guy gets $N = 9.4 \times 10^5$. Who will calculate the larger r? How many stars would one have to search before finding the nearest civilization, given each of their estimates for N?

2. Another student, Angela Angst, takes L = 100 years. Does Angela think two-way messages are possible? What does it mean if your estimate for N is less than one?

3. Given your estimate for N, would you expect your estimate for r to go up or down if the Sun were closer to the center of the galaxy?

B. Communication with Extraterrestrial Civilizations

1. Describe the spectrum of electromagnetic radiation, identifying the various wavelength regions. Indicate which are higher in frequency and shorter in wavelength.

2. Why are radio waves generally favored as the wavelength region for interstellar communication? What range of frequencies is best? What are the arguments for this range? Answer for both planets with and without atmospheres like Earth's.

3. Explain three suggestions for "magic" frequencies. Discuss whether they are convincing or not.

4. Draw a diagram showing how a vertically polarized electromagnetic wave can produce an alternating current in an antenna.

5. Explain how a radio telescope works.

6. Describe the problems of recognizing and decoding signals. What features should a signal have in order to make it easier to recognize and to be decoded? Describe AM, FM, analog, and digital signals.

7. Make up a message by coding a picture into a series of 1's and 0's.

8. Describe the pulsars and OH maser emission. Why don't we think these are signals from ETI?

9. Describe the methods and results of Project Ozma.

10. Describe the META projects.

11. Describe the NASA search for extraterrestrial intelligence (ETI) and its successor, Project Phoenix. Explain the differences between the all-sky survey and the discrete source search. Which of these would make the most sense for the values in your Drake equation?

12. Describe the Allen Telescope Array and how it could extend the search.

13. Describe the proposed SKA project. What would its capabilities be?

C.   Review Questions for *Contact*

1. Describe the ARGUS facility discussed in *Contact* in as much detail as you can. How many telescopes, how many frequencies, how narrow were the filters?

2. Describe the signal detected by ARGUS. What frequency was it first detected at, what other frequencies did it show up at, what was the bandwidth, what was the intensity? How could the scientists in *Contact* tell it was not a terrestrial signal? How could they tell it came from Vega? What did they learn from the absence of a Doppler shift due to motion of the transmitter around Vega?

3. Describe the four levels of information coded into the signal received by ARGUS. How was each modulated and how was each decoded? What was the purpose of each level of information? What is a palimpsest?

4. When the ARGUS scientists were looking for the Primer, Ellie asked S. Hadden for advice. Describe the various suggestions he gave. Which turned out to be correct?

5. In Chapter 11 of **Contact**, various attitudes toward interstellar communication are expressed at the meeting of the World Message Consortium. Describe the various opinions and who expressed each one. Which is closest to your own attitude?

6. Describe the journey taken by the people in the machine. What is Eda's theory for how the transport system works (see Chapter 23)?

D.   Travel

1. Give three motivations for interstellar travel. Use your estimates for factors in the Drake equation to compute how many habitable planets there are in the Galaxy. Assume that a planet remains habitable for 10×10^9 years.

2.	In what order did the following steps occur in exploration of our own solar system: missions with astronauts, flybys, landers, colonization, orbital probes, telescopic observations? How would this sequence differ for interstellar travel? Why?

3.	Describe Project Orion and Project Daedalus. Give as much detail as you can.

4.	Describe two of the exotic ideas for interstellar travel. What are the problems with them?

5.	Give an example of time dilation.

6.	What is a Bracewell probe? What are its advantages and disadvantages for searching for ETI?

7.	What are the implications of the view that colonization of the Galaxy is relatively easy for very advanced civilizations?

8.	What is the Hart Hypothesis? Be sure that you can explain how this argument works and what its significance is. If you have a large estimate for N, you will have to have a good counter-argument to Hart.

9.	What are the four categories of UFO's? What is a close encounter of the third kind?

**E.	Broader Questions**

1.	For your values of N and r, what would be the strategy with the best chance of success, a sky survey or a targeted search of stars? Are two-way messages possible? Would any of the searches done so far had a chance to detect your nearest civilization? If you have a very small value for N, you should still think about these issues because none of us know for sure that our answers are right.