**CYTOSCAPE SIMULATION QUESTIONS** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per:\_\_\_\_\_ Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_

**Instructions –** Using any browser except Internet Explorer, please visit this page to load the Cell Phone Cytoscape Simulator: <http://cellphonesim.systemsbiology.net>.

**Part I - Familiarize yourself with the web application.**

1. First click the “Fit” button. What does this do to the network?
2. How does your hand drawn network compare to the network displayed on the Cell Phone Cytoscape Simulator? How is it different?
3. You and your classmates each created a challenge question about the cell phone network for homework. You should have received another group’s challenge question. Try answering it using this simulator. Feel free to click the buttons at the top of the page to familiarize yourself with the webapp. Or use the “Hints” below to navigate the functions in order to answer your question. If you ever get stuck, look for the “reset your graph” button to start again.

Write the challenge question you received here:

Write the answer here:

**HINT:**  To answer the following questions select the “Statistics” button. Next, click the 5C node. Then click the “Step” button in the “Phone Tree” to send the message onward. You will be able observe how the message moves through the entire network step by step.

**Part II**

1. Your teacher just decided to give a pop quiz in biology tomorrow. Student 5C heard her mention this in the hall today after school. Answer the following questions assuming that 5C passes the message on to everyone in his/her phonebook then everyone who hears the message passes it on to everyone in their phone book, etc.
   1. Will the whole class know about the quiz by tomorrow?
   2. Which person(s) will **receive** the **most** phone calls about the quiz? How many calls does this person receive?
   3. Which person(s) will **make** the **most** phone calls about the quiz? How many calls does this person make?
   4. Which person(s) will **make** the **fewest** phone calls about the quiz? How many calls does this person make?
   5. If one phone call takes 30 seconds to make, how long will it take for the first message to get from 5C to 2A? (Show your work.)

***HINT:*** *For this series of questions make a prediction. Next select the node and use the “KNOCKOUT” button to run the specific scenario and check your prediction.*

* 1. If student 4D’s phone runs out of power and he/she can’t make or receive any calls, how many students will find out about the pop quiz?
  2. If student 3E is grounded and can’t use his/her phone, how many students will find out about the pop quiz?

**Part III – Using Phone Attributes**

1. Sprint PCS’s cell phone towers are struck down by a meteorite. Will this change who can call who? Are any groups now isolated from each other? (Please give examples such as, “Can group 6 contact group 1?”)
2. Sprint PCS rebuilds its cell phone towers and all now work. However, one week later AT&T Wireless is bought out and all of its customers temporarily lose their service. Which outage has a bigger impact on our overall cell phone network: Sprint or AT&T Wireless? Explain.

1. Assuming the entire cell phone network of your class works to its fully capabilities again. Let’s consider a new scenario. Remember that not all of the phones in our classroom network have analog roam capabilities. If our class goes on a field trip to rural Montana (where only the phones **with** roaming capability will work) will this change who can call who in our network?
   1. List the students that 5C will be able to pass a message to.
   2. Will students in group 7 be able to pass a message to students in group 2?
   3. Will students in group 7 be able to pass a message to students in group 5?
2. On this field trip, student 3E takes a picture of a cool rock formation and sends it to everyone he/she can (and they, in turn, send it to everyone they can). How many students will receive the picture? (Not all phones can take/send/receive photos.)
3. Back at home (no longer roaming), student 2D receives a funny email and forwards it to everyone in his/her phone book (and they, in turn, forward it to everyone in their phone books). Which students will receive the email forward? (Notice not all of the phones have email capabilities.)

**Part IV – Summarizing and making connections to scientific and/or biological examples**

1. Please pick 2-3 alpha-bullets below to answer and discuss below:
   1. Given all you are learning about the properties of systems through these lessons, what general patterns have you noticed in this system?
   2. Do you see certain network characteristics as being good (or advantageous) to have in a system? Do some lead to robustness or strength in a system? Do some lead to weakness?
   3. What connections can you make to these patterns, characteristics, and properties? Is there some system you know of in our world that might have some of the same patterns, characteristics, or properties? Please describe.
   4. There are several functions you did not use. Click the “SFN” (Select First Neighbor) button. Give 1-2 real-world scenarios where this function might be useful when analyzing network dynamics.