**Introduction**

This assignment consists of two parts. One part is to figure out a problem posed on this sheet, the other is to read the first chapter in the text and answer some questions. Both are due on paper in class on January 21.

**Part One: Analyzing Communication Systems**

A small town far in the hills of Vermont has a school with children from 120 families. Sometimes school has to be closed because of snow. There is no radio station in town, so the principal is considering various communication systems to use to notify all 120 families. Your assignment is to analyze and compare these three systems.

*The Three Systems*

[1] The principal has a list of the telephone numbers of all 120 families. She calls every number, one by one.

[2] The principal calls the first person on the list. That person calls the second person on the list. The second person calls the third person on the list, etc.

[3] The principal calls the first two people on the list. Each of those two people calls two other people. And each person called calls two other people based on some chart devised by the school.

In all three cases, if nobody is at home at a number, the caller leaves a message if there is an answering machine. Of course, the people may be out of town and the message might not be received for several days.

**Questions**

1. For each of the three systems, how long will it take to tell all 120 families that school is closed? Make a reasonable estimate for how long each call takes. Explain your computation.

2. Imagine that exactly one family is out of town. What does this do to the effectiveness of each system? For each of the three systems: (a) how does the absence of one family affect other families, (b) what could the largest number of families not notified, and (c) what could be the smallest number of families not notified?

Your answer to question 2 shows that even one absent family can prevent other families from getting the news. Given that fact, answer questions 3 and 4.

3. Devise and describe a modification to each system that makes sure all present families are notified even if one or more families are not in town.

4. The principal likes your answers to question 3, but she still wants to know that all families that can be notified are notified. Devise and describe a further extension of the system so the principal knows when all present families are notified.

5. Consider modifying system [3] so that each person calls 3 other people, or 4 other people, or 5.. Does making more calls shorten the time to notify everyone? Use numbers to support your argument.

6. Finally, consider 120 college students who like to go to parties. When any one of the 120 hears of a party, he or she wants to make sure all the other 119 people know about it. Do any of these three systems provide a good solution to this problem? Why or why not? Can you think of a different system to the party notification problem?

**Part Two: Textbook Question**

Based on your reading of Chapter 1 in the *Balanced Introduction to Computer Science*, write answers to the following Review Questions at the end of that chapter (pages 16-17): 1 through 11, 20 through 22.

**Turning in Work**

Turn in your answer on paper, word-processed or typed, not handwritten. You may include hand-drawn diagrams if you like. Put your name on the paper. Bring it to class.

If you discuss the problem with anyone and use any ideas they offer, you must cite them at the top of the page. We shall discuss team efforts soon.

No late work will be accepted. If you cannot finish all the problems, turn in what you have.