COMP 170 Discrete Mathematical Tools for CS
2008 Fall Semester – Final Extra Credit Problem
Distributed: November 28 2008 – Due: December 5, 2008

At the top of your solution, please write your (i) name, (ii) student ID #, (iii) email address and (iv) tutorial section.
Some Notes:

- Please follow the guidelines on doing your own work and avoiding plagiarism given on the class home page. Don't forget to *acknowledge* individuals who assisted you, or sources where you found solutions.
- Please make a *copy* of your assignment before submitting it. If we can't find your paper in the submission pile, we will ask you to resubmit the copy.
- Your solutions should be before 5PM of the due date, in the collection bin in front of Room 4213A (near lift 21)

Challenge Problem:

Suppose that each person in a population, independently of all others, has a certain disease with probability p. The disease can be identified by a blood test, but of course the test has a cost.

For a group of $k > 1$ persons, we will compare two strategies.

Strategy 1 is to test the k persons individually, so k tests are required.

Strategy 2 is to pool the blood samples of the k persons and test the pooled sample first. We assume that the test is negative if and only if all k persons are free of the disease; in this case just one test is required. On the other hand, the test is positive if and only if at least one person has the disease, in which case we then have to test the persons individually; in this case $k + 1$ tests are required.

When does the second strategy require fewer tests, in terms of expected value, than the first strategy?