<u>"Struck by Lightning" Supplementary Materials</u>

<u>Class Exercise About Infectious Diseases</u>

We will consider the following models for the spread of a fatal infectious disease.

First, just one student will be "infected" (and thus stand up).

Then, that infected student will select m other non-infected students (each still sitting down), that they are assumed to have come into "contact" with.

Then, each of those other students will, in turn, roll a die. If the die shows a number r or smaller, then the other student also becomes infected (and thus stands up). If not, then they remain seated.

Finally, after those other students are finished rolling their dice, then the original infected student "dies" (and thus stands flat against the classroom's outer wall).

The above steps are then repeated for the next infected student (if any).

The question is, what is the probability that <u>all</u> students will get infected, before the disease is completely gone?

We will consider the following scenarios, both in whole-class experiments and in small-groups discussions:

(a) $m = 3$, $r = 4$.

(b) $m = 1$, $r = 2$.

(c) $m = 2$, $r = 2$.

(d) $m = 3$, $r = 2$.

(e) $m = 4$, $r = 2$.

(f) $m =$ result of a fresh die roll, $r = 2$.

At some point, you will then be assigned to new groups. Introduce yourselves to each other. Then, working cooperatively with your group, consider the following questions:

1. For each of the above scenarios, what do you think is the probability that all students will become infected? Do you think it is close to 1? close to 0? close to 1/2?

2. Can you come up with a general rule, in terms of m and r, for when the disease is or is not likely to infect all students. [Hint: don't forget the Law of Large Numbers!]