

**Book Problems**

In McClave and Sincich do questions 4.18, 4.36, 4.118(a,b), 5.4, 5.22, 5.26, 5.32, 5.130.

**1.**

a. Suppose 20% of the individuals in a population of interest have hypertension. Coding a case of hypertension by 1, and not hypertension by 0, show that we can interpret the probability of a randomly drawn person as having hypertension as the expected value (or the expected number of cases per person).

b. What is the expected number of cases of hypertension in a group of 5 people selected at random from that population?

c. Now imagine that we have an automated blood pressure machine.

The machine *correctly* gives a positive result (says the patient is hypertensive) for 84% of those who really do have hypertension.

The machine *incorrectly* gives a positive result (says the patient is hypertensive) for 23% of those who don't have hypertension.

As stated above, the rate of hypertension in the population of interest is 20%.

What is the probability that an individual in the population is hypertensive given that he/she tests positive? What is the probability that an individual in the population is not hypertensive given that she/he tests negative?

**2.**

In planning a huge outdoor concert for August 17, the producer estimates that the attendance will depend on the weather according to the following table.

<b>Weather</b>	<b>Attendance</b>	<b>Relative Frequency</b>
wet and cold	5,000	.2
wet and warm	20,000	.2
dry and cold	30,000	.1
dry and warm	50,000	.5

a. What is the expected (mean) attendance?

b. The tickets will sell for \$9 each. The costs will be \$2 per person for cleaning and crowd-control, plus \$150,000 for the band, plus \$60,000 for administration and facilities. Would you advise the producer to go ahead with the concert,? Why or why not?

c. Suppose that the producer decides to go ahead with the concert, but a week before the concert receives a gloomy weather forecast that changes the probabilities for the above weather conditions to

.3, .2, .2, and .3 respectively. If the producer cancels the concert, then she will still owe one half of the administrative and facility fees of \$60,000, plus a 10% cancellation fee to the band. Would you advise her to cancel? Why or why not?

### 3.

In February 2000, legislation appeared before the Washington State Senate mandating that fluoride be added to all drinking water in the state.<sup>1</sup> The Washington State Dental Association and the American Dental and Medical Associations were in favor of the bill. Senator Sen. Pat Thibaudeau, D-Seattle argued that adding fluoride to drinking water is the “safest, most cost-effective and most equitable method of reducing tooth decay in communities throughout the state.” Advocates say that fluoride in the water can reduce tooth decay by much as 65 percent in children and 35 percent adults.

Senator Dan Swecker, R-Rochester, Thurston County, sponsored an opposing bill that would have halted all new fluoridation programs in the state pending further study of the compound's effect on the environment, particularly fluoride runoff into salmon streams. Others who oppose fluoridation fear fluoride may actually weaken teeth or present other health risks.

Suppose you are working on a Public Health and Water Supply project for Washington State. The state is working to insure that an *appropriate level* of fluoride is maintained in public water supplies. Fluoride promotes good dental health when it is present in drinking water at a concentration of at least 1 ppm (part per million). The concentration of fluoride in Washington State water supplies has been found to be normally distributed, with mean 3 ppm and standard deviation 1 ppm.

- a. What percentage of Washington water supplies has a fluoride concentration that falls below 1 ppm?
- b. The state is preparing the training session regarding fluoridation techniques for communities whose water contains less than 1 ppm fluoride. Training sessions cost \$1000 per community. How much is this program expected cost the state? (How would you calculate this?)
- c. Scientific research has shown that when the level of fluoride in drinking water is too high, there is a possibility of toxic impacts on humans and the environment. A consultant to the state has said that a 0.13% (yes, a fraction of one percent) of Washington state water supplies have fluoride concentrations which are high enough to present a health risk. What is the cut off for fluoride concentration above which the consultant is concerned?
- d. Write a 3 to 4 sentence summary presenting your findings.

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<sup>1</sup> Adapted from Gaudette, Karen. “Both sides reject claims as committee considers fluoride bill” *Seattle Times*, February 1, 2000 and “Association of dentists urges statewide water fluoridation” *Seattle Times* December 31, 1999