WS #7 - Duality of Probability - Names:

Ian Hacking in *The Emergence of Probability* (2006, 2nd edition, p.12) writes

> It is notable that the probability that emerged so suddenly is Janus-faced. On the one side it is statistical, concerning itself with stochastic laws of chance processes. On the other side it is epistemological, dedicated to assessing reasonable degrees of belief in propositions quite devoid of statistical background.

One point for us is that the word probability has two distinct uses that must not be confused. Degree-of-belief (DOB) probability is a measure of how much evidence there is for a given proposition. "Hillary Clinton probably will run for president" uses DOB probability. Stochastic probability describes random or stochastic events. "The probability of a fair die turning up 6 is 1/6" uses stochastic probability. Stochastic probability also describes sample means and other statistics when the data have been generated using randomization.

The second point is that these two notions can arise simultaneously: "I don't trust him, he'll probably use crooked dice so that the probability of turning up 6 will be greater than 1/6." It is this simultaneous or dual probability that is used in statistics where DOB and stochastic probability are related but must not be confused.

Label the following italicized words as either DOB or stochastic probability. Assume that any references to data are such that randomization was used.

1. The *probability* of drawing an ace from a well-shuffled deck is 4/52.

2. There is good *chance* you'll get an A on your next BIOS test.

3. ECU *probably* will go to a bowl game next year.

4. The student with the highest score on the first test *probably* knows the difference between DOB and stochastic probability.

5. Female professors *probably* are paid less than male professors.

6. If the mean salary for male and female professors were the same, there is a very small *chance* of seeing such a large difference in the sample means.

7. The new pain reliever *likely* will relieve pain longer than the current pain reliever.

8. If the mean length of pain relief provided by the new drug is the same as the current drug, then the *probability* of seeing such a great difference in the sample means is less than 0.05.

9. The biological effects of the new drug are *probably* very similar to the standard drug.

10. If there were a large difference in the cholesterol lowering properties of these two drugs, it would be very *unlikely* that we'd observe such a small difference between the sample means.

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