

Extra probability problems

- (1) The article, “A Two-minute test for the AIDS Virus,” published in *Maclean’s* on February 17, 1997, described an HIV blood-testing kit, developed by Octopus Diagnostics Research of Hantsport, Nova Scotia, that reportedly can detect the virus that causes AIDS in a drop of blood in two minutes (standard tests can take up to five days). It was found in clinical trials that the test correctly identified 95% of the people who were HIV-positive and accurately ruled out HIV in 98% of the people who were HIV-negative. It is estimated that 2 out of every 1000 college students in the United States is HIV-positive. For each of the following, either give the value, or state why you cannot give it based on the information given.
 - (a) the sensitivity of the test
 - (b) the specificity of the test
 - (c) the probability of a false positive for the population of U.S. college students
- (2) During the Spring 1996 and Fall 1996 semesters, a survey of Stern School undergraduates was undertaken to assess their reasoning in choosing a major field (the survey was performed under the direction of Professor Priscilla A. LaBarbera, director of the Marketing Department’s Undergraduate Program). Among the questions asked of the students were the following. In each case, the student was asked “How important are the following factors in choosing a major?”, with responses coded from 1 (Not at all important) to 5 (Extremely important).
 - (1) Number of employment opportunities upon graduation
 - (2) Size of salary upon graduation
 - (3) Quality of work life (e.g. hours worked, perks, etc.)
 - (4) Prestige associated with the career
 - (5) Glamour associated with the career
 - (6) Need for highly developed oral communications skills
 - (7) Entrepreneurial aspects
 - (8) Quantitative nature of the major courses
 - (9) Qualitative nature of the major courses
 - (10) Peer pressure
 - (11) Coursework considered easy
 - (12) Enjoyment of a chosen career
 - (13) Parental influence in choosing a major

The data can be found in the `undergrd.mtp` file in the `js` directory of the course disk. Examine the different possible motivations of the students in choosing their major, and how they relate to each other. Are the marginal distributions similar for different possible reasons? Can you think of any reasons that would explain the observed patterns? Now examine the joint distributions of different motivations, and

compare them to what would be expected under independence. Do certain motivations seem to be related to each other, while others are not? Why might that be?

Note: be sure to read the case “Perceptions of the New York City subway system: safety and cleanliness” (pp. 43–46 of the Casebook), and then look at the handout “Using the Casebook and MINITAB” under “Perceptions of the New York City subway system: safety and cleanliness” to see how to construct the joint distribution under independence. You do not have to look at the joint distributions of all possible pairs of variables (there are 78 of them!); choose ones that seem interesting to you.

CHS: “Amniocentesis, blood tests, and Down’s syndrome” — Verify the given values for the probability of a positive test result, the proportion of positive tests that are false positives, and the proportion of negative tests that are false negatives.

- (3) According to figures from the Admissions Office of the Stern School, the full-time MBA class of 1998 consisted of 269 enrolled students, 37% of whom were women. The full-time MBA class of 1999 consisted of 312 enrolled students, 44% of whom were women. A prospective member of the class of 2000 visited the school last April, and was introduced to a woman identified as a full-time MBA student. What is the probability that she was a member of the class of 1999? For this problem, assume that no students drop out or transfer to the part-time program (note that this implies that last April all full-time students came from either the class of 1998 or the class of 1999).
- (4) Academy Awards have been given for achievement in the movie industry since 1928, with *Wings* being the first winner of the Best Picture Oscar. Through the 1997 Oscars, 70% of the films that won the Best Picture Oscar had received the most Oscar nominations that year and 84.3% of the films that won the Best Picture Oscar won the most Oscars that year. Of the Best Picture winners that had the most wins that year, 78% had had the most nominations. As you probably know, *Shakespeare in Love* won the 1998 Best Picture Oscar, and it had the most nominations going into the awards ceremony. Given this, what was the probability that it would end up with the most wins?