Quantitative methods for business 13th edition

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Born in Grand Forks, North Dakota, he earned his B.S., M.S., and Ph.D. degrees from Purdue University.Dennis J. Sweeney is Professor Emeritus of Quantitative Analysis and founder of the Center for Productivity Improvement at the University of Cincinnati. Born in Des Moines, Iowa, he earned a BSBA degree from Drake University and his MBA and DBA degrees from Indiana University, where he was an NDEA Fellow. Professor Sweeney has worked in the management science group at Procter & Gamble and has been a visiting professor at Duke University. Professor Sweeney served as Head of the Department of Quantitative Analysis and four years as Associate Dean of the College of Business Administration at the University of Cincinnati. Professor Sweeney has published more than 30 articles and monographs in the area of management science and statistics. The National Science Foundation, IBM, Procter & Gamble, Federated Department Stores, Kroger and Cincinnati Gas & Electric have funded his research, which has been published in Management Science, Operations Research, Mathematical Programming, Decision Sciences and other journals. Professor Sweeney has co-authored ten textbooks in the areas of statistics, management science, linear programming and production and operations management.N/ADr. Jeffrey D. Camm is the Inmar Presidential Chair and Associate Dean of Business Analytics in the School of Business at Wake Forest University. Born in Cincinnati, Ohio, he holds a B.S. from Xavier University (Ohio) and a Ph.D. from Clemson University. Prior to joining the faculty at Wake Forest, he served on the faculty of the University of Cincinnati. He has also served as a visiting scholar at Stanford University and as a visiting Professor of Business Administration at the Tuck School of Business at Dartmouth College. Dr. Camm has published more than 40 papers in the general area of optimization applied to problems in operations management and marketing. He has published his research in numerous professional journals, including Science, Management Science, Operations Research and Interfaces. Dr. Camm was named the Dornoff Fellow of Teaching Excellence at the University of Cincinnati and he was the 2006 recipient of the INFORMS Prize for the Teaching of Operations Research Practice. A firm believer in practicing what he preaches, he has served as an operations research consultant to numerous companies and government agencies. From 2005 to 2010 he served as editor-in-chief of Interfaces. In 2016, Dr. Camm received the George E. Kimball Medal for service to the operations research profession and in 2017 he was named an INFORMS Fellow.James J. Cochran is Associate Dean for Research, Professor of Applied Statistics and the Rogers-Spivey Faculty Fellow at The University of Alabama. Born in Dayton, Ohio, he earned his B.S., M.S., and M.B.A. from Wright State University and his Ph.D. from the University of Cincinnati. He has been at The University of Alabama since 2014 and has been a visiting scholar at Stanford University, Universidad de Talca, the University of South Africa and Pole Universitaire Leonard de Vinci. Dr. Cochran has published more than 40 papers in the development and application of operations research and statistical methods. He has published in several journals, including Management Science, The American Statistician, Communications in Statistics--Theory and Methods, Annals of Operations Research, European Journal of Operational Research, Journal of Combinatorial Optimization, Interfaces and Statistics and Probability Letters. He received the 2008 INFORMS Prize for the Teaching of Operations Research Practice, 2010 Mu Sigma Rho Statistical Education Award and 2016 Waller Distinguished Teaching Career Award from the American Statistical Association. Dr. Cochran was elected to the International Statistics Institute in 2005, was named a Fellow of the American Statistical Association in 2011 and was named a Fellow of INFORMS in 2017. He received the Founders Award in 2014, the Karl E. Peace Award in 2015 from the American Statistical Association and the INFORMS President's Award in 2019. A strong advocate for effective operations research and statistics education as a means of improving the quality of applications to real problems, Dr. Cochran has chaired teaching effectiveness workshops around the globe. He has served as operations research consultant to numerous companies and not-for-profit organizations. "About this title" may belong to another edition of this title. 1. Chapter 2 Introduction to Probability 2 - 22 - 2 Quantitative Methods for Business 13th Edition Anderson SOLUTIONS MANUAL Full download at: edition-anderson-solutions-manual/ Quantitative Methods for Business 13th Edition Anderson TEST BANK Full download at: edition-anderson-test-bank/ Chapter 2 Introduction to Probability Learning Objectives 1. Obtain an understanding of the role probability information plays in the decision making process. 2. Understand probability as a numerical measure of the likelihood of occurrence. 3. Be able to use the three methods (classical, relative frequency, and subjective) commonly used for assigning probabilities and understand when they should be used. 4. Be able to use the addition law and be able to compute the probabilities of events using conditional probability and the multiplication law. 5. Be able to use new information to revise initial (prior) probability estimates using Bayes' theorem. 6. Know the definition of the following terms: experiment addition law sample space mutually exclusive event conditional probability complement independent events Venn Diagram multiplication law union of events prior probability intersection of events posterior probability Bayes' theorem Simpson's Paradox 2. Chapter 2 Introduction to Probability 2 - 32 - 3 Solutions: 1. a. Go to the x-ray department at 9:00 a.m. and record the number of persons waiting. b. The experimental outcomes (sample points) are the number of people waiting: 0, 1, 2, 3, and 4. Note: While it is theoretically possible for more than 4 people to be waiting, we use what has actually been observed to define the experimental outcomes. c. Number Waiting Probability 0 .10 1 .25 2 .30 3 .20 4 .15 Total: 1.0 0 d. The relative frequency method was used. 2. a. Choose a person at random, have her/ him taste the 4 blends and state a preference. b. Assign a probability of 1/4 to each blend. We use the classical method of equally likely outcomes here. c. Blend Probability 1 .20 2 .30 3 .35 4 .15 Total: 1.0 0 3. Chapter 2 Introduction to Probability 2 - 42 - 4 3. The relative frequency method was used. Initially a probability of .20 would be assigned if selection is equally likely. Data does not appear to confirm the belief of equal consumer preference. For example using the relative frequency method we would assign a probability of 5 / 100 = .05 to the design 1 outcome, .15 to design 2, .30 to design 3, .40 to design 4, and .10 to design 5. 4. a. Of the 132,275,830 individual tax returns received by the IRS, 31,675,935were in the 1040A, Income Under $25,000 category. Using the relative frequency approach, the probability a return from the 1040A, Income Under $25,000 category would be chosen at random is 31675935/132275830 = 0.239. b. Of the 132,275,830 individual tax returns received by the IRS, 3,376,943 were in the Schedule C, Reciepts Under $25,000 category; 3,867,743 were in the Schedule C, Reciepts $25,000-$100,000 category; and were 2,288,550 in the Schedule C, Reciepts $100,000 & Over category. Therefore, 9,533,236 Schedule Cs were filed in 2006, and the remaining 132,275,830 - 9,533,236 = 122,742,594 individual returns did not use Schedule C. By the relative frequency approach, the probability the chosen return did not use Schedule C is 122742594/132275830 = 0.928. 4. Chapter 2 Introduction to Probability 2 - 52 - 5 c. Of the 132,275,830 individual tax returns received by the IRS, 12,893,802 were in the Non 1040A, Income $100,000 & Over category; 2,288,550 were in the Schedule C, Reciepts $100,000 & Over category; and 265,612 were in the Schedule F, Reciepts $100,000 & Over category. By the relative frequency approach, the probability the chosen return reported income/reciepts of $100,000 and over is (12893802 + 2288550 + 265612)/132275830 = 15447964/132275830 = 0.117. d. 26,463,973 Non 1040A, Income $50,000-$100,000 returns were filed, so assuming examined returns were evenly distributed across the ten categories (i.e., the IRS examined 1% of individual returns in each category), the number of returns from the Non 1040A, Income $50,000-$100,000 category that were examined is 0.01(26463973) = 264,639.73 (or 264,640). e. The proportion of total returns in the Schedule C, reciepts $100,000 & Over is 2,288,550/132,275,830 = 0.0173. Therefore, if we assume the recommended additional taxes are evenly distributed across the ten categories, the amount of recommended additional taxes for the Schedule C, Reciepts $100,000 & Over category is 0.0173($13,045,221,000.00) = $225,699,891.81. 5. a. No, the probabilities do not sum to one. They sum to 0.85. b. Owner must revise the probabilities so that they sum to 1.00. 6. a. P(A) = P(150 - 199) + P(200 and over) = 26 5 100 100 = 0.31 b. P(B) = P(less than 50) + P(50 - 99) + P(100 - 149) = 0.13 + 0.22 + 0.34 = 0.69 7. a. b. P(A) = .40, P(B) = .40, P(C) = .60 P(A B) = P(E1, E2, E3, E4) = .80. Yes P(A B) = P(A) + P(B). c. Ac = {E3, E4, E5} Cc = {E1, E4} P(Ac) = .60 P(Cc) = .40 d. A Bc = {E1, E2, E5} P(A Bc) = .60 e. P(B C) = P(E2, E3, E4, E5) = .80 8. a. Let P(A) be the probability a hospital had a daily inpatient volume of at least 200 and P(B) be the probability a hospital had a nurse to patient ratio of at least 3.0. From the list of thirty hospitals, sixteen had a daily inpatient volume of at least 200, so by the relative frequency approach the probability one of these hospitals had a daily inpatient volume of at least 200 is P(A) = 16/30 = 0.533, Similarly, since ten (one-third) of the hospitals had a nurse-to-patient ratio of at least 3.0, the probability of a hospital having a nurse-to-patient ratio of at least 3.0 is P(B) = 10/30 = 0.333. Finally, since seven of the hospitals had both a daily inpatient volume of at least 200 and a nurse-to-patient ratio of at least 3.0, the probability of a hospital having both a daily inpatient volume of at least 200 and a nurse-to-patient ratio of at least 3.0 is P(A∩B) = 7/30 = 0.233. b. The probability that a hospital had a daily inpatient volume of at least 200 or a nurse to patient ratio of at least 3.0 or both is P(A U B) = P(A) + P(B) - P(A∩B) = 16/30 + 10/30 – 7/30 = (16 + 10 – 7)/30 = 19/30 = 0.633. 5. Chapter 2 Introduction to Probability 2 - 62 - 6 c. The probability that a hospital had neither a daily inpatient volume of at least 200 nor a nurse to patient ratio of at least 3.0 is 1 – P(A U B) = 1 - 19/30 = 11/30 = 0.367. 9. Let E = event patient treated experienced eye relief. S = event patient treated had skin rash clear up. Given: P (E) = 90 / 250 = 0.36 P (S) = 135 / 250 = 0.54 P (E S) = 45 / 250 = 0.18 P (E S) = P (E) + P (S) - P (E S) = 0.36 + 0.54 - 0.18 = 0.72 10. P(Defective and Minor) = 4/25 P(Defective and Major) = 2/25 P(Defective) = (4/25) + (2/25) = 6/25 P(Major Defect | Defective) = P(Defective and Major) / P(Defective) = (2/25)/(6/25) = 2/6 = 1/3. 11. a. Yes; the person cannot be in an automobile and a bus at the same time. b. P(Bc) = 1 - P(B) = 1 - 0.35 = 0.65 12. a. b. P(A B) P(A B) 0.40 0.6667 P(B) 0.60 P(B A) P(A B) 0.40 0.80 P(A) 0.50 c. No because P(A | B) P(A) 13. a. Reason for Applying Quality Cost/Convenience Other Total Full Time Part Time 0.218 0.208 0.204 0.307 0.511 0.039 0.024 0.461 0.539 Total 0.426 0.063 1.00 b. It is most likely a student will cite cost or convenience as the first reason: probability = 0.511. School quality is the first reason cited by the second largest number of students: probability = 0.426. c. P (Qualityfull time) = 0.218/0.461 = 0.473 d. P (Qualitypart time) = 0.208/0.539 = 0.386 6. Chapter 2 Introduction to Probability 2 - 72 - 7 e. P (B) = 0.426 and P (BA) = 0.473 Since P (B) P (BA), the events are dependent. 14. $0-$499 $500-$999 >=$1000 = 2 yrs 75 275 200 550 195 515 290 1000 $0-$499 $500-$999 >=$1000 = 2 yrs 0.075 0.275 0.2 0.55 0.195 0.515 0.29 1.00 a. P(< 2 yrs) = .45 b. P(>= $1000) = .29 c. P(2 accounts have > = $1000) = (.29)(.29) = .0841 d. P($500-$999 | >= 2 yrs) = P($500-$999 and >= 2 yrs) / P(>=2yrs) = .275/.55 = .5 e. P(< 2 yrs and >=$1000) = .09 f. P(>=2 yrs | $500-$999) = .275/.515 = .533981 15. a. A joint probability table for these data looks like this: Automobile Insurance Coverage Yes No Total Age 18 to 34 35 and over .375 .475 .085 .065 .46 .54 Total .850 .150 1.00 For parts (b) through (g): Let A= 18 to 34 age group B= 35 and over age group Y = Has automobile insurance coverage N = Does not have automobile insurance coverage b. We have P(A) = .46 and P(B) = .54, so of the population age 18 and over, 46% are ages 18 to 34 and 54% are ages 35 and over. c. The probability a randomly selected individual does not have automobile insurance coverage is P(N) = .15. d. If the individual is between the ages of 18 and 34, the probability the individual does not have automobile insurance coverage is P N A = PN A = .085 = .1848. P A .46 7. Chapter 2 Introduction to Probability 2 - 82 - 8 e. If the individual is age 35 or over, the probability the individual does not have automobile insurance coverage is P N B = PN B = .065 = .1204. P B .54 f. If the individual does not have automobile insurance, the probability that the individual is in the 18–34 age group is P A N = PAN = .085 = .5667. P N .15 g. The probability information tells us that in the US, younger drivers are less likely to have automobile insurance coverage. 16. a. P(A B) = P(A)P(B) = (0.55)(0.35) = 0.19 b. P(A B) = P(A) + P(B) - P(A B) = 0.90 - 0.19 = 0.71 c. 1 - 0.71 = 0.29 17. a. P(attend multiple games) = 196 / 989 ≈ 19.8%. b. P(male | attend multiple games) = 177 / 196 ≈ 90.3%. c. P(male and attend multiple games) = P(male | attend multiple games) × P(attend multiple games) = (177 / 196) × (196 / 989) = 177 / 989 ≈ 17.9%. d. P(attend multiple games | male) = P(attend multiple games and male) / P(male) = (177 / 989) / (759 / 989) = 177 / 759 ≈ 23.3%. e. P(male or attend multiple games) = P(male) + P(attend multiple games) – P(male and attend multiple games) = (759 / 989) + (196 / 989) – (177 / 989) = 778 / 989 ≈ 78.7%. 18. a. P(B) = 0.25 P(SB) = 0.40 P(S B) = 0.25(0.40) = 0.10 b. P(B S) P(SB) 0.10 0.25 P(S) 0.40 c. B and S are independent. The program appears to have no effect. 19. Let: A = lost time accident in current year B = lost time accident previous year Given: P(B) = 0.06, P(A) = 0.05, P(AB) = 0.15 a. P(A B) = P(AB)P(B) = 0.15(0.06) = 0.009 b. P(A B) = P(A) + P(B) - P(A B) = 0.06 + 0.05 - 0.009 = 0.101 or 10.1% 8. Chapter 2 Introduction to Probability 2 - 92 - 9 20. a. P(B A1) = P(A1)P(BA1) = (0.20)(0.50) = 0.10 P(B A2) = P(A2)P(BA2) = (0.50)(0.40) = 0.20 P(B A3) = P(A3)P(BA3) = (0.30)(0.30) = 0.09 b. P(A B) 0.20 0.512 0.10 0.20 0.09 c. Events P(Ai) P(BAi) P(Ai B) P(AiB) A1 0.2 0 0.5 0 0.1 0 0.2 6A2 0.5 0 0.4 0 0.2 0 0.5 1A3 0.3 0 0.3 0 0.0 9 0.2 31.0 0 0.3 9 1.0 0 21. S1 = successful, S2 = not successful and B = request received for additional information. a. P(S1) = 0.50 b. P(BS1) = 0.75 (0.50)(0.75) 0.375 c. P(S1 B) 0.65 (0.50)(0.75) (0.50)(0.40) 0.575 22. a. Let F = female. Using past history as a guide, P(F) = .40 b. Let D = Dillard's P(F D) .40(3/ 4) .30 .67 .40(3/ 4) .60(1/ 4) .30 .15 The revised (posterior) probability that the visitor is female is .67. We should display the offer that appeals to female visitors. 23. a. P(Oil) = 0.50 + 0.20 = 0.70 b. Let S = Soil test results Events P(Ai) P(SAi) P(Ai S) P(AiS) High Quality (A1) 0.5 0 0.2 0 0.10 0.435 Medium Quality (A2) 0.2 0 0.2 0 0.04 0.174 No Oil (A3) 0.3 0 0.3 0 0.09 0.391 1.0 0 P(S) = 0.23 1.000 P(Oil) = 0.609 which is good but not as good as estimated prior to the soil test; probabilities also still favor high quality oil. 9. Chapter 2 Introduction to Probability 2 - 102 - 10 24. Let S= speeding is reported SC = speeding is not reported F = Accident results in fatality for vehicle occupant We have P(S) = .129, so P(SC) = .871. Also P(F|S) = .196 and P(F|SC) = .05. Using the tabular form of Bayes' Theorem provides: Prior Conditional Joint Posterior Events Probabilities Probabilities Probabilities Probabilities S .129 .196 .0384 .939 SC .871 .050 .0025 .061 1.000 P(F) = .0409 1.000 P(S | F) = .2195, i.e., if an accident involved a fatality. the probability speeding was reported is 0.939. 25. Events P(Ai) P(DAi) P(AiD) P(AiD) Supplier A 0.6 0 0.0025 0.0015 0.2 3Supplier B 0.3 0 0.0100 0.0030 0.4 6Supplier C 0.1 0 0.0200 0.0020 0.3 11.0 0 P(D) = 0.0065 1.0 0 a. P(D) = 0.0065 b. B is the most likely supplier if a defect is found. 26. a. Events P(Di) P(S1|Di) P(Di S1) P(Di |S1) D1 .60 .15 .090 .2195 D2 .40 .80 .320 .7805 1.00 P(S1) = .410 1.0000 P(D1 | S1) = .2195 P(D2 | S1) = .7805 b. Events P(Di) P(S2 |Di) P(Di S2) P(Di |S2) D1 .60 .10 .060 .500 D2 .40 .15 .060 .500 1.00 P(S2) = .120 1.000 P(D1 | S2) = .50 P(D2 | S2) = .50 10. Chapter 2 Introduction to Probability 2 - 112 - 11 c. Events P(Di) P(S3 |Di) P(Di S3) P(Di |S3) D1 .60 .15 .090 .8824 D2 .40 .03 .012 .1176 P(D1 | S3) = .8824 1.00 P(S3) = .102 1.0000 P(D2 | S3) = .1176 d. Use the posterior probabilities from part (a) as the prior probabilities here. Events P(Di) P(S2 | Di) P(Di S2) P(Di | S2) D1 .2195 .10 .0220 .1582 D2 .7805 .15 .1171 .8418 1.0000 .1391 1.0000 P(D1 | S1 and S2) = .1582 P(D2 | S1 and S2) = .8418 27. a. Let A = age 65 or older P(A) 1.835 .165 b. Let D = takes drugs regularly P(A D) = P(A)P(D A) C C P(A)P(D A) P(A)P(D A) = .165(.82) .165(.82) .835(.49) = .1353 = .2485 .1353 .4092 28. a. P(A1) = .095 P(A2) = .905 P(W | A1) = .60 P(W | A2) = .49 11. Chapter 2 Introduction to Probability 2 - 122 - 12 b. Events P(Ai) P(W|Ai) P(Ai∩W) P(Ai|W) A1 0.095 0.60 0.05700 0.1139 A2 0.905 0.49 0.44345 0.8861 P(W) = 0.50045 1.0000 P(A1|W) = .1139 c. Events P(Ai) P(M|Ai) P(Ai∩M) P(Ai|M) A1 0.095 0.40 0.03800 0.0761 A2 0.905 0.51 0.46155 0.9239 P(M) = 0.49995 1.0000 P(A1|M) = .0761 d. P(W) = .50045 P(M) = .49965 29. a. Gender Too Fast Acceptable Male Golfers 35 65 Female Golfers 40 60 The proportion of male golfers who say the greens are too fast is 35/(35 + 65) = 0.35, while the proportion of female golfers who say the greens are too fast is 40/(40 + 60) = 0.40. There is a higher percentage of female golfers who say the greens are too fast. b. There are 50 male golfers with low handicaps, and 10 of these golfers say the greens are too fast, so for male golfers the proportion with low handicaps who say the greens are too fast is 10/50 = 0.20. On the other hand, there are 10 female golfers with low handicaps, and 1 of these golfers says the greens are too fast, so for female golfers the proportion with low handicaps who say the greens are too fast is 1/10 = 0.10. c. There are 50 male golfers with higher handicaps, and 25 of these golfers say the greens are too fast, so for male golfers the proportion with higher handicaps who say the greens are too fast is 25/50 = 0.50. On the other hand, there are 90 female golfers with higher handicaps, and 39 of these golfers says the greens are too fast, so for female golfers the proportion with higher handicaps who say the greens are too fast is 39/90 = 0.43. d. When the data are aggregated across handicap categories, the proportion of female golfers who say the greens are too fast exceeds the proportion of male golfers who say the greens are too fast. However, when we introduce a third variable, handicap, we see different results. When sorted by handicap categories, we see that the proportion of male golfers who find the greens too fast is higher than female golfers for both low and high handicap categories. This is an example of Simpson's paradox. 12. Chapter 2 Introduction to Probability 2 - 132 - 13 30. a. Male Applicants Female Applicants Accept 70 40 Deny 90 80 After combining these two crosstabulations into a single crosstabulation with Accept and Deny as the row labels and Male and Female as the column labels, we see that the rate of acceptance for males across the university is 70/(70+90) = .4375 or approximately 44%, while the rate of acceptance for females across the university is 40/(40+80) = .33 or 33%. b. If we focus solely on the overall data, we would conclude the university's admission process is biased in favor of male applicant. However, this occurs because most females apply to the College of Business (which has a far lower rate of acceptance that the College of Engineering). When we look at each college's acceptance rate by gender, we see the acceptance rate of males and females are equal in the College of Engineering (75%) and the acceptance rate of males and females are equal in the College of Business (33%). The data do not support the accusation that the university favors male applicants in its admissions process. Quantitative Methods for Business 13th Edition Anderson SOLUTIONS MANUAL Full download at: edition-anderson-solutions-manual/ Quantitative Methods for Business 13th Edition Anderson TEST BANK Full download at: edition-anderson-test-bank/ quantitative methods for business 12th edition pdf free download quantitative methods for business 13th edition pdf free download quantitative methods for business anderson pdf quantitative methods for business 13th edition solution manual free quantitative methods for business anderson sweeney williams pdf quantitative methods for business 13th solutions quantitative methods for business 10th edition pdf quantitative methods for business anderson pdf download 13. Markov Processes