

### Homework Questions for Chapter 3 “Element of Chance: Probability Methods”

3.5 A corporation takes delivery of some new machinery that must be installed and checked before it becomes available to use. The corporation is sure that it will take no more than 7 days for this installation and check to take place. Let A be the event “ It will be more than 4 days before the machinery becomes available” and be the event “It will be less than 6 days before the machinery becomes available.”

- a. Describe the event that is the complement of event A.
- b. Describe the event that is the intersection of events A and B.
- c. Describe the event that is the union of events A and B.

3.7 Florni Frenti operates a small used car lot that has three Mercedes (M1, M2, M3) and two Toyotas (T1, T2). Two customers, Cezara and Anda, come to his lot, and each selects a car. The customers do not know each other, and there is no communication between them. Let the events A and B be defined as follows:

A: The customers select at least one Toyota.

B: The customers select two cars of the same model.

- a. Identify all pairs of cars in the sample space
- b. Describe event A.
- c. Describe event B.
- d. Describe the complement of A.
- e. Show that  $(A \cap B) \cup (\bar{A} \cap B) = B \cap$
- f. Show that  $A \cup (\bar{A} \cap B) = A \cup B$ .

3.9 The sample space contains 6 As and 4 Bs. What is the probability that a randomly selected set of 3 will include 1A and 2 Bs?

3.13 A corporation has just received new machinery that must be installed and checked before it becomes operational. The accompanying table shows a manager’s probability assessment for the number of days required before the machinery becomes operational.

Number of Days	3	4	5	6	7
Probability	0.08	0.24	0.41	0.20	0.07

Let A be the event :It will be more than 4 days before the machinery becomes operational,” and let B be the event “It will be less than 6 days before the machinery becomes available.”

- a. Find the probability of event A.
- b. Find the probability of event B.
- c. Find the probability of the complement of event A.
- d. Find the probability of the intersection of events A and B.
- e. Find the probability of the union of events A and B.

3.17 A department store manager has monitored the number of complaints received per week about poor service. The probabilities for numbers of complaints in a week, established by this review, are show in the following table. Let A be the event “There will be at least 1 complaint in a week and B the event “There will be fewer than 10 complaints in a week.”

Number of Complaints	0	1 to 3	4 to 6	7 to 9	10 to 12	More than 12
Probability	0.14	0.39	0.23	0.15	0.06	0.03

- Find the probability of A.
- Find the probability of B.
- Find the probability of the complement of A.
- Find the probability of the union of A and B.
- Find the probability of the intersection of A and B.
- Are A and B mutually exclusive?
- Are A and B collectively exhaustive?

3.19 The probability of A is 0.60, the probability of B is 0.45, and the probability of either is 0.80. what is the probability of both A and B.

3.23 The probability of A is 0.60, the probability of B is 0.45, and the probability of both is 0.30. what is the conditional probability of A, given B? Are A and B independent in a probability sense?

3.31 A student committee has six members- four undergraduate and two graduate students. A subcommittee of three members is to be chosen randomly so that each possible combination of three of the six students is equally likely to be selected. What is the probability that there will be no graduate students on the subcommittee?

3.43 A private school recruits publicly educated students for scholarships. In order to be eligible for the scholarship, the publicly educated students must pass 12 exams at a grade A and pass an entrance test for the private school. The private school estimates that the probability the student will fail to obtain 12 A exam grades is 0.04 (i.e., the student does not pass 12 exams at A grade with a probability of 0.04), the probability the student will not pass the entrance test is 0.24, and that these are independent events. According to these estimates, what is the probability that a given publicly educated student will be recruited into the private school for scholarship next year?

3.45 An inspector examines items coming from an assembly line. A review of his record reveals that he accepts only 8% of a defective items. It was also found that 1% of all items from the assembly line are both defective and accepted b the inspector. What is the probability that a randomly chosen item from this assembly line is defective?

3.51 A corporation was concerned with the basic education skills of its workers and decided to offer a selected group of them separate classes in reading and practical mathematics. Of these workers 40% signed up for the reading classes and 50% for the practical mathematics classes. Of those signing up for the reading classes 30% signed up for the mathematics classes.

- What is the probability that a randomly selected worker signed up for both classes?
- What is the probably that a randomly selected worker who signed up for the mathematics classes also signed up for the reading classes?
- What is the probability that a randomly chosen worker signed up for at least one of these two classes?
- Are the events “Signs up for the reading classes” and “Signs up for the mathematics classes” statistically independent?

3.69 A corporation regularly takes deliveries of a particular sensitive part from three subcontractors. It found that the proportion of parts that are good or defective from the total received were as shown in the following table:

Part	Subcontractor		
	A	B	C
Good	0.27	0.30	0.33
Defective	0.02	0.05	0.03

- If a part is chosen randomly from all those received, what is the probability that it is defective?
- If a part is chosen randomly from all those received, what is the probability it is from subcontractor B?
- What is the probability that a part from subcontractor B is defective?
- What is the probability that a randomly chosen defective part is from subcontractor B?
- Is the quality of a part independent of the source of supply?
- In terms of quality, which of the three subcontractors is most reliable?

3.71 The accompanying table shows proportions of computer salespeople classified according to marital status and whether they left their jobs or stayed over a period of 1 year.

Marital Status	Stayed 1 Year	Left
Married	0.64	0.13
Single	0.17	0.06

- What is the probability that a randomly chosen salesperson was married?
- What is the probability that a randomly chosen salesperson left the job within the year?
- What is the probability that a randomly chosen single salesperson left the job within the year?
- What is the probability that a randomly chosen salesperson who stayed in the job over the year was married?

3.77 Before books aimed at preschool children are marketed, reactions are obtained from a panel of preschool children. These reactions are categorized as “favorable,” “neutral,” or “unfavorable.” Subsequently, book sales are categorized as “high,” “moderate,” or “low,” according to the norms of this market. Similar panels have evaluated 1,000 books in the past. The accompanying table shows their reactions and the resulting market performance of the books.

Sales	Panel Reaction		
	Favorable	Neutral	Unfavorable
High	173	101	61
Moderate	88	211	70
Low	42	113	141

- If the panel reaction is favorable, what is the probability that sales will be high?
- If the panel reaction is unfavorable, what is the probability that sales will be low?
- If the panel reaction is neutral or better, what is the probability that sales will be low?
- If sales are low, what is the probability that the panel reaction was neutral or better?

3.81 Given  $P(A1) = 0.80$ ,  $P(B1|A1) = 0.60$ , and  $P(B1|A2) = 0.20$ , what is the probability of  $P(A1|B1)$ ?

3.83 Given  $P(A1) = 0.40$ ,  $P(B1|A1) = 0.60$ , and  $P(B1|A2) = 0.70$ , what is the probability of  $P(A2|B2)$ ?

3.85 A publisher sends advertising materials for an accounting text to 80% of all professors teaching the appropriate accounting course. Thirty percent of the professors who received this material adopted the book, as did 10% of the professors who did not receive the material. What is the probability that a professor who adopts the book has received the advertising material?

3.87 The Watts New Lightbulb Corporation ships large consignments of light bulbs to big industrial users. When the production process is functioning correctly, which is 90% of the time, 10% of all bulbs produced are defective. However, the process is susceptible to an occasional malfunction, leading to a defective rate of 50%. If a defective bulb is found what is the probability that the process is functioning correctly? If a non-defective bulb is found that is the probability that the process is operating correctly?

3.99 In a campus restaurant it was found that 35% of all customers order vegetarian meals and that 50% of all customers are students. Further, 25% of all customers who are students order vegetarian meals.

- What is the probability that a randomly chosen customer both is a student and orders a vegetarian meal?
- If a randomly chosen customer orders a vegetarian meal, what is the probability that the customer is a student?
- What is the probability that a randomly chosen customer both does not order a vegetarian meal and is not a student?

- d. Are the events “customer orders a vegetarian meal” and “Customer is a student” independent?
- e. Are the events “Customer orders a vegetarian meal” and “Customer is a student” mutually exclusive?
- f. Are the events “Customer orders a vegetarian meal” and “Customer is a student” collectively exhaustive?

3.101 In a large corporation 80% of the employees are men and 20% are women. The highest levels of education obtained by the employees are graduate training for 10% of the men, undergraduate training for 30% of the men, and high school training for 60% of the men. The highest levels of education obtained are also graduate training for 15% of the women, undergraduate training for 40% of the women, and high school training for 45% of the women.

- a. What is the probability that a randomly chosen employee will be a man with only a high school education?
- b. What is the probability that a randomly chosen employee will have graduate training?
- c. What is the probability that a randomly chosen employee who has graduate training is a man?
- d. Are gender and level of education of employees in this corporation statistically independent?
- e. What is the probability that a randomly chosen employee who has not had graduate training is a woman?

3.111 A dean has found that 62% of entering freshmen and 78% of community college transfers eventually graduate. Of all entering students, 73% are freshmen and the remainder are community college transfers.

- a. What is the probability that a randomly chosen entering student is a freshman who will eventually graduate?
- b. Find the probability that a randomly chosen entering student will eventually graduate?
- c. What is the probability that a randomly chosen entering student either is a freshmen or will eventually graduate (or both)?
- d. Are the events “Eventually graduates” and “Enters as community college transfer” statistically independent?