NATIONAL UNIVERSITY OF SINGAPORE
DEPARTMENT OF STATISTICS & APPLIED PROBABILITY

ST2334 PROBABILITY AND STATISTICS

SEMESTER I, AY 2022/2023

Tutorial 02

This set of questions will be discussed by your tutors during the tutorial in Week 4.

Please work on the questions before attending the tutorial.

1. The probability that a Singapore company will set up a factory in City A is 0.7. The probability that it will set up a factory in City B is 0.4 and the probability that it will set up in either City A or City B or both is 0.8. What is the probability that the company will set up a factory

   (a) in both cities?

   (b) in neither city?

2. Suppose there are 500 applicants for five equivalent positions at a factory and the company is able to narrow the field to 30 equally qualified applicants. Seven of the finalists are minority candidates. Assume that the five who are chosen are selected at random from this final group of thirty.

   (a) In how many ways can the selection be made?

   (b) What is the probability that none of the minority candidates is hired?

   (c) What is the probability that no more than one minority candidates are hired?

3. Consider 5-card poker hands dealt from a standard 52 card deck. Two important events are

   $A = \{$You draw a flush$\}$; a flush means: 5 cards from the same suit;

   $B = \{$You draw a straight$\}$; straight means: values of the 5 cards are in sequence, e.g., 9 of diamonds, 10 of hearts, jack of hearts, queen of spades and king of spades), assuming that aces can be high or low.

   Note: we consider a straight flush, i.e., 5 consecutive cards of the same suit, is not a straight.

   If you are dealt a 5-card hand, find the following probability:

   (a) $P(A)$

   (b) $P(B)$

4. There are two intersections with traffic lights along the route taken a motorist in driving to work. The probability that he must stop at the first light is 0.4, the probability that he must stop at the second light is 0.5, and the probability that he must stop at least one of the two lights is 0.6. What is the probability that he must stop

   (a) at both lights?

   (b) at exactly one light?

   (c) at neither light?

   (d) at the second light given that he has stopped at the first light?

   (e) Is the event stopping at first traffic light independent of the event stopping at the second traffic light?

5. Consider 9-digit numbers where each digit is one of the 10 integers $0, 1, 2, \ldots, 9$.

   (a) What is the probability that no two consecutive digits are the same in a randomly selected 9-digit number?

   (b) What is the probability that 0 appears as a digit for a total of 3 times in a randomly selected 9-digit number?

6. A soft-drink bottling company maintains records concerning the number of unacceptable bottles of soft drink obtained from the filling and capping machines. Based on the past data, the probability that a bottle came from machine I and was nonconforming is 0.01, and the probability that a bottle came from machine II and was nonconforming is 0.025. Half the bottles are filled on machine I and the other half are filled on machine II. If a filled bottle of soft drink is selected at random, what is the probability that

   (a) it is a nonconforming bottle?

   (b) it was filled on machine II?

   (c) it was filled on machine II and is a conforming bottle?

   (d) It was filled on machine I or is a conforming bottle?

   (e) Suppose you know that the bottle was produced on machine I. What is the probability that it is nonconforming?

   (f) Suppose you know that the bottle is nonconforming. What is the probability that it was produced on machine I?

   (g) Explain the difference in the answers to (e) and (f).

Answers

1. (a) 0.3;

   (b) 0.2.

2. (a) 142506;

   (b) 0.2361;

   (c) 0.6711.

3. (a) 0.001981

   (b) 0.003925

4. (a) 0.3

   (b) 0.3

   (c) 0.4

   (d) 0.75

   (e) Not independent

5. (a) 0.4305;

   (b) 0.03307.

6. (a) 0.035

   (b) 0.5

   (c) 0.475

   (d) 0.975

   (e) 0.02

   (f) 0.2857