Statistics 213
Assignment 2

1   Patients arriving at a hospital outpatient clinic can select one of two stations for service. Suppose that physicians are randomly assigned to the stations and that the patients have no station preference. Three patients arrive at the clinic and their selection of stations is observed.
(a) List the outcomes in the sample space. (8 in total)
(b) List the outcomes of the event A that each station received at least one patient. (6 in total)
(c) Find P(A). (.75)

2   A small advertising firm consists of 2 men and 1 woman. The firm has two clients who are particularly difficult to deal with. To decide who sees the first client, one person is randomly selected from the three. The same procedure is followed for the second client. Note: It may help to write out the sample space.
(a) Find the probability that both clients are served by the same person from the advertising firm. (1/3)
(b) Find the probability that both clients are served by men. (4/9)
(c) Find the probability that the events of (a) and (b) occur simultaneously. (2/9)

3   A survey of 50 randomly selected customers at a supermarket showed that 10 purchased mil k, butter and eggs: 14 purchased milk and butter; 13 purchased milk and eggs: 12 purchased butter and eggs: 23 purchased milk; 21 purchased butter and 12 did not purchase any of these items. What is the probability that a person selected at random will buy:
(a) only eggs? (8/50)
(b) eggs?   (23/50)
(c) milk and butter but no eggs? (4/50)

4   A survey of 50 randomly selected customers at a supermarket showed that 14 purchased milk and butter; 2 purchased butter and eggs; 23 purchased milk; 21 purchased butter and 12 did not purchase any of these items (milk, butter, eggs). Further, no one purchased milk and eggs. What is the probability that a person selected at random will buy:
(a) only eggs? (8/50)
(b) eggs?   (10/50)
(c) milk and butter? (14/50)
(d) milk and eggs?   (0)

5   Among 32 dieters following a similar routine, 18 lost weight, 5 gained weight, and 9 remained the same weight. If one of these dieters is randomly chosen, find the probability that he or she
(a) gained weight (5/32)
(b) lost weight   (18/32)
(c) neither gained nor lost weight (9/32)

6   Suppose A and B are events such that $P(A) = 0.25$, $P(B) = 0.40$, and $P(A \cup B) = 0.50$
(a) Determine   (i) $P(A \cap B)$ (.15)
                 (ii) $P(\bar{A} \cap \bar{B})$ (.50)
                 (ii) $P(\bar{A})$ (.75)
                 (iii) $P(\bar{B})$ (.60)
(b) Are A and B mutually exclusive? Independent?

7   80% of the patrons at hockey games buy a soft drink. 60% buy popcorn and 50% purchase both. What is the probability that a person:
(a) doesn't buy a soft drink or doesn't buy popcorn? (.50)
(b) buys only a soft drink? (.30)

8   A stock is selected at random each morning from the Toronto Stock Exchange. It is observed that there is a 50% chance that a stock will go up that day, a 10% chance that it is worth more than $100 and a 45% chance that it will go down and be worth $100 or less.
(a) What is the probability that the stock goes up and is worth more than $100? (.05)
(b) What is the probability that the stock goes down and is worth more than $100? (.05)

9   A store has found that 80% of their customers purchase shoes, 40% purchase purses and 30% purchase both.
(a) What is the probability that a customer will purchase only shoes? (.5)
(b) If a person buys shoes, what is the probability that he/she will buy a purse? (.375)
(c) If a person buys a purse, what is the probability that he/she will buy shoes? (.75)
(d) What is the probability that a person buys neither shoes nor a purse? (.1)
(e) Are the purchase of shoes and the purchase of purses independent? Explain (No)
(f) Are the purchase of shoes and the purchase of purses mutually exclusive? Explain (No)

10   A card is drawn from a well shuffled deck of 52 cards. Let
        A = card chosen is King or Queen
        B = card chosen is a picture card (J, Q, K)
        C = card is a club
        D = card is a king or a spade
Determine whether or not the following pairs of events are independent: (Hint: use conditional probabilities)
        (a) (A,B) (No)
        (b) (A,C) (Yes)
        (c) (B,D) (No)

11   An automatic drilling machine produces good pieces 91%. Faulty pieces are drilled either off-centre (C) or at an incorrect angel (A). In the total production, 5% are drilled off-centre and 2% are drilled both off-centre and at an incorrect angle.
(a) What percentage is drilled at an incorrect angle? (6%)
(b) If a part is drilled off-centre, what is the probability that it will be drilled off-angle? (.4)
(c) Is "off-centre" drilling independent of "off-angle" drilling? Explain (No)

12   A secretary types four letters (a,b,c,d) and their respective envelopes (A,B,C,D). Suppose that the letters are put randomly into the envelopes, one letter in each envelope.
(a) How many outcomes are there in the sample space? List them. (24)
(b) List the outcomes of the event A that exactly three letters end up in the wrong envelopes.
(c) Find P(A) (1/3)

13   Two standard dice are rolled simultaneously. Find the probabilities of the following events:
(a) the sum of the dice is an even number (½)
(b) the sum of the dice is at least 8   (15/36)
(c) the sum of the dice is not greater than 9 (30/36)

14   A certain company encourages its employees to participate in some type of physical activity. A survey revealed that 40% play golf, 50% fish and 25% play golf and fish. Define the events as
        A: play golf   B: fishes
(a) P($\bar{A} \cup B$) (.85)
(b) P(A $\cap$ $\bar{B}$)   (.15)
(c) P(A $\cup$ B)   (.65)
(d) P($\bar{A}$ $\cap$ $\bar{B}$) (.35)

15   The failure rate of a heart attack alarm in an ICU is 0.001. For improved safety, a duplicate alarm is installed.   What is the probability that a heart attack will not be signaled if the alarms work independently of one another? (0.000001)

16   A house is randomly chosen in Calgary. The probability is 0.35 that the house is occupied by a single parent and 0.03 that it is occupied by an elderly person (who is not a single parent – not that they couldn't be.)
    (a)   What is the probability the house chosen does not have a single parent as a resident? (.65)
    (b)   What is the probability the house chosen is occupied by single parent or an elderly person?   (.38)
    (c)   What is the probability the house chosen does not have a single parent nor an elderly person living as a resident? (.62)

17   50 people at a conference were classified by town of residence and sex, giving the following results:

Sex	City			Total
	Calgary (C1)	Red Deer (C2)	Edmonton (C3)	
Male (A1)	8	9	13	30
Female (A2)	2	6	12	20
Total	10	15	25	50

  A person is selected at random from those attending the conference.
    (a)   What is the probability that the person selected is from Calgary? (.2)
    (b)   What is the probability that the person selected is not from Red Deer? (.7)
    (c)   What percentage of the participants are women? (40%)
    (d)   What is the probability that the person chosen is from Calgary and Red Deer? (0)
    (e)   What is the probability that the person chosen is male and from Red Deer? (.18)
    (f)   What is the probability that the person chosen is from Red Deer or Edmonton? (.8)
    (g)   What is the probability that the person chosen is female or is from Edmonton? (.66)
    (h)   What is the probability that the person chosen is male if the person selected is from Edmonton? (.52)
    (i)   What is the probability that the person chosen is from Red Deer given that a male is selected? (.3)
    (j)   Are the events "Male" and "from Calgary" independent? Mutually exclusive? Explain using probability values from this question.