MATH3332 **Homework 1, Due Sep. 09 before class.**

Please do the following exercises in the textbook. Please show your calculation. Otherwise, points will be deducted.

## Chapter 1

### Exercise 1.2-1

**1.2-1.** Of a group of patients having injuries, 28% visit both a physical therapist and a chiropractor and 8% visit neither. Say that the probability of visiting a physical therapist exceeds the probability of visiting a chiropractor by 16%. What is the probability of a randomly selected person from this group visiting a physical therapist?

### Exercise 1.2-3

**1.2-3.** Draw one card at random from a standard deck of cards. The sample space $S$ is the collection of the 52 cards. Assume that the probability set function assigns 1/52 to each of the 52 outcomes. Let

$A = \{x: x \text{ is a jack, queen, or king}\}$,

$B = \{x: x \text{ is a 9, 10, or jack and } x \text{ is red}\}$,

$C = \{x: x \text{ is a club}\}$,

$D = \{x: x \text{ is a diamond, a heart, or a spade}\}$.

Find (a) $P(A)$, (b) $P(A \cap B)$, (c) $P(A \cup B)$, (d) $P(C \cup D)$, and (e) $P(C \cap D)$.

### Exercise 1.2-5

**1.2-5.** A field of beans is planted with three seeds per hill. For each hill of beans, let $A_i$ be the event that $i$ seeds germinate, $i = 0, 1, 2, 3$. Suppose that $P(A_0) = 1/64$, $P(A_1) = 9/64$, and $P(A_2) = 27/64$. Give the value of $P(A_3)$.

### Exercise 1.2-9

**1.2-9.** Given that $P(A' \cup B) = 0.76$ and $P(A \cup B') = 0.87$, find $P(A)$.

### Exercise 1.3-1

**1.3-1.** A boy found a bicycle lock for which the combination was unknown. The correct combination is a four-digit number, $d_1d_2d_3d_4$, where $d_i$, $i = 1, 2, 3, 4$, is selected from 1, 2, 3, 4, 5, 6, 7, and 8. How many different lock combinations are possible with such a lock?

### Exercise 1.3-3

**1.3-3.** How many different license plates are possible if a state uses

(a) Two letters followed by a four-digit integer (leading zeros are permissible and the letters and digits can be repeated)?

(b) Three letters followed by a three-digit integer? (In practice, it is possible that certain "spellings" are ruled out.)

### Exercise 1.3-5

**1.3-5.** How many four-letter code words are possible using the letters in HOPE if

(a) The letters may not be repeated?

(b) The letters may be repeated?

### Exercise 1.3-9

**1.3-9.** Some albatrosses return to the world's only mainland colony of royal albatrosses, on Otago Peninsula near Dunedin, New Zealand, every two years to nest and raise their young. In order to learn more about the albatross, colored plastic bands are placed on their legs so that they can be identified from a distance. Suppose that three bands are placed on one leg, with the color of the band selected from the colors red, yellow, green, white, and blue. Find the number of different color codes that are possible for banding an albatross if

(a) The three bands are of different colors.

(b) Repeated colors are permissible.

### Exercise 1.3-11

**1.3-11.** The World Series in baseball continues until either the American League team or the National League team wins four games. How many different orders are possible (e.g., *ANNAAA* means the American League team wins in six games) if the series goes

(a) Four games?

(b) Five games?

(c) Six games?

(d) Seven games?

### Exercise 1.3-13

**1.3-13.** A cafe lets you order a deli sandwich your way. There are six choices for bread, four choices for meat, four choices for cheese, and 12 different garnishes (condiments). How many different sandwich possibilities are there if you choose

(a) One bread, one meat, and one cheese?
(b) One bread, one meat, one cheese, and from 0 to 12 garnishes?
(c) One bread; 0, 1, or 2 meats; 0, 1, or 2 cheeses; and from 0 to 12 garnishes?

## Exercise 1.3-15

**1.3-15.** Three students ($S$) and six faculty members ($F$) are on a panel discussing a new college policy.

(a) In how many different ways can the nine participants be lined up at a table in the front of the auditorium?
(b) How many lineups are possible, considering only the labels $S$ and $F$?
(c) For each of the nine participants, you are to decide whether the participant did a good job or a poor job stating his or her opinion of the new policy; that is, give each of the nine participants a grade of $G$ or $P$. How many different "scorecards" are possible?

## Exercise 1.4-3

**1.4-3.** Let $A_1$ and $A_2$ be the events that a person is left-eye dominant or right-eye dominant, respectively. When a person folds his or her hands, let $B_1$ and $B_2$ be the events that the left thumb and right thumb, respectively, are on top. A survey in one statistics class yielded the following table:

| | $B_1$ | $B_2$ | Totals |
|---|---|---|---|
| $A_1$ | 5 | 7 | 12 |
| $A_2$ | 14 | 9 | 23 |
| Totals | 19 | 16 | 35 |

If a student is selected randomly, find the following probabilities: (a) $P(A_1 \cap B_1)$, (b) $P(A_1 \cup B_1)$, (c) $P(A_1 \mid B_1)$, (d) $P(B_2 \mid A_2)$. (e) If the students had their hands folded and you hoped to select a right-eye-dominant student, would you select a "right thumb on top" or a "left thumb on top" student? Why?

## Exercise 1.4-5

**1.4-5.** Suppose that $P(A) = 0.7$, $P(B) = 0.5$, and $P([A \cup B]') = 0.1$.

(a) Find $P(A \cap B)$.
(b) Calculate $P(A \mid B)$.
(c) Calculate $P(B \mid A)$.

## Exercise 1.4-9

**1.4-9.** An urn contains four colored balls: two orange and two blue. Two balls are selected at random without replacement, and you are told that at least one of them is orange. What is the probability that the other ball is also orange?

## Exercise 1.4-11

**1.4-11.** In a string of 12 Christmas tree light bulbs, 3 are defective. The bulbs are selected at random and tested, one at a time, until the third defective bulb is found. Compute the probability that the third defective bulb is the

(a) Third bulb tested.
(b) Fifth bulb tested.
(c) Tenth bulb tested.

## Exercise 1.4-17

**1.4-17.** A drawer contains four black, six brown, and eight olive socks. Two socks are selected at random from the drawer.

(a) Compute the probability that both socks are the same color.
(b) Compute the probability that both socks are olive if it is known that they are the same color.

## Exercise 1.5-1

**1.5-1.** Let $A$ and $B$ be independent events with $P(A) = 0.7$ and $P(B) = 0.2$. Compute (a) $P(A \cap B)$, (b) $P(A \cup B)$, and (c) $P(A' \cup B')$.

## Exercise 1.5-5

**1.5-5.** If $P(A) = 0.8$, $P(B) = 0.5$, and $P(A \cup B) = 0.9$, are $A$ and $B$ independent events? Why or why not?

## Exercise 1.5-7

**1.5-7.** Each of three football players will attempt to kick a field goal from the 25-yard line. Let $A_i$ denote the event that the field goal is made by player $i$, $i = 1, 2, 3$. Assume that $A_1$, $A_2$, $A_3$ are mutually independent and that $P(A_1) = 0.5, P(A_2) = 0.7$, $P(A_3) = 0.6$.

(a) Compute the probability that exactly one player is successful.
(b) Compute the probability that exactly two players make a field goal (i.e., one misses).

## Exercise 1.5-9

**1.5-9.** Suppose that $A$, $B$, and $C$ are mutually independent events and that $P(A) = 0.5$, $P(B) = 0.8$, and $P(C) = 0.9$. Find the probabilities that (a) all three events occur, (b) exactly two of the three events occur, and (c) none of the events occur.

## Exercise 1.5-13

**1.5-13.** An urn contains two red balls and four white balls. Sample successively five times at random and with replacement, so that the trials are independent. Compute the probability of each of the two sequences $WWRWR$ and $RWWWR$.

## Exercise 1.6-1

**1.6-1.** Bowl $B_1$ contains two white chips, bowl $B_2$ contains two red chips, bowl $B_3$ contains two white and two red chips, and bowl $B_4$ contains three white chips and one red chip. The probabilities of selecting bowl $B_1$, $B_2$, $B_3$, or $B_4$ are 1/2, 1/4, 1/8, and 1/8, respectively. A bowl is selected using these probabilities and a chip is then drawn at random. Find

(a) $P(W)$, the probability of drawing a white chip.

(b) $P(B_1 \mid W)$, the conditional probability that bowl $B_1$ had been selected, given that a white chip was drawn.

## Exercise 1.6-3

**1.6-3.** A doctor is concerned about the relationship between blood pressure and irregular heartbeats. Among her patients, she classifies blood pressures as high, normal, or low and heartbeats as regular or irregular and finds that (a) 16% have high blood pressure; (b) 19% have low blood pressure; (c) 17% have an irregular heartbeat; (d) of those with an irregular heartbeat, 35% have high blood pressure; and (e) of those with normal blood pressure, 11% have an irregular heartbeat. What percentage of her patients have a regular heartbeat and low blood pressure?

## Exercise 1.6-5

**1.6-5.** At a hospital's emergency room, patients are classified and 20% of them are critical, 30% are serious, and 50% are stable. Of the critical ones, 30% die; of the serious, 10% die; and of the stable, 1% die. Given that a patient dies, what is the conditional probability that the patient was classified as critical.

## Exercise 1.6-7

**1.6-7.** Among 60-year-old college professors, 90% are nonsmokers and 10% are smokers. The probability of a nonsmoker dying in the next year is 0.005 and the probability for smokers is 0.05. Given that one of this group of college professors dies in the next year, what is the conditional probability that the professor was a smoker?