

2025-2026

Problem Set I

Q1)

a) Two cards are drawn from a standard 52-card playing deck. What is the probability that the draw will yield an ace and a face card?

b) Five cards are dealt from a standard 52-card deck. What is the probability that we draw 3 aces and 2 kings?

c) Five cards are dealt from a standard 52-card deck. What is the probability that we draw 1 ace, 1 two, 1 three, 1 four, and 1 five?

Q2) Cards are dealt, one at a time, from a standard 52-card deck. If the first 2 cards are both spades, what is the probability that the next three cards are also spades?

Q3) Suppose economists are analyzing current economic conditions in two U.S. regions: the West Coast (California) and the East Coast (Florida). Let A represent the event that the unemployment rate in California decreases as projected this quarter, and let B represent the event that consumer confidence in Florida improves as expected this quarter. Assume that A and B are independent events and that $P(A) > P(B)$. Additionally, it is known that

$$P(A \cup B) = 0.626 \text{ and } P(A \cap B) = 0.144$$

Determine the probabilities $P(A)$ and $P(B)$.

Q4) Same product is produced by machines A, B and C. %5 of the products produced by Machine A, %4 of the product produced by Machine B and %3 of the products produced by Machine C is broken. In a single day %25 of the products are produced by Machine A, %30 of the products are produced by Machine B and %45 of the products are produced by Machine C. A product produced in a single day is randomly selected and known to be broken then what is the probability that that product is produced by Machine C.

Q5) Medical case histories indicate that different illnesses may produce identical symptoms. Suppose that a particular set of symptoms, denoted H , occurs only when any one of three illnesses, I_1 , I_2 , or I_3 , occurs. Assume that the simultaneous occurrence of more than one of these illnesses is impossible and that

$$P(I_1) = .01, P(I_2) = .005, P(I_3) = .02.$$

The probabilities of developing the set of symptoms H , given each of these illnesses, are known to be

$$P(H | I_1) = .90, P(H | I_2) = .95, P(H | I_3) = .75$$

Assuming that an ill person exhibits the symptoms, H , what is the probability that the person has illness I_1 ?

Q6) The undergraduate statistics club at a certain university has 24 members.

- a) All 24 members of the club are eligible to attend a conference next week, but they can only afford to send 4 people. In how many possible ways could 4 attendees be selected?
- b) All club members are eligible for any of the four positions of president, VP, secretary, or treasurer. In how many possible ways can these positions be occupied?
- c) Suppose it's agreed that two people will be cochair, one person secretary, and one person treasurer. How many ways are there to fill these positions now?

Q7) One needs to distribute 20 labors to four different construction jobs. The first job required 6 labors, the second, third and fourth utilized 4, 5 and 5 labors, respectively. Find the probability of the observed events assuming that the labors are randomly assigned to jobs.

- a) All 4 members of a particular ethnic group are placed on job 1.
- b) An ethnic group member is assigned to each type of job.

Q8) A local fraternity is conducting a raffle where 50 tickets are to be sold- one per customer. There are three prizes to be rewarded. If the four organizers of the raffle each buy one ticket, what is the probability that the four organizers win

- a. All the prizes?
- b. Exactly two of the prizes?
- c. Exactly one of the prizes?
- d. None of the prizes?

Q9) We know the following about a colormetric method used to test lake water for nitrates. If water specimens contain nitrates, a solution dropped into the water will cause the specimen to turn red 95% of the time. When used on water specimens without nitrates, the solution causes the water to turn red 10% of the time (because chemicals other than nitrates are sometimes present and they also react to the agent). Past experience in a lab indicates that nitrates are contained in 30% of the water specimens that are sent to the lab for testing. If a water specimen is randomly selected

- a) from among those sent to the lab, what is the probability that it will turn red when tested?
- b) and turns red when tested, what is the probability that it actually contains nitrates?

Q10) A monkey is to demonstrate that she recognize colors by tossing one red, one black and one white ball into boxes of the same respective colors, one ball to a box. If the monkey has not learned the colors and merely tosses one ball into each box at random, find the probability of the following results:

- a. There are no colors matches.
- b. There is exactly one color match.