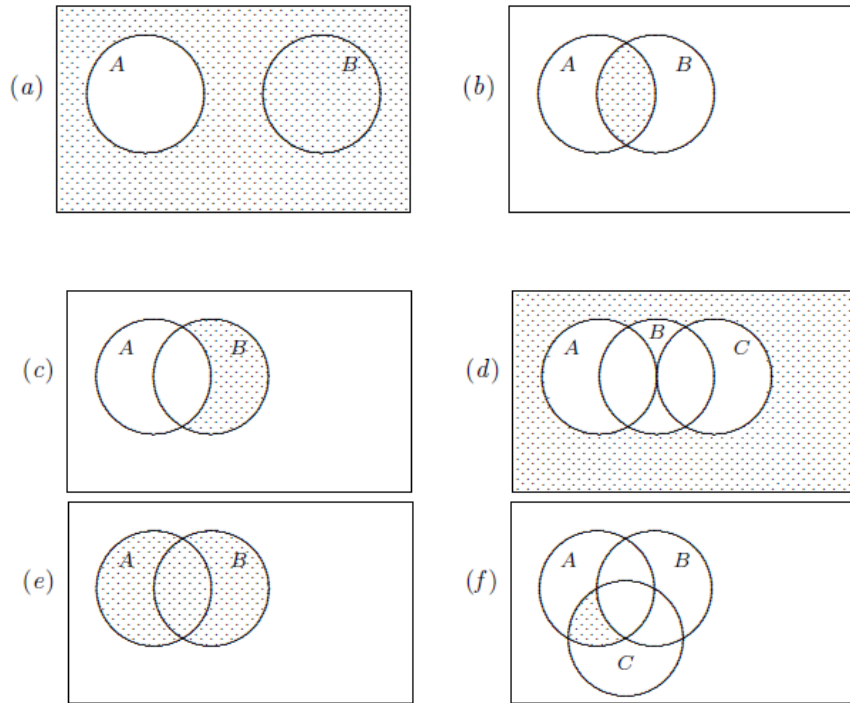


11. Let A , B , and C be any three events defined over sample space S . From the Venn diagrams that follow, describe the shaded areas using set notation.



12. How would you respond to a student who claimed that the probability of getting at least 1 head in 2 tosses of a fair coin is $\frac{2}{3}$, his argument being that there are 3 possible outcomes, H, TH, and TT, two of which, H and TH, satisfy the event “at least one head.”
14. In a study of the effects of acid rain on fish populations in Adirondack mountain lakes, samples of yellow perch, *Perca flavescens*, were collected. Forty percent of the fish had gill filament deformities and 70% were stunted. Twenty percent exhibited both abnormalities.
- Find the probability that a randomly sampled fish will be free of both symptoms.
 - If a fish has a gill filament deformity, what is the probability it will be stunted?
 - Are the two symptoms independent of each other? Explain.
16. A plant pathologist studying fire blight (a bacterial disease of apple trees) surveyed a large population of commercial apple trees of a variety called Empire. She noted that 60% of the trees had pink flowers and the remainder had white flowers. Thirty percent of the trees had some evidence of fire blight infection and 10% were pink-flowered and infected.
- Draw a Venn diagram representing this situation.
 - What percentage of the trees were white-flowered and infected?
 - What is the probability that a white-flowered tree will be infected?
 - What is the probability that a pink-flowered tree will be infected?
 - Are flower color and disease resistance independent? Explain.
 - What kind of trees should she recommend to growers? Explain.

18. A large fruit-eating bat called the black flying fox, *Pteropus alceto*, occupies a large mangrove swamp on Indooroopilly Island. Assume that about 80% of these bats are infected with an ectoparasitic mite and 30% have larger tick parasites. Twenty percent are infected with both.

(a) Find the probability that a randomly chosen bat will have some parasites.

(b) If a randomly chosen bat has mites, what is the probability that it will not have ticks?

(c) Are the presence of the two types of ectoparasites independent of each other?

25. In studies linking obesity to Non-Insulin Dependent Diabetes (NIDD) it is thought that obesity genes interact with diabetes susceptibility genes. Consider the following:

- Obesity reaches 30% in industrialized countries.

- Seven percent of obese patients develop NIDD, i.e., $P(\text{NIDD}|\text{obese}) = 0.07$.

- Ninety percent of patients with NIDD are obese, i.e., $P(\text{obese}|\text{NIDD}) = 0.90$.

(a) What proportion of the population in the industrialized world are obese and have NIDD?

(b) What proportion of the population have NIDD?

D. Suppose that for a certain population of dogs:

51% are brown, 55% have short tails, 45% have short hair

7% have short hair and short tails and are brown

17% are brown and have short hair

20% are brown and have short tails

12% have short tails, but are not brown and do not have short hair.

What percentage of dogs have short hair, but are not brown and do not have short tails? [Venn diagram].