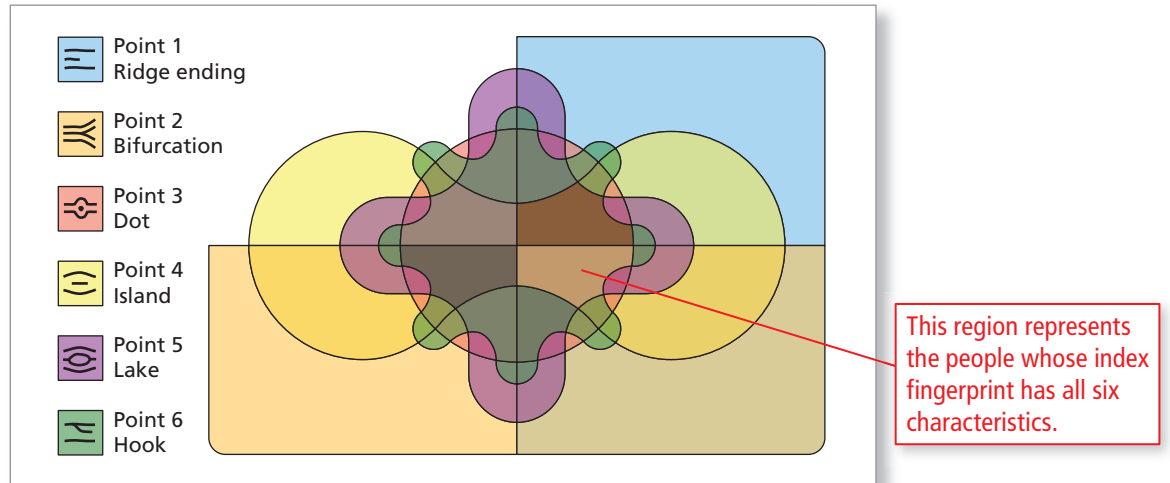


EXAMPLE 4 Finding the Intersection of Sets

Suppose there are 1 billion people whose index fingerprint has the Point 1 characteristic. A similar number of people have each of the other five characteristics. Suppose that for any 2 of the 6 basic sets in the diagram, there is a 20% overlap. Explain why a 6-point match between 2 fingerprints is not a guarantee that the fingerprints came from the same person.



SOLUTION

Twenty percent (or 200 million) of the people have Points 1 and 2. Up to 40 million people have Points 1, 2, and 3. Continuing this pattern, up to 320,000 people have all 6 points. This gives you some idea why a 6-point match is not good enough to make a positive identification.

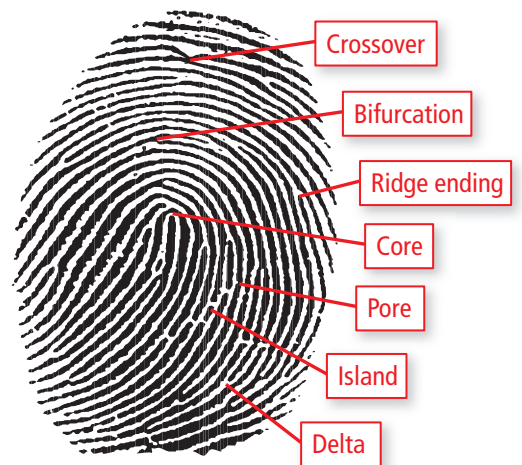
✓ Checkpoint

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Fingerprints (A) and (B) come from the same finger but look different. Fingerprints (C) and (D) come from different fingers but look similar.

In the research article “On the Individuality of Fingerprints,” the authors state “the probability that a fingerprint with 36 minutiae points will share 12 minutiae points with another arbitrarily chosen fingerprint with 36 minutiae points is 6.10×10^{-8} .”



In Example 4, suppose that there are 12 different points. Continue the pattern described in the solution to find the number of people who are in the intersection of all 12 sets.