1. **Is it possible that an event is independent of itself? If so, when?**

Ans- No, it is not possible for an event to be independent of itself. Independence of events means that the occurrence of one event does not affect the probability of the other event occurring. If an event is dependent on itself, then the occurrence of that event would affect the probability of its own occurrence, which is a contradiction. Therefore, an event cannot be independent of itself.

1. **Is it always true that if A and B are independent events, then Ac and Bc are independent events? Show that it is, or give a counterexample.**

Ans- No, it is not always true that if A and B are independent events, then Ac and Bc are independent events. Here's a counterexample:

Suppose we have a coin that has a 1/3 chance of landing heads up and a 2/3 chance of landing tails up. Let A be the event that the coin lands heads up, and let B be the event that the coin lands tails up.

Since the coin cannot land both heads up and tails up at the same time, we have P(A and B) = 0. Therefore, A and B are clearly independent events.

Now let Ac be the event that the coin does not land heads up (i.e., it lands tails up), and let Bc be the event that the coin does not land tails up (i.e., it lands heads up). Then we have:

P(Ac and Bc) = P(neither heads nor tails) = 0

P(Ac) = P(tails) = 2/3

P(Bc) = P(heads) = 1/3

Since P(Ac and Bc) ≠ P(Ac) × P(Bc), Ac and Bc are not independent events.