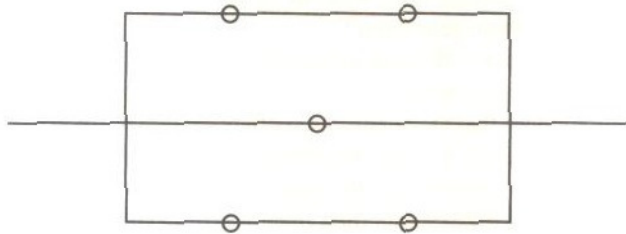


## Independent Events

1. What does it mean for two events  $A$  and  $B$  to be *independent*?
2. Draw a ticket from the box [ R1, R2, R3, B1, B2, B3]. Are “color” and “number” independent events? If you include B4 in the box, are they still independent events?
3. Draw a card from a standard deck. Let event  $A$  be “ace” and event  $B$  be “heart”. Are  $A$  and  $B$  disjoint events? Are they independent events?
4. Toss a fair coin twice. Let event  $A$  be “heads on first toss”,  $B$  be “tails on second toss”, and event  $C$  be “tails on first toss”. Are these three events independent? What does it mean for three or more events to be independent?
5. A set of 25 items contains 5 defective items. Items are sampled at random one at a time. What is the probability that the 3<sup>rd</sup> and 4<sup>th</sup> defectives occur at the 8<sup>th</sup> and 9<sup>th</sup> sample draws if the items are not replaced after each draw?
6. What is the probability that the following system works if each unit fails independently with probability  $p$  ?



7. Suppose that  $n$  components are connected in series. For each unit, there is a backup unit, and the system fails if and only if both a unit and its backup fail. Assuming that all the units are independent and fail with probability  $p$  , what is the probability that the system works?
8. Draw five times with replacement from the box [ R, R, R, W, W, W, W ]. Find the probability of getting exactly three white tickets. If we think of “success” as getting a white ticket then the question is equivalent to asking for the probability of exactly 3 successes in 5 independent trials where the probability of success in any given trial is  $4/7$ .