3. In two rolls of a fair die what is the probability that
(a) the two outcomes are the same?
(b) the second outcome is larger than the first?
(c) the second outcome is a five?

4. What is the probability of getting
(a) at least three heads in four tosses of a fair coin?
(b) at least two tails in four tosses of a fair coin? (Assume that all $2^4 = 16$ outcomes are equally likely.)

5. A ball is chosen at random out of an urn containing three black balls and two red balls and then a selection is made from the remaining four balls. Find the probability that a black ball will be selected
(a) at the first time
(b) the second time
(c) both times (assume all twenty outcomes are equally likely).

6. How many possible pairs consisting of a president and a vice-president can be formed from a club of sixty members, provided no member can hold both offices?

7. Special alloys are usually produced in batches called 'melts'. Any castings, forgings or machined parts which are made from these alloys carry an identification of the melt because there may be significant variation from melt to melt. The usual identification employed is three letters. How many melt designations are possible?

8. A group of randomly selected people compare the months and days of their birthdays. How large a group is required to have at least an even chance of finding two people with the same birthday? (Ignore leap years.) Hint: Define the event E_2 as the second birthday does not match the first; the event E_3 as the third does not match the first or second; and so on. Then P(No match between n people)

$$= P(E_n)$$

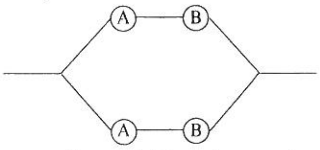
$$= P(E_2)P(E_3|E_2)P(E_4|E_3E_2)\ldots P(E_n|E_{n-1}\ldots E_2).$$

9. If a batch contains ninety good and ten defective valves, what is the probability that a sample size five drawn from the batch will not contain any defective items?

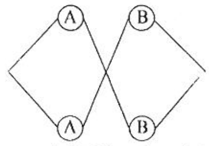
10. (a) In order that the system

S_1: 

consisting of components A and B should function correctly, both components must function correctly. Assuming that each component functions independently of the other, find the probability that S_1 functions, given that A, B have probabilities 0·8, 0·9 respectively of functioning correctly.
(b) The system

S_2: 

is connected in parallel in such a way that if either of the sub-systems A–B functions correctly, S_2 functions correctly. Find the probability that S_2 functions correctly.
(c) The system

S_3: 

functions correctly if either A and either B function correctly. Find the probability that S_3 functions correctly.

11. You are playing Russian roulette with a gun which has six chambers. What is the probability of someone being killed during the first six pulls of the trigger? (The chamber is spun after each firing and you may assume that the probability of hitting a loaded chamber $= \frac{1}{6}$. This 'game' is not recommended!)

NM 318/317: Do Ex. 3, 4, 9, 10, 11
NM 309: Do Ex. 3, 4, 10