1 From a pack of 52 cards, a card is drawn at random. What is the probability that it is:

    (a)   black?

    (b)   a king or a queen?

    (c)   a diamond?

    (d)   a five or a spade?

2 There are five marbles in a bag; one red, two white, one blue and one black. Find the probability that if a marble is drawn at random, then it is:

    (a)   blue

    (b)   white

    (c)   white or red

    (d)   not black.

3 The digits 1, 2 and 3 are arranged to form two-digit numbers.

    (a)   List all the possible two-digit numbers so formed.

    (b)   If one of these two-digit numbers is chosen at random, what is the probability of the number being greater than 30?

4 A box contains three red apples and three green apples. Apples are drawn at random and not replaced. Find the probability that:

    (a)   a red apple is drawn first

    (b)   the three red apples are the first three drawn

    (c)   the three red apples are drawn in succession.

5 An urn contains four black and three white balls. Two balls are drawn at random and placed in a hat. What is the probability that the hat contains:

(a)   two white balls?

(b)   a white and a black ball?

6 In a certain strain of plant the probability that a seed will produce a pink flower is $\frac{1}{5}$. Determine the least number of seeds that must be planted in order that the probability of obtaining at least one pink flower exceeds 0.99.

(1) (a) $P(\text{black}) = \frac{26}{52} = \frac{1}{2}$

   (b) $P(\text{a king or a queen}) = \frac{8}{52} = \frac{2}{13}$

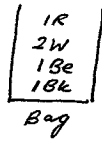   (c) $P(\text{a diamond}) = \frac{13}{52} = \frac{1}{4}$

   (d) $P(\text{a 5 or a spade}) = P(\text{a 5}) + P(\text{a spade}) - P(5 \cap \text{spade})$

$$= \frac{4}{52} + \frac{13}{52} - \frac{1}{52}$$

$$= \frac{16}{52} = \frac{4}{13}$$

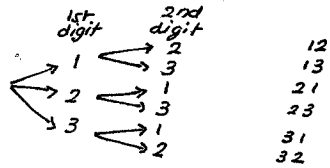(2) (a) $P(\text{blue}) = \frac{1}{5}$

   (b) $P(\text{white}) = \frac{2}{5}$

   (c) $P(\text{white or red}) = \frac{1}{5} + \frac{1}{5}$

$$= \frac{2}{5}$$

   (d) $P(\text{not black}) = \frac{4}{5}$

| 1R |
| 2W |
| 1Be |
| 1Bk |

Bag

(3) (a) Use a tree diagram or otherwise (assuming "no repetitions")

1st. digit   2nd digit

1 → 2 ... 12
1 → 3 ... 13
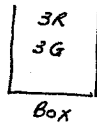2 → 1 ... 21
2 → 3 ... 23
3 → 1 ... 31
3 → 2 ... 32

   (b) $P(\text{No.} > 30) = \frac{2}{6} = \frac{1}{3}$

(4) (a) $P(\text{red}) = \frac{3}{6} = \frac{1}{2}$

   (b) $P(RRR) = \frac{3}{6} \times \frac{2}{5} \times \frac{1}{4}$

$$= \frac{1}{20}$$

| 3R |
| 3G |

Box

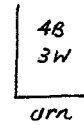   (c) $P(RRRGGG) = \frac{1}{20} \times \frac{3}{3}$

$$= \frac{1}{20}.$$

(5) (a) $P(WW) = \frac{3}{7} \times \frac{2}{6} = \frac{1}{7}$

   (b) $P(WB \text{ or } BW)$

$$= 2 \times \frac{3}{7} \times \frac{4}{6}$$

$$= \frac{4}{7}.$$

| 4B |
| 3W |

Urn

(6) Let $p = $ prob. of pink flower $= \frac{1}{5}$

$$q = \tilde{p} = \frac{4}{5}$$

$P(\text{No pink}) = q^n = \left(\frac{4}{5}\right)^n$

$\therefore P(\text{At least one pink}) = 1 - q^n$

$$= 1 - \left(\frac{4}{5}\right)^n > 0.99$$

$\therefore 1 - 0.99 > \left(\frac{4}{5}\right)^n$

$\ln 0.01 > \ln\left(\frac{4}{5}\right)^n$

Divide by $\ln\left(\frac{4}{5}\right)$ $\left[\text{Note: } \ln\left(\frac{4}{5}\right) < 0\right]$

$\therefore \frac{\ln 0.01}{\ln\left(\frac{4}{5}\right)} < n$

$\therefore 20.63\ldots < n$

$\therefore \underline{n = 21 \text{ seeds}.}$