6. \[ \frac{2 \times (n-1)!}{n!} \]

[To calculate the numerator, consider A & B on a single person (say C) such that there are \(n-1\) persons in total who are to be arranged in a row. This can be done in \((n-1)!\) ways. For each such arrangement in place of C, we can either place A, B or B, A.]

12. \[ \binom{35}{8} + \binom{35}{10} \]

\[ \binom{35}{10} \text{ # ways 10 people can be selected for the 1st team out of 35.} \]

\(\binom{35}{8} = \text{ # ways we can select A, B in the 1st team (we just need to select 8 other persons from 33 = 35-2)}\)

\(\binom{35}{10} = \text{ # ways we can select A, B in the 2nd team.}\)

18. \[ \frac{\binom{20}{2}}{100 \choose 10} \]

[there are \(\binom{20}{2}\) ways to choose 2 awardees from a given class of 20 students. Hence there are \(\binom{20}{2}\)5 ways to choose 2 awardees from each of the five classes.]

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Sec. 1.9(4) The numbers of ways to arrange 8 s, 3 t, 2 i, 1 a & 1 e in a row = \(\binom{10}{3,3,2,1,1}\) Arrangements of elements of more
than two (in this case = 5) distinct types

\[ \text{Reqd prob.} = \frac{1}{\binom{10}{3,3,2,1,1}} = \frac{1}{50,400} \]

8. \( \text{Prob (six different numbers will appear at least once)} \)

\[ = \sum_{i=1}^{6} \text{Prob (i will appear twice, rest will appear exactly once)} \]

\[ = 6 \times \binom{7}{2,1,1,1,1,1} \]

\[ = \frac{6 \times 7!}{2! \cdot 6!} = \frac{7!}{2 \cdot 6!} \]

8. \( \binom{12}{3,3,3,3} \binom{40}{10,10,10,10} \)

\[ \frac{52}{\binom{13,13,13,13}{12}} \]

(or = ) \( \frac{\binom{13}{4}}{\binom{52}{12}} \)

[see example 1.9.4 in the book]

Sec. 4.10 \( \text{P(exactly one letter in correct envelop)} \)

\[ = 3 \times \text{P(letter A in envelop A, letter B in envelop B, letter C in envelop C)} \]

(by symmetry)

\[ = 3 \times \frac{1}{3!} = \frac{1}{2} \]

Sec. 1.12 6. (a) The relevant event:

We select a without-replacement sample of size \( r \) from a population of \( m + 2 \) balls and all of them are red.
Reqd. prob. = \( \frac{\binom{r}{r} \binom{w}{w}}{\binom{r+w}{r}} = \frac{1}{\binom{r+w}{r}} = \frac{r! \cdot w!}{(r+w)!} \)

The relevant event: we select a without-replacement sample of size \( r+1 \) from a population of \( r+w \) balls and it contains \( r \) red balls and a single white ball.

Reqd. prob. = \( \frac{\binom{r}{r} \binom{w}{w}}{\binom{r+w}{r+1}} = \frac{w}{\binom{r+w}{r+1}} = \frac{w!}{(r+w)!} \cdot \binom{r+w}{r+1} = \frac{w!}{(r+w)!} \cdot \frac{(r+w)!}{(w-r-1)! (r+1)!} \)

Sec. 1.10 G:-

Let \( R \) = the event no red ball is selected
\( W = \) white
\( B = \) blue

Reqd. prob. = \( P(R \cup W \cup B) = P(R) + P(W) + P(B) - P(R \cap W) - P(W \cap B) - P(R \cap B) + P(R \cap W \cap B) \)

\( P(R) = P(W) = P(B) = \frac{\binom{10}{6}}{10} \)

\( P(R \cap W) = P(W \cap B) = \frac{\binom{10}{9}}{10} \)

Hence,
Reqd. prob. = \( 3 \times \frac{\binom{10}{9}}{\binom{10}{10}} = 3 \cdot \frac{\binom{10}{9}}{\binom{10}{10}} \).