33. One day a machine produced 50 good circuit boards and eight defective ones.

In how many ways can two defective and three good circuit boards be selected?

In how many ways can 5 circuit boards be selected including at most 2 defective ones

\[
C \left( \begin{array}{c} \text{# of ways to select 3 good circuit out of 50} \\ \text{c}(50,3) \\ 19600 \end{array} \right) \quad \text{AND} \quad \begin{array}{c} \text{# of ways to select 2 defective circuit out of 8} \\ \text{c}(8,2) \\ 28 \end{array}
\]

\[
19600 \times 28 = 548,800
\]

D) \quad \begin{array}{c} \text{# of ways to select 3 good Board out of 50} \\ \text{c}(50,3) \times \text{c}(8,2) \quad \text{or} \quad 54,880 \end{array} \quad \begin{array}{c} \text{# of ways to select 2 defective Board out of 8} \\ \text{c}(8,1) \quad \text{or} \quad 124,240 \end{array} \quad \begin{array}{c} \text{c}(8,0) \quad \text{or} \quad 2,187,400 \end{array}
\]

Ways to select 5 with at most 2 defective = \[ C(50,3) \cdot C(8,2) + C(50,2) \cdot C(8,1) + C(50,3) \cdot C(8,0) \]

\[ 54,880 + 184,2400 + 2,187,400 \]

\[ 4509,200 \]
48. Draw a tree diagram showing the ways a girl and then a boy can be selected from the children Carlos Betty Darla Gary and Natasha. There are 4 ways to select a boy and a girl as pairs.

**First Activity: Pick a girl**

- Betty
  - Darla
  - Natasha

**Second Activity: Pick a boy**

- Carlos
  - Betty
    - Gary
    - Darla
    - Natasha
  - Carlos
  - Gary
  - Carlos
  - Gary
A student is allowed to check out four books from the science room. The books must come from one collection of six books or from another collection of eight books. In how many different ways can the selection be made?

There are two ways for this student can choose her books.

She can choose 4 of the 6 books in the first collection or she can choose 4 of the 8 books in the second collection.

\[
\binom{6}{4} \text{ or } \binom{8}{4}
\]

\[
\frac{6!}{4!2!} + \frac{8}{4!4!} = 15 + 70 = 85.
\]

85 ways to choose 4 books.
50. Three married couples are seated in a row. How many different seating arrangements are possible:

(a) if there is no restriction of seating order?

if the men sit together and the women sit together?

if a husband and wife sit together?

\[ \text{a) } P(6,6) \text{ or } 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720 \]

\[ \text{b) } 6 \times 2 \times 1 \times 3 \times 2 \times 1 = 72 \]

\[ \text{c) } 6 \times 4 \times 1 \times 2 \times 1 = 48 \]
51. How many different words are possible using all the letters of

(a) RELAX?  (b) PUPPY?  (c) OFFICIAL?

Solution:

(a) There are 5 letters. The number of permutations is

\[ 5! = 120 \]

(b) There are 5 letters, with 3 P's. The number of permutations is

\[ \frac{5!}{3! \cdot 2!} = 20 \]

(c) There are 8 letters, with 2 F's and 2 I's. The number of permutations is

\[ \frac{8!}{2! \cdot 2!} \cdot \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1 \cdot 2 \cdot 1} = \frac{20160}{2} = 10,080 \]