Problem:

Find the number of ways of selecting 4 letters from the word EXAMINATION.

Solution :

There are 11 letters in the word of which A,I,N are repeated twice.

Thus, we have 11 letters of 8 different kinds as given below.

$$(A, A), (I, I), (N, N), E, X, M, T, O$$

The group of 4 letters can be selected in any one of the following 4 forms.

(i) 2 alike and other 2 alike.

(ii) 2 alike and other 2 different.

(iii) all 4 are different

Case (i) :

If 2 are alike and other 2 are also alike, any 2 of the 3 groups

$$(A, A),(I, I),(N, N)$$

will be selected.

The number of ways is

$$= 3C2$$

$$= 3$$

Case (ii) :

If 2 are alike and other 2 are different, any one of the three groups

$$(A, A), (I, I), (N, N)$$

and 2 letters from 7 different letters are selected.

[E, X, M, T, O + 2 different letters from (A, A), (I, I),(N, N), because one of the groups is already selected]

The number of ways is

$$= 3C1 \cdot 7C2$$

$$= 3 \cdot 21$$

$$= 63$$

Case (iii) :

If all four are different, 4 from 8 different letters

A, I, N, E, X, M, T, O

are selected.

The number of ways is

$$= 8C4$$

$$= 70$$

Thus the total number of ways is

$$= 3 + 63 + 70$$

$$= 136$$