Chapter 10 Permutations & Combinations

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1. A band can play 25 different pieces of music. From these pieces of music, 8 are to be selected for a concert.

    a. Find the number of different ways this can be done.

    $^{25}C_8 = 1081575$ [1]

    The 8 pieces of music are then arranged in order.

    b. Find the number of different arrangements possible.

    $^{8}P_8 = 40320$ [1]

    The band has 15 members. Three members are chosen at random to be the treasurer, secretary and agent.

    c. Find the number of ways in which this can be done.

    $^{15}P_3 = 2730$ [1]

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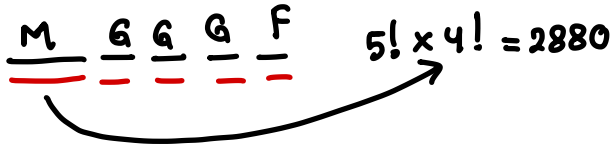
2. (a) Eight books are to be arranged on a shelf. There are 4 mathematics books, 3 geography books and 1 French book.

(i) Find the number of different arrangements of the books if there are no restrictions.

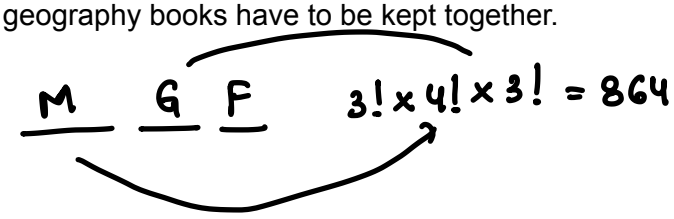
$8! = 40320$ [1]

(ii) Find the number of different arrangements if the mathematics books have to be kept together.



[3]

(iii)Find the number of different arrangements if the mathematics books have to be kept together and the geography books have to be kept together.



[3]

(b) A team of 6 players is to be chosen from 8 men and 4 women. Find the number of different ways this can be done if

(i)there are no restrictions,

$^{12}C_6 = 924$ [1]

(ii) there is at least one woman in the team [2]

$924 - $ no woman

$924 - {}^8C_6 = 896$

^4W	^8M	
		$^4C_4 \times {}^8C_2$
4	2 →	
3	3 →	$^4C_3 \times {}^8C_3$
2	4 →	$^4C_2 \times {}^8C_4$
1	5 →	$^4C_1 \times {}^8C_5$
		896

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3. (a) Jack has won 7 trophies for sport and wants to arrange them on a shelf. He has 2 trophies for cricket, 4 trophies for football and 1 trophy for swimming. Find the number of different arrangements if

(i) there are no restrictions,

$7! = 5040$ [1]

(ii) the football trophies are to be kept together, [3]

F C C S

$4! \times 4! = 576$

(iii) the football trophies are to be kept together and the cricket trophies are to be kept together. [3]

F C S $\Rightarrow 3! \times 4! \times 2! = 288$

(b) A team of 8 players is to be chosen from 6 girls and 8 boys. Find the number of different ways the team may be chosen if

(i) there are no restrictions,

$^{14}C_8 = 3003$ [1]

(ii) all the girls are in the team,

$^{6}C_6 \times {}^{8}C_2 = 28$ [1]

(iii) at least 1 girl is in the team.

$3003 - {}^{8}C_8 = 3002$ [2]

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4.(a) Eleven different television sets are to be displayed in a line in a large shop.

(i) Find the number of different ways the televisions can be arranged.

$11! = 39916800$ [1]

Of these television sets, 6 are made by company *A* and 5 are made by company *B*.

(ii) Find the number of different ways the televisions can be arranged so that no two sets made by company *A* are next to each other.

A B A B A B $\quad {}^{6}P_{6} \times {}^{5}P_{5} = 86400$ [2]

(b) A group of people is to be selected from 5 women and 3 men.

(i) Calculate the number of different groups of 4 people that have exactly 3 women.

${}^{5}C_{3} \times {}^{3}C_{1} = 30$ [2]

(ii) Calculate the number of different groups of at most 4 people where the number of women is the same as the number of men.

W	M	
2	2	${}^{5}C_{2} \times {}^{3}C_{2}$
1	1	${}^{5}C_{1} \times {}^{3}C_{1}$

45 [2]

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5.(a) Jess wants to arrange 9 different books on a shelf. There are 4 mathematics books, 3 physics books and 2 chemistry books. Find the number of different possible arrangements of the books if

(i) there are no restrictions,

$9! = 362880$ [1]

(ii) a chemistry book is at each end of the shelf,

C _ _ _ _ _ _ _ C

$7! \times 2 = 10080$ [2]

(iii) all the mathematics books are kept together and all the physics books are kept together.

M P C C

$4! \times 4! \times 3! = 3456$ [3]

(b) A quiz team of 6 children is to be chosen from a class of 8 boys and 10 girls. Find the number of ways of choosing the team if

(i) there are no restrictions,

$^{18}C_6 = 18564$

[1]

(ii) there are more boys than girls in the team

[4]

8 B	10 G	
6	0	$^8C_6$
5	1	$^8C_5 \times {}^{10}C_1$
4	2	$^8C_4 \times {}^{10}C_2$

$28 + 560 + 3150$

$= 3738$

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6. (a) A5-digit code is to be chosen from the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9. Each digit may be used once only in any 5-digit code. Find the number of different 5-digit codes that may be chosen if

(i) there are no restrictions, $^9P_5 = 15120$ [1]

(ii) the code is divisible by 5, $8P_4 = 1680$ [1]

(iii) the code is even and greater than 70 000. [3]

(b) A team of 6 people is to be chosen from 8 men and 6 women. Find the number of different teams that may be chosen if

(i) there are no restrictions, $^{14}C_6 = 3003$ [1]

(ii) there are no women in the team, $^8C_6 = 28$ [1]

(iii) there are a husband and wife who must not be separated. [3]

$^{12}C_4 + {}^{12}C_6$

$495 + 924 = 1419$

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7. A 5-digit code is formed using the following characters.

5	Letters	a	e	i	o	u
6	Numbers	1	2	3	4	5	6
3	Symbols	@	*	#		

No character can be repeated in a code. Find the number of possible codes if

(i) there are no restrictions, $^{14}P_5 = 240240$ [2]

(ii) the code starts with a symbol followed by two letters and then two numbers, [2]

S L L N N

$3P_1 \times 5P_2 \times {}^6P_2 = 1800$

(iii) the first two characters are numbers, and no other numbers appear in the code. [2]

N N _ _ _ (not number)

$6P_2 \times {}^8P_3 = 10080$