

FORM 5

CHAPTER 4 Permutation and Combination

Self Test 1

1 (a) (i) $8! = {}^8P_8 = 40\,320$

- (ii) KEMANUSIAAN
A – repeated thrice
N – repeated twice

$$\begin{aligned} \therefore \text{Number of words} &= \frac{11!}{3!2!} \\ &= 3\,326\,400 \end{aligned}$$

(b) 2, 3, 5, 6, 9

(i) $\frac{2/6}{{}^4P_3} = \frac{2/6}{{}^2P_1}$
 $= 24 \times 2$
 $= 48$

(ii) $\frac{5/9}{6} = \frac{2/6}{2}$

Number of even numbers greater than 5 000

$$\begin{aligned} &= ({}^2P_1 \times {}^3P_2 \times {}^2P_1) + (1 \times {}^3P_2 \times 1) \\ &= 24 + 6 \\ &= 30 \end{aligned}$$

2 (a) ${}^5P_4 = 120$

(b) $\frac{R}{1} \frac{S}{1}$

$$1 \times {}^3P_2 \times 1 = 6$$

(c) Vowels arranged together:

$$\frac{A/I}{2} \frac{S}{1}$$

$${}^2P_1 \times {}^3P_2 \times 3 = 36$$

$$\begin{aligned} \therefore \text{Number of words if the vowels cannot be arranged side by side} \\ &= 120 - 36 \\ &= 84 \end{aligned}$$

3 (a) $\frac{3/6}{2} \frac{S}{1}$

$${}^2P_1 \times {}^3P_3 = 12$$

(b) $\frac{3}{6} \frac{7}{3/7}$

$$\frac{6}{2} \frac{3/7}{2}$$

Number of words

$$\begin{aligned} &= (1 \times {}^2P_1 \times 1) + (1 \times {}^2P_2 \times {}^2P_1) \\ &= 2 + 4 \\ &= 6 \end{aligned}$$

Self Test 2

1 (a) Number of students = $12 + 8 = 20$

Number of ways to choose
 $= {}^{20}C_5$
 $= 15\,504$

(b) 3 boys, 3 girls

$$\begin{aligned} &= {}^{12}C_3 \times {}^8C_2 \\ &= 220 \times 28 \\ &= 6\,160 \end{aligned}$$

(c)	<u>Girls</u>	<u>Boys</u>
	3	2
	4	1
	5	0

Number of ways

$$\begin{aligned} &= {}^8C_3 \times {}^{12}C_2 + {}^8C_4 \times {}^{12}C_1 + {}^8C_5 \times {}^{12}C_0 \\ &= 3\,696 + 840 + 56 \\ &= 4\,592 \end{aligned}$$

2 (a) 3 Science subjects, 2 Arts subjects

Number of ways = ${}^4C_3 \times {}^4C_2$
 $= 24$

(b)	<u>Science</u>	<u>Arts</u>
	3	2
	4	1

Number of ways = ${}^4C_3 \times {}^4C_2 + {}^4C_4 \times {}^4C_1$
 $= 24 + 4$
 $= 28$

3 (a) Teachers Students

5	3
6	2
7	1
8	0

Number of ways

$$\begin{aligned} &= {}^{10}C_5 \times {}^{15}C_3 + {}^{10}C_6 \times {}^{15}C_2 + {}^{10}C_7 \times {}^{15}C_1 + {}^{10}C_8 \times {}^{15}C_0 \\ &= 114\,660 + 22\,050 + 1\,800 + 45 \\ &= 138\,555 \end{aligned}$$

(b) Teachers : Students = 3 : 1

Thus, the number of teachers is 6 and number students of students is 2.

$${}^{10}C_6 \times {}^{15}C_2 = 22\,050$$

(c) ${}^{10}C_1 \times {}^{15}C_7 = 64\,350$

SPM Practice

Paper 1

1 $\frac{5/9}{8} \frac{0/2/4/8}{0/2/4}$

$$\frac{8}{2} \frac{0/2/4}{2}$$

Number of three-digit even numbers greater than 500

$$\begin{aligned} &= ({}^2P_1 \times {}^4P_1 \times {}^4P_1) + (1 \times {}^4P_1 \times {}^3P_1) \\ &= 32 + 12 \\ &= 44 \end{aligned}$$

2 (a) $\frac{P/R}{2} \frac{S}{1}$

Letters P and R arranged together

$$\begin{aligned} &= ({}^2P_2 \times {}^4P_4) \times 5 \\ &= 240 \end{aligned}$$

Number of words formed without condition

$$\begin{aligned} &= {}^6P_6 \\ &= 720 \end{aligned}$$

\therefore Number of words formed such that P and R are not arranged together

$$\begin{aligned} &= 720 - 240 \\ &= 480 \end{aligned}$$

(b) Number of ways = ${}^6C_6 \times {}^5C_2 \times {}^4C_2$
 $= 60$

3 (a) Number of ways = ${}^{20}C_6$
 $= 38\,760$

(b) 3 new members, 3 existing members
 Number of ways = ${}^8C_3 \times {}^{12}C_3$
 $= 12\,320$

4 (a) Number of ways = $\frac{11!}{2!2!2!}$
 $= 4\,989\,600$

(b) Number of ways = $\frac{{}^6P_1 \times 10!}{2!2!2!}$
 $= 2\,721\,600$

5 (a)

_ _ _ GIRLS _ _ _

Number of ways = ${}^7P_7 \times {}^3P_3 \times 4$
 $= 120\,960$

(b) $\underline{\text{L}}$ _ _ _ _ _ _ _ $\underline{\text{L}}$

Number of ways = ${}^3P_1 \times {}^2P_1 \times 8!$
 $= 241\,920$

6 (a) Number of ways = ${}^5C_3 = 10$

(b) Number of ways = ${}^3C_3 = 1$

(c) Number of ways = ${}^4C_3 = 4$

7 (a) Number of codes = ${}^9P_3 = 504$

(b) Number of codes = ${}^5P_3 = 60$

(c) _ _ $\underline{5}$

Number of ways = ${}^8P_2 \times 1$
 $= 56$

8 (a) ${}^{14}C_6 = 3\,003$

(b) Boys : Girls = 4 : 2
 Number of ways = ${}^8C_4 \times {}^6C_2$
 $= 1\,050$

(c) Number of ways to choose without girls
 $= {}^8C_6$
 $= 28$

Number of ways to choose with ≥ 1 girl
 $= 3\,003 - 28$
 $= 2\,975$