

COUNTING & PROBABILITY (Q 6, PAPER 2)

2003

- 6 (a) I write down today's date as 09062003 and then select one of the digits at random.
- (i) What is the probability that I select the 9?
 - (ii) What is the probability that I select an odd digit?
- (b) Two women, Ann and Bríd, and two men, Con and Declan, sit in a row for a photograph.
- (i) How many different arrangements of the four people are possible?
 - (ii) Write out the four possible arrangements that have the two women in the middle.
 - (iii) If the arrangement of the four people is chosen at random from all of the possible arrangements, what is the probability that the two women will be in the middle?

- (c) In a certain school the examination subjects for senior students are grouped as follows:

Compulsory Subjects	Block A	Block B	Block C
Irish English mathematics	French German	biology home economics construction studies accounting	business organisation history physics

As well as taking all three of the compulsory subjects, each student must choose *one* subject from Block A, *two* from Block B and *one* from Block C.

- (i) In choosing two subjects from Block B, how many different selections are possible?
- (ii) In choosing the full range of subjects, how many different selections are possible?
- (iii) One student has already decided to do German and construction studies. How many different selections of the remaining subjects are possible for this student?
- (iv) If the student referred to in part (iii) selects her remaining subjects at random, what is the probability that she will select both biology and physics?

SOLUTION

6 (a) (i)

$$p(E) = \frac{\text{Number of desired outcomes}}{\text{Total possible number of outcomes}} \dots\dots \textcircled{4}$$

There are 8 digits in total. There is one 9.

$$p(\text{Selecting a 9}) = \frac{\text{No. of 9's}}{\text{No. of digits}} = \frac{1}{8}$$

6 (a) (ii)

$$p(\text{Selecting an Odd Digit}) = \frac{\text{No. of Odd Digits}}{\text{No. of digits}} = \frac{2}{8} = \frac{1}{4}$$

6 (b) (i)

You can do this question the long way by writing out all the possibilities or the shorter way by using some formulae.

Long way:

A	B	C	D	B	A	C	D	C	B	A	D	D	B	C	A
A	B	D	C	B	A	D	C	C	B	D	A	D	B	A	C
A	C	B	D	B	C	A	D	C	A	B	D	D	C	B	A
A	C	D	B	B	C	D	A	C	A	D	B	D	C	A	B
A	D	B	C	B	D	A	C	C	D	B	A	D	A	B	C
A	D	C	B	B	D	C	A	C	D	A	B	D	A	C	B

You can see there are 24 arrangements of 4 people.

Short way:

$$\text{The number of arrangements of } n \text{ different objects taking } r \text{ at a time with no repeats} = {}^n P_r \dots\dots \textcircled{2}$$

How many ways can you arrange 4 different objects, all taken, no repeats (order is important)?

$${}^4 P_4 = 4 \times 3 \times 2 \times 1 = 24$$

4 (b) (ii)

(Con, Ann, Brid, Declan), (Declan, Ann, Brid, Con),

(Con, Brid, Ann, Declan), (Declan, Brid, Ann, Con)

4 (b) (iii)

$$p(E) = \frac{\text{Number of desired outcomes}}{\text{Total possible number of outcomes}} \dots\dots \textcircled{4}$$

$$p(\text{2 women in the middle}) = \frac{4}{24} = \frac{1}{6}$$

6 (c) (i)

Compulsory Subjects	Block A	Block B	Block C
Irish English mathematics	French German	biology home economics construction studies accounting	business organisation history physics

[Must take all 3] [Must choose 1 from 2] [Must choose 2 from 4] [Must choose 1 from 2]

How many ways (order is **not** important) can 2 subjects be selected from 4 subjects?

$${}^4C_2 = \frac{4 \times 3}{2 \times 1} = 6$$

The number of selections of n different

objects taking r at a time $= {}^nC_r = \binom{n}{r}$ **1**

CALCULATOR: Calculate 4C_2 .

4 **SHIFT** **nCr** **2** **=**

4C2

6

6 (c) (ii)

Compulsory subjects: You need to select 3 from 3 (no choice) **AND**

Block A: You need to select 1 from 2 **AND**

Block B: You need to select 2 from 4 **AND**

Block C: You need to select 1 from 3.

NOTE: AND means multiply.

No. of different selections $= {}^3C_3 \times {}^2C_1 \times {}^4C_2 \times {}^3C_1 = 1 \times 2 \times 6 \times 3 = 36$

6 (c) (iii)

Compulsory Subjects	Block A	Block B	Block C
Irish English mathematics	French German	biology home economics construction studies accounting	business organisation history physics

[Choice made] [Choice made] [Must choose 1 from 3] [Must choose 1 from 2]

No. of different selections $= 1 \times 1 \times {}^3C_1 \times {}^3C_1 = 1 \times 1 \times 3 \times 3 = 9$

6 (c) (iv)

There are 9 possible selections. Selecting biology and physics is one such selection.

$p(\text{Physics and Biology}) = \frac{1}{9}$