Mutually Exclusive Events

Let A, B be events, A and B are **mutually exclusive events** (互斥事件) if $A \cap B = \phi$.

i.e. The events A and B **cannot happen on the same time**.

e.g.1 In a rolling die:

A = the event that the number is odd = {1, 3, 5}

B = the event that the number is even = {2, 4, 6}

C = the event that the number is a multiple of 3 = {3, 6}

$A \cap B = \phi$, $\therefore$ A and B are mutually exclusive events.

$A \cap C = \{3\}$, $\therefore$ A and C are not mutually exclusive events.

e.g.2 In tossing a coin 3 times :

A = event that there are 2 heads and 1 tail = {HHT, HTH, THH}

B = event that there are 3 heads = {HHH}

C = event that the first toss is a head = {HTT, HTH, HHT, HHH}

$A \cap B = \phi$, $\therefore A$ and B are mutually exclusive events.

$A \cap C$ = {HTH, HHT}, $\therefore A$ and C are not mutually exclusive events.

By axiom 3 in Chapter 3, if A and B are mutually exclusive events, $A \cap B = \phi$,

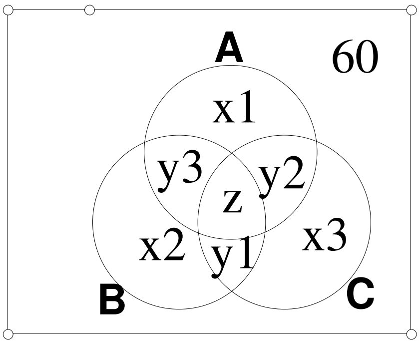
$P(A \cup B) = P(A) + P(B)$ .This is called the **addition law**.(加法定理)

Example 3

60 students took part in a test of three questions A, B and C. 37 students answered A correctly, 30 answered B correctly and 25 answered C correctly, 20 students scored A and B, 17 scored A and C, 13 scored B and C, 5 got all A, B and C.

(a) How many students scored at least one question?
A student is selected at random, what is the probability of scoring none?

(b) What is the probability of scoring at most one question?



(a) Consider the above Venn diagram

$x_1 + y_2 + y_3 + z = 37$

$x_2 + y_1 + y_3 + z = 30$

$x_3 + y_1 + y_2 + z = 25$

$y_3 + z = 20$; $y_2 + z = 17$; $y_1 + z = 13$

$z = 5$

The remaining part is left as an exercise.

[Ans. (a) 47, $\frac{13}{60}$; (b) $\frac{1}{3}$]