COUNTING PRINCIPLES

1. A person buying a personal computer system is offered a choice of three models of the basic unit, two models of keyboard, and two models of printer. How many distinct systems can be purchased?

   Answer

Basic Unit		Keyboard		Printer
3	*	2	*	2

   This is a multiplication rule problem. There are 12 distinct systems can be purchased from the choice of three models of the basic unit, two models of keyboard, and two models of printer.

2. Suppose that a code consists of five characters, two letters followed by three digits. Find the number of:

   (a) codes;

   Answer

Letter 1		Letter 2		Digit 1		Digit 2		Digit 3
A ... Z		A ... Z		0 ... 9		0 ... 9		0 ... 9
26	*	26	*	10	*	10	*	10

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   Q2=26^2 * 10^3
   ```

   The number of a code consists of five characters, two letters followed by three digits is 26^2X10^3.

   (b) codes with distinct letters.

   Answer

Letter 1		Letter 2		Digit 1		Digit 2		Digit 3
A ... Z		A ... Z		0 ... 9		0 ... 9		0 ... 9
26	*	25	*	10	*	10	*	10

   ```
   Q2=26 *25* 10^3
   ```

   The number of a code with distinct letters consists of five characters, two letters followed by three digits is $26X25X10^3$.

3. Consider all positive integers with three digits. (Note that zero cannot be the first digit.) Find the number of them which are:

   (a) greater than 700

   Answer

Digit 1		Digit 2		Digit 3
7,8,9		0 ... 9		0 ... 9
3	x	10	x	10

   There is a high chance that the following sequence might occur namely 700 which is not greater tahan 700.

Digit 1		Digit 2		Digit 3
7		0		0
1	x	1	x	1

   Hence, there are 299 number which are greater than 700.

   (b) odd.

   Answer

Digit 1		Digit 2		Digit 3
1, ... ,9		0 ... 9		1,3,5,7,9
9	x	10	x	5

   There are 450 number which are odd.

4. A typical PIN (personal identification number) is a sequence of any four symbols chosen from the 26 letters in the alphabet and the ten digits, with repetition allowed. How many different PINs are possible?

   Answer

Symbol 1		Symbol 2		Symbol 3		Symbol 4
A, ... ,9		A, ...,9		A, ...,9		A, ... ,9
36	x	36	x	36	x	36

   Hence, 36^4 different PINs are possible to occur.

5. The letters ABCDE are to be used to form strings of length 3. How many strings:

   (a) begin with A, allowing repetitions

   Answer

Letter 1		Letter 2		Letter 3
A		A,B,C,D,E		A,B,C,D,E
1	x	5	x	5

   There are 25 strings.

   (b) begin with A, repetitions are not allowed?

Answer

Letter 1		Letter 2		Letter 3
A		B,C,D,E		B,C,D,E
1	x	4	x	3

There are 12 strings.

6. Hexadecimal numbers are made using the sixteen digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. They are denoted by the subscript 16.

   (a) How many hexadecimal numbers begin with one of the digits 3 through B, end with one of the digits 5 through F and are 5 digits long?

   Answer

Digit 1		Digit 2		Digit 3		Digit 4		Digit 5
3, ... ,B		0, ...,F		0, ...,F		0, ... ,F		5, ... ,F
9	x	16	x	16	x	16	x	11

   There are $99x16^3$ hexadecimal numbers.

   (b) How many strings of hexadecimal digits consist of from one through three digits?

   Answer

   First case is 1 digit hexadecimal numbers

Digit 1
0,...,F
16

   Second case is 2 digit hexadecimal numbers

Digit 1		Digit 2
1,...,F		0,...,F
15	x	16

   Third case is 3 digit hexadecimal numbers

Digit 1		Digit 2		Digit 3
1,...,F		0,...,F		0,...,F
15	x	16	x	16

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Q6A=16+(15*16)+(15*16*16)
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   There are 4096 strings of hexadecimal digits consist of from one through three digits

7. A group of eight people are going to watch a movie together. Two of the eight must sit side-by-side. In how many ways can the eight be seated together in a row?

   Answer

First case 2 person sit side-by-side

Seat 1		Seat 2
2	x	1

Second case all are taking their seats but the earlier 2 person sit side-by-side are tied together as one seat only

Seat 1		Seat 2		Seat 3		Seat 4		Seat 5		Seat 6		Seat 7
7	x	6	x	5	x	4	x	3	x	2	x	1

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Q7A=factorial(2)*factorial(7)
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There are 1.008×10^4 ways the eight people can be seated together in a row.