Book Review

Counting

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We are now living in a digital world. Watches are digital. The study of DNA is digital. The security codes on the net and in the banks are also digital. When we talk about the so called real-life applications of secondary mathematics, it is not so easy to give such examples. Often the examples given are either so easy that students could not see the usefulness of mathematics or so difficult that teachers find it almost impossible to present them at the school level. However it is not too difficult to give real-life applications if we refer to discrete mathematics, step one of which is counting and this is the subject of the book under review.

Calculus for hundreds of years has been the gateway to advanced mathematics. It provides mathematical models for many problems in science and engineering. The models are continuous models, that is, the variables involved are continuous. Counting provides discrete models. A passage of music can be described as legato (continuous) or staccato (discrete). A discrete model is equivalent to a staccato passage in music.

Parts of discrete mathematics are also known by other names, for example, combinatorics, graph theory, networks, etc. Such topics are now popular undergraduate courses in the universities. The book under review gives a glimpse of the subject. It has 13 chapters and the content can be classified roughly into three components. Chapters 1 to 4 contain the addition principle, the multiplication principle, leading to permutations and combinations (topics in the A level mathematics syllabus), and finally applications. Suppose there are 3 ways to travel from city X to city Y by one means and 4 other ways by another means. Then the total number of ways is $3 + 4 = 7$. This is known as the addition principle. Suppose there are 3 ways to travel from city X to city Y and 4 ways to travel from city Y to city Z. Then the total number of ways to travel from city X to city Z is $3 \times 4 = 12$. This is known as the multiplication principle. The principles are simple, but their implication is immense.

Chapters 5 to 9 are on the bijection principle, that is, there is a one-to-one correspondence between two finite sets of the same size. Then applications are given to problems involving prime numbers and the problem of distribution of balls into boxes. Chapters 10 to 12 are the binomial expansion, including Pascal's triangle. Chapter 13 consists of miscellaneous problems. As we can see, the book provides an excellent introduction to the subject.

Counting is also a standard topic to be taught to students taking part in the International Mathematical Olympiad (IMO) and some other mathematical competitions. The book has been used for such training and also for an in-service course for teachers. The style of writing is conversational and that makes it easy to read. It contains a host of interesting and some challenging exercises. It is definitely accessible to students at the junior college level and students with Additional Mathematics. In fact, it is strongly advocated by the curriculum planner that discrete mathematics should be made part of the mathematics syllabus at the junior college level. The rationale is not just to introduce an interesting subject but also to make mathematics more relevant to the modern world.

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