Suitening our Nomenclature

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Abstract

Donald E. Knuth has suggested an alternative name for a multiset that I like very much: a *suite*, as in a suite of rooms or a suite of dances. Please join me in replacing "multiset" and "bag" with "suite" in our mathematical lexicon.

In a set, the order of the elements doesn't matter, nor does it matter how often an element is repeated; the sets $\{1,0\}$, $\{0,1\}$, and $\{0,0,1\}$ are all equal. In a sequence, on the other hand, both order and repetition do matter; the sequences $(1,0)$, $(0,1)$, and $(0,0,1)$ are all distinct. There is an intermediate concept in which order doesn't matter, but repetition does. The names "multiset" and "bag" are both used for this intermediate type of collection. The multisets $\{1,0\}$ and $\{0,1\}$ are equal, but the multiset $\{0,0,1\}$ is a proper supermultiset of $\{1,0\} = \{0,1\}$.

I think that the term "multiset" is both too long and too obviously a derived form to work well as a name for a very basic concept. "Submultiset" and "supermultiset" are even worse. The last sentence of the previous paragraph is one example, and here is another, from a book that I am writing about splines:

> Two n-ic functions agree to k^{th} order at a point $\mathbf{p}$ if and only if their polar forms agree on all multisets of polar arguments that are supermultisets of $A := \{\underbrace{\mathbf{p},\ldots,\mathbf{p}}_{n-k}\}$.

Not intolerable, but decidedly clumsy. (Denoting multiplicities with horizontal braces is also clumsy; the formulas $\{(n-k)\cdot\mathbf{p}\}$ and $\{\mathbf{p}^{n-k}\}$ are more concise alternatives. But this note is about nomenclature, not notation.)

Because I don't like "multiset", I was planning to use the term "bag" instead, in my spline book. I wrote to Donald E. Knuth, asking him who should get the credit for suggesting "bag". In the ensuing exchange, I learned that Knuth has—as such things go—a passionate hatred of "bag". He refers to it as "the b-word"! Knuth convinced me that "bag" is a poor choice, primarily because it has the wrong connotation: It refers more to the container than to the things contained. There are other problems as well. The phrase "in the bag" is an irrelevant idiom meaning "certain". The compound "sub-bag" probably needs a hyphen. And some people are disturbed by the fact that "bag" also means "udder", "scrotum", and "unattractive woman". If, despite these arguments, you still prefer "bag" to "multiset", you should be nervous, because the people who write textbooks [1, 2, 3] seem convinced that "bag" is bad.

Knuth's letter to me included the following remark, however:

> My favorite [word], I suppose, if I were to have a chance at giving multisets a new name, would be 'suite'.

I think that "suite" is a perfectly wonderful suggestion. It has just the right connotations: A set of encyclopedia contains each volume only once, but a suite of rooms often contains several bedrooms. "Suite" is one syllable. It starts with the same letter and ends with the same sound as "set", so it will form all of the same compounds that "set" does. Try replacing "multiset" and "supermultiset" with "suite" and "supersuite" in the sample sentences above. I find their rhythm to be much improved.

Knuth commented that some people nowadays are talking about "posets" and "pomsets", meaning partially ordered sets and partially ordered multisets. To my mind, the contraction from "po-multiset" to "pomset" is further proof that the prefix "multi-" is too clumsy. Wouldn't we be better off with "posets" and "posuites"?

Adopting "multiset" also leads one down the garden path towards a horrible consistency in which almost every noun is prefixed by "multi-". For example, Knuth mentioned that he is planning to define a *language* in his Volume 6 to be a multiset of strings. He added, "Maybe I'll (ugh) have to call such things multilanguages?" If we define languages to be suites of strings, we won't be tempted to call them multilanguages.

What say you? It's now or never. Let's convert *tout de suite.*

References

[1] Ian P. Goulden and David M. Jackson. *Combinatorial Enumeration*, pages 50–52. John Wiley & Sons (1983).

[2] Donald E. Knuth. *The Art of Computer Programming, Volume II: Seminumerical Algorithms*, second edition, exercise 4.6.3–19 on page 464 and its answer on page 636. Addison-Wesley (1981).

[3] Richard P. Stanley. *Enumerative Combinatorics, Volume I*, page 15. Wadsworth & Brooks/Cole, Monterey, CA (1986).