

Shrikrishna Shikshan Sanstha's



SHRIKRISHNA MAHAVIDYALAYA, GUNJOTI.

TQ. OMERGA, DIST. OSMANABAD

DEPARTMENT OF MATHEMATICS.

Name of the Students :- Pophale Vishal Odgyrao

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Head
HOD
Department of Mathematics,
Shrikrishna Mahavidyalaya, Gunjoti
Tq. Omurga Dist. Osmanabad
(M.S.)-413606

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* Studies on Canonical Forms *

In mathematics and computer science a canonical, normal, or standard form of a mathematical object is a standard way of presenting that object as a mathematical expression often, it is one which provides the simplest representation of an object and which allows it to be identified in a unique way. The distinction between "canonical" and "normal" forms varies from subfield to subfield. In most fields, a canonical form specifies a unique representation for every object, while a normal form simply specifies its form, without the requirement of uniqueness.

Definition -

Given a sets of objects with an equivalence relation R on S , a cononical form is given by designating some objects of S to be "in canonical form", such that every object under considerration is equivalent to exactly one object in canonical form. In other words, the canonical form in S represent the equivalence classes, once and only once. To test whether two objects are equivalent it then suffices to test equality on their canonical forms. A cononical form thus provides a classification theorem and more in that it not only classifies every class, but also gives a distinguished (canonical) representative for each object in the class.

formally, a canonicalization with respect to an equivalence relation R on a set S is a mapping $c: S \rightarrow S$ such that for all $s, s_1, s_2 \in S$:

$$\exists c(s) = c(c(s)) \text{ [idempotence]}$$

$\exists s_1, R, s_2$ if and only if $c(s_1) = c(s_2)$ [decisiveness], and

$\exists s, R, c(s)$ (representativeness)
property 3 is redundant; it follows by applying 2 to 1

A canonical form may simply be a convention, or a deep theorem. For example polynomials are conventionally written with the terms in descending powers; it is more usual to write $x^2 + x + 30$ than $30 + x^2$, although the two forms define the same polynomial by contrast, the existence of

Jordan canonical form for a matrix is deep theorem.

History -

"In mathematics, denotes a form, usually the simplest or most symmetrical, to which, without loss of generality, all functions of the same class can be reduced."

Example -

① Large number notation - standard form is used by many mathematicians and scientists to write extremely large number in a more concise and understandable way, the most prominent of which being the scientific notation.

② Number theory - cononical represe-

sentation of a positive integer,
cononical form of a continued
fraction.

See Also -

① canonicalization, canonical
basis, conioical class, Normalization
(disambiguation) standardization.

References -

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