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An Automatic Index in Natural Language for UDC Editions

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Description of the procedures for and the advantages of the automatic creation of index entries from the class descriptions in the schedules of the UDC. Examples show the addings to or alterations of the class descriptions in order that the index entries may be truly informative about the concept contained in a "classification number" (UDC-notation). In the annex sample pages are given of the computer printouts listing the cards, the entries in the schedule and the entries in the index, all relating to one sample page of UDC 532.614-533.42.

(I. C.)

0. Introduction

The problems of manual preparation of the indexes of UDC editions led us to study their automatic preparation.

A System was created, named ELVCDU3, which is based on the processing of natural language existing in the schedules in order to obtain an automatic preparation of the alphabetic index.

The System can work in any language and it requires only the inclusion of the translation of some grammatically important words in the programme of the System.

As the UDC schedules have not been written with their automatic transformation in an index in mind, a revision will have to be accomplished for small alterations in the text so that it may be adapted to the System. For an example of the existing UDC texts in the schedules see the page 73 of (2) in 7.1.

1. Description of the System

1.1 Format for data input

The text of a schedule is key-punched in cards, according to the following format:

The classification number is punched starting at column 1. The text related to this number is punched, preceded by two blank columns, and it can be continued in a new card, following the same format. The notes are punched following the same disposition they have in the schedule.

For this purpose, the same classification number is punched in a new card, but three blank spaces are left before the punching of the note. See the printout of the listing of the cards in 7.2.

In each card, column 80 is reserved for punching information related to the type of schedule that will be processed; in the future, we will be able to have the UDC full edition on magnetic tapes for the processing of each complete edition, of the medium or abridged edition and, if necessary, of the whole full edition.

1.2 Processing

1.2.1 Index creation

The punched cards are recorded on magnetic tape. The System separates each sentence of the text and analyses each one of its elements (words or symbols); from this analysis, the elements considered grammatically important create new sentences when necessary. Each sentence so created is rotated in order to allow each significant word of the sentence to stand out in the index.

A vocabulary of non-significant words in the programme allows these words to be eliminated and thus not to be considered as main entries in the index; they appear merely as logical linking elements in the sentences.

As a general rule, one period or two spaces indicate the end of the sentence. Its elements are distributed for the sentence formation:

532.68 Motions due to capillary forces¹

Sentences for the index:

Motions

due to capillary forces 532.68

Capillary

forces, Motions due to 532.68

Several guidelines were established for the formation of new sentences, according to the order of the elements in the original sentence:

1. The elements comma (,) and "AND", even when followed by a preposition or by an article, lead to the formation of new sentences:

532.78 Crystallisation of liquids and of solutions

Sentences for the index:

Crystallisation

of liquids 532.78

of solutions 532.78

Liquids

crystallisation of 532.78

Solutions

crystallisation of 532.78

533.24 Liquefaction and solidification of gases

Sentences for the index:

Liquefaction

of gases 533.24

Solidification

of gases 533.24

Gases

Liquefaction of 533.24

Solidification of 533.24

1 Examples were taken from the Abridged English Edition (1) and the English Full Edition (2)

As an exception, these two elements constitute one sentence when followed by a possessive:

532.1 Universe and its structure

Sentences for the index:

Universe

 and its structure 523.1

Structure

 Universe and its 523.1

77.03 Photographic records and their interpretation

Sentences for the index:

Photographic

 records and their interpretation 77.03

Records

 and their interpretation 77.03

Interpretation

 Photographic records and their 77.03

2. The element "OR" interrupts the sentence, and the preceding elements will begin the next sentence to be created:

331.845 Use of leisure or spare time

Sentences for the index:

Leisure

 Use of 331.845

Spare

 time, Use of 331.845

Time

 Use of spare 331.845

3. The elements "OTHER" and "ANOTHER" are considered the end of a sentence, and the text that follows will be considered a new sentence:

661.31 Potash and other potassium compounds

Sentences for the index:

Potash 661.31

Potassium

 compounds 661.31

Compounds

 Potassium 661.31

4. The word or sentence that precedes the colon (:) is added to the words or sentences after the colon, in parentheses, as an explanation:

347.811 Aircraft: purchase, construction, registration

Sentences for the index:

Aircraft 347.811

Purchase (Aircraft) 347.811

Construction (Aircraft) 347.811

Registration (Aircraft) 347.811

5. The word or sentence in parentheses must have a complete meaning to allow its individual retrieval in the index:

532-2 Visible light rays (spectrum)

Sentences for the index:

Visible

 light rays 532-2

Light

 rays, Visible 535-2

Rays

 Visible light 535-2

Spectrum 535-2

These guidelines were established through the analysis of the linguistic structure of the UDC schedules.

1.2.2 Index listing (see also 7.4)

After the alphabetic ordering, the index is listed in two columns with each significant word of the sentence standing out.

At the top of each column, the explanation (cont.) is added to the word that stands out, when it is a continuation of the preceding column.

When there is more than one classification number for one sentence, all of them are cited between commas. The cuts made in long sentences are pointed out by the symbols (<=).

1.2.3 Schedule listing (see also 7.3)

The schedule is listed in one column and will later be listed in two columns.

Classification numbers having up to 3 digits stand out by being centralised in the line together with their text.

1.2.4 Updating and corrections

The System allows inclusion, elimination and substitution of cards in the file on magnetic tape, thus permitting the continuous updating of the file.

2. Equipment and language

Programmes were written in PL1 language and processed in an IBM 370 mod. 165 computer.

3. Utilisation of the System

The system was used in the processing of the following UDC Editions:

1) UDC Medium Edition, in Portuguese

Classification numbers: 35,759

Sentences in the index: 154,386

Number of index pages: 1,446

Number of schedule pages: 781

Processing time (CPU):

 Index creation: 36 minutes

 Alphabetic ordering: 57 seconds

 Index listing: 11 minutes

 Schedule listing: 90 seconds

2) UDC Full Edition, 32 Politics, in Portuguese

4. Tests made with the System

Tests were made with other languages, such as English, French, German and Spanish, with positive results and without changes in programmes.

5. Advantages

With this System, after a speed revision of the text, the only thing that must be done is the punching of the input cards, since the preparation of the index and the schedules are done by the computer, and for publication it is sufficient to reproduce by offset the computer listings. Thus, we have eliminated the slowness of manual preparation of the cards to be alphabetized for the index, their typing and typographic composing of the index as well as of the schedules.

532.614	<u>Surface and boundary layer energy</u>	532.7	KINETIC THEORY OF LIQUIDS. OSMOSIS. DISSOLUTION. SOLUTION
.2	Surface energy		
.3	Boundary layer energy		
615	Surface energy of dissolved substances	532.71	Osmosis
532.62	Properties of thin liquid films, etc. Soap bubbles. Minimum surfaces. Plateau's figures	.712	Osmotic pressure
.623	Soap bubbles	.713	Osmotic energy. Heat of solution
532.63	Capillarity in the strict sense	532.72	Diffusion
	For electro-capillarity see 537.361	532.73	Solution. Phenomena of solution
.631	Capillary pressure	.731	— Of gases in liquids
.632	Capillary energy	.732	— Of liquids in liquids
.635	Surface tenacity and rigidity	.733	— Of solid bodies in liquids
532.64	Angle of contact. Wetting angle	.739	Velocity of solution
.08	Measurement of the angle of contact	.2	Mutual influence of dissolved substances on the solubility
532.65	Free surface under the action of capillary forces	532.74	Other phenomena
532.66	Capillary tubes	532.77	Solubility. Solvent power
532.68	Motions due to capillary forces		Molecular state. Association
.685	Moisture movement in porous bodies, e.g. in porous stones		Physical properties of solutions. <u>Influences on the boiling point and freezing point and on the vapour pressure</u>
532.69	Various properties depending on surface tension	.771	The influence of the solute on the properties of the solvent is classified by using the colon, e.g. 532.77 : 532.612.4 Surface tension of solutions
.691	Surface activity in general	.772	Dilute solutions
.692	Power of forming thin films. Oiliness	.773	Concentration with reference to the quantity of the different constituents
.694	Properties of gas-liquid systems		Concentrated solutions
.1	Foam formation	532.78	Crystallisation of liquids and of solutions
.4	Fluffiness		See also 548.5 Formation and growth of crystals
.695	Behaviour relating to formation of emulsions	.781	Crystallisation of pure liquids
.1	Power of forming emulsions	.782	Undercooled metastable liquids. Solid solutions
.2	Power of being emulsified	.785	Crystallisation of solutions
.696	Behaviour relating to solids	.787	Supersaturated solutions
.1	Wetting		
.2	Washing		

533 Mechanics of Gases. Aerodynamics

See also

621.5	Compression and rarefaction of gases
621.6	Pumping and blowing machinery
661.9	Gases in chemical technology
Under 533 are to be classed only works referring exclusively to gases. Those referring to gases and liquids come preferably under 532. If necessary, subdivisions of 522 can be combined with those of 532 with the aid of the colon	

533.1 PROPERTIES OF GASES

.11	<u>Specific volume</u>
.12	<u>Density</u>
	For determination of density see 531.758
.13	Principle of Archimedes applied to gases. <u>Correction of weight. Upthrust</u>
	See also 533.61 Theory of balloons
.15	<u>Diffusion and penetration. Inflow</u>
.16	<u>Internal friction and viscosity</u>
.17	Outflow

533.2	<u>ELASTICITY. COMPRESSIBILITY. LIQUEFACTION. GAS MIXTURES</u>
.21	Compressibility
.22	Approximate laws. Boyle's or Mariotte's law
.23	Limit of Boyle's law. Experiments of Pouillet, Dulong, Arago and Regnault
.24	<u>Liquefaction and solidification. Liquid air</u>
	See also
	661.9 Gases in chemical technology
	621.56 Refrigeration
.27	<u>Mixtures of gases. Properties</u>
.275	Humidity. Hygrometry
	See also 551.57 Aqueous vapour
.276	Katathermometers. Katathermometry
533.4	BAROMETERS
	For manometers see 531.787
	Barometers containing liquids, mercury, etc.
.41	Corrections and reductions for liquid barometers
.42	

7.1 Copy of the UDC page 73

Since the text is in accordance with the System, corrections and updating of the text and the automatic processing of the index and schedules are easy to accomplish because all that is necessary is the punching of cards with the new text and their inclusion in the UDC file through an appropriate programme.

In the future, we will have the Full UDC Edition, in Portuguese, on computer file.

Another advantage of the System is the high processing speed.

6. References

- 1) International Federation for Documentation: *Universal Decimal Classification. Abridged English Edition*. 3rd ed. rev., 1961. London: British Standards Institution 1961. 245 p. = FID Publ. No. 289.
- 2) International Federation for Documentation: *Universal Decimal Classification. English Full Edition*. Fourth Intern. Ed.,

Vol. 2, Pt. 1, Classes 50/53. London: British Standards Institution 1943. 103 p.

- 3) Oliveira, Elvira de Andrade: *Automação dos Índices das tabelas da Classificação Decimal Universal*. In: Ciencia da Informação, Rio de Janeiro, 2 (1973) No. 2, p. 139-168 (Dissertation to obtain the Master Degree in Librarianship and Documentation)

7. Annexes

The sample used is taken from the English Full Edition (2); the modifications of the text are indicated by lines and underlinings in the copy of the UDC page (7.1) as well as in the printout of the schedule (7.3).

7.1 Copy of the UDC page 73

7.2 Listing of the cards

7.3 Schedule

7.4 Index

532.614 SURFACE ENERGY. BOUNDARY LAYER ENERGY
 532.614.2 SURFACE ENERGY
 532.614.3 BOUNDARY LAYER ENERGY
 532.615 SURFACE ENERGY OF DISSOLVED SUBSTANCES
 532.62 PROPERTIES OF THIN LIQUID FILMS, ETC. SOAP BUBBLES. MINIMUM SURFACES.
 532.62 PLATEAU'S FIGURES
 532.623 SOAP BUBBLES
 532.63 CAPILLARITY. IN THE STRICT SENSE
 532.631 CAPILLARITY. CAPILLARITAT. SEE 537.361
 532.632 CAPILLARY PRESSURE
 532.633 CAPILLARY ENERGY
 532.635 SURFACE TENACITY AND RIGIDITY
 532.64 ANGLE OF CONTACT. WETTING ANGLE
 532.64.08 MEASUREMENT OF THE ANGLE OF CONTACT
 532.65 FREE SURFACE UNDER THE ACTION OF CAPILLARY FORCES
 532.66 CAPILLARY TUBES
 532.68 MOTIONS DUE TO CAPILLARY FORCES
 532.685 MOISTURE MOVEMENT IN POROUS BODIES. E.G. IN POROUS STONES
 532.69 VARIOUS PROPERTIES DEPENDING ON SURFACE TENSION
 532.691 SURFACE ACTIVITY IN GENERAL
 532.692 POWER OF FORMING THIN FILMS. OILINESS
 532.694 PROPERTIES OF GAS-LIQUID SYSTEMS
 532.694.1 FOAM FORMATION
 532.694.4 FLUIDITY
 532.695 BEHAVIOUR RELATING TO FORMATION OF EMULSIONS
 532.695.1 POWER OF FORMING EMULSIONS
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 532.696 BEHAVIOUR RELATING TO SOLIDS
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 532.71 KINETIC THEORY OF LIQUIDS. OSMOSIS. DISSOLUTION. SOLUTION
 532.711 OSMOSIS
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 532.713 OSMOTIC ENERGY. HEAT OF SOLUTION
 532.72 DIFFUSION
 532.73 SOLUTION. PHENOMENA OF SOLUTION
 532.73.1 SOLUTION OF GASES IN LIQUIDS
 532.73.2 SOLUTION OF LIQUIDS IN LIQUIDS
 532.73.3 SOLUTION OF SOLID BODIES IN LIQUIDS
 532.734 VELOCITY OF SOLUTION
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 532.739 OTHER PHENOMENA OF SOLUTION
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 532.771 DILUTE SOLUTIONS
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 532.773 CONCENTRATED SOLUTIONS
 532.78 CRYSTALLISATION OF LIQUIDS AND OF SOLUTIONS
 532.78 SEE ALSO 546.5 FORMATION AND GROWTH OF CRYSTALS
 532.781 CRYSTALLISATION OF PURE LIQUIDS
 532.782 UNDERCOOLED METASTABLE LIQUIDS. SOLID SOLUTIONS
 532.783 CRYSTALLISATION OF SOLUTIONS
 532.784 CRYSTALLISATION OF LIQUIDS
 532.785 MECHANICS OF GASES. AERODYNAMICS
 533 SEE ALSO
 533.621.5 COMPRESSION AND LIQUEFACTION OF GASES
 533.621.6 PUMPING AND BLOWING MACHINERY
 533.661.9 GASES IN CHEMICAL TECHNOLOGY
 533.66 UNDER 531 ARE TO BE CLASSED ONLY WORKS REFERRING EXCLUSIVELY TO GASES.
 533.66 THOSE REFERRING TO GASES AND LIQUIDS COME PREFERABLY UNDER 532. IF
 533.66 NECESSARY, SUBDIVISIONS OF 522 CAN BE COMBINED WITH THOSE OF 532 WITH
 533.66 AID OF THE COLON
 533.66 PROPERTIES OF GASES
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 533.12 DENSITY OF GASES
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 533.24 621.56 REFRIGERATION AND LIQUEFACTION OF GASES
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 533.275 SEE ALSO 551.57 AQUEOUS VAPOUR
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 533.41 BAROMETERS CONTAINING LIQUIDS, MERCURY, ETC.
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 532.78 SEE ALSO 546.5 FORMATION AND GROWTH OF CRYSTALS
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 533.276 KATATHERMOMETERS. KATATHERMOMETRY
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7.2 Listing of the cards

7.3 UDC Schedule

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