HARVARD MONOGRAPHS IN APPLIED SCIENCE

NUMBER 8

AUTOMATIC LANGUAGE TRANSLATION

LEXICAL AND TECHNICAL ASPECTS, WITH PARTICULAR REFERENCE TO RUSSIAN

ANTHONY G. OETTINGER

with a Foreword by Joshua Whatmough

HARVARD UNIVERSITY PRESS Cambridge, Massachusetts, 1960

CONTENTS

Foreword by Joshua Whatmough

Chapter 1	1. AUTOMATIC INFORMATION-PROCESSING MACHINES	1
1.1.	The Organization of Information-Processing Machines	2
1.2.	Signs and Their Representations	4
1.3.	The Organization of the Univac	6
	Elements of Programming	9
	Information Input and Output	16
	The Characteristics of Information-Storage Media	21
	The Organization of Stored Information	30
1.8.	Bibliographic Notes	35
App	endix. Univac I Instructions	38
Chapter	2. THE STRUCTURE OF SIGNS	40
2.1.	Use, Mention, and Representation	40
2.2.		45
	Transformations	48
	The Identification of Indiscernibles	50
2.5.	Models	52
2.6.	The Structure of Representations	55
	The Structure of Tokens	63
	Code Conversion: Adapting the Univac for Processing Russian	71
2.9.	Bibliographic Notes	83
Chapter	3. FLOW CHARTS AND AUTOMATIC CODING	84
3.1.	Flowcharts	84
3.2.	An Illustrative Flow Chart	90
3.3.	Program Modules and Relative Addressing	95
3.4.	Automatic Coding; The Description of Problems, Algorithms,	
	and Programs	98
3.5.	Bibliographic Notes	102
Chapter	4. THE PROBLEM OF TRANSLATION	104
	Translation	104
	Types of Translations	105
	The Translation of Natural Languages	110
4.4.		114
4.5.	Grammar and Interlingual Correspondence	118
4.6.		122
4.7.	Syntactic and Semantic Problems	122
4.8.	Bibliographic Notes	126
Chapter	5. Entry Keys for an Automatic Dictionary	127
5.1.	Inflection, Derivation, Homography, and Polysemanticism	127
5.2.	Paradigm and Reduced Paradigm	132
5.3.	Canonical Strings; Direct and Inverse Inflection	134
5.4.	A Definition of Russian Affixes and Canonical Stems	138
5.5.	An Inverse Inflection Algorithm for Russian	143
5.6.	Direct Inflection	151
Chapter (6. MORPHOLOGICAL AND FUNCTIONAL CLASSIFICATIONS OF RUSSIAN	154
<i>c</i> 1	WORDS	154
6.1.	A Morphological Classification of Russian Words	154
()	A Emptional Classification of Dussian W 1	163
6.2.	A Functional Classification of Russian Words	
6.3.	The Classification of Nominal Forms	163
6.3. 6.4.	The Classification of Nominal Forms The Classification of Adjectival Forms	163 169
6.3. 6.4. 6.5.	The Classification of Nominal Forms The Classification of Adjectival Forms The Classification of Verbal Forms	163 169 170
6.3. 6.4. 6.5. 6.6.	The Classification of Nominal Forms The Classification of Adjectival Forms The Classification of Verbal Forms Other Forms	163 169
6.3. 6.4. 6.5. 6.6.	The Classification of Nominal Forms The Classification of Adjectival Forms The Classification of Verbal Forms Other Forms endix	163 169 170 176
6.3. 6.4. 6.5. 6.6.	The Classification of Nominal Forms The Classification of Adjectival Forms The Classification of Verbal Forms Other Forms	163 169 170

	Synoptic Classification Table for Verbs	214
Chapter 7. DICTIONARY COMPILATION		
7.1.		216
7.2.	The Structure of Items	220
	The Structure of Files	224
7.4.	Word Selection	226
	The Morphological Classification of Words and their Transcription	234
	Detecting and Correcting Mistakes in Classification and	
	Transcription	236
7.7.	Direct and Inverse Inflection; Condensation	244
	English Correspondents and Grammatical Codes	248
	Mistake Detection and Correction; Assembly	257
	·	265
-	8. DICTIONARY OPERATION	265
8.1.		265
8.2.	1 · · · · · · · · · · · · · · · · · · ·	267
8.3.		271
8.4.	Word-by-Word Translations; Index-Dictionaries and Other	275
0.5	By-Products Level 1 to April 1 to 1 to 2 to 2 to 2 to 2 to 2 to 2 to	275
8.5.	Immediate Applications of Word-by-Word Translations Appendix	282
	Edited Trot	289
	Transcription of Edited Trot	300
	Conventional Translation	301
	Conventional Translation	301
Chapter 9. PROBLEMS IN DICTIONARY COMPILATION AND OPERATION		302
9.1.	Paradigm Homography	302
9.2.	Stem Homography	305
9.3.	The Definition of Affixes	307
9.4.	The Detection of Homographs; Missing Homographs	313
9.5.	Homograph Condensation	315
9.6.	"Short" Words	315
9.7.	Important Classes of Homographs	316
9.8.	The Existence of Strings	319
9.9.	The Structure of the Dictionary File	321
9.10.	Detecting and Correcting Mistakes in Dictionary Compilation	323
Chapter 1	10. From Automatic Dictionary to Automatic Translator	328
10.1.	The Interpretation of Affixes	328
10.1.	English Inflection and Derivation	337
10.2.	Paradigm Dictionaries	340
10.3.	The Analysis of Contexts	341
10.4.	Trial Translating	345
10.5.	Formula Finding	3 4 5
10.7.	Bibliographic Notes	350
	ndix. The Interpretation of Desinences in Nouns	352
. ippo	2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2	352
Bibliography		367
Index	Turdan	
HUCX		377