

# Contents

<b>1</b>	<b>Algorithm</b>	<b>8</b>
1.1	Problem analysis and specification . . . . .	9
1.2	Algorithm development . . . . .	9
1.3	Algorithm coding – writing an algorithm . . . . .	10
1.3.1	Algorithm described by natural language . . . . .	10
1.3.2	Algorithm described by structured language . . . . .	11
1.3.3	Algorithm described graphically . . . . .	11
1.3.4	Algorithm described by mathematical language . . . . .	11
1.3.5	Algorithm described by flowcharts . . . . .	12
1.3.6	Basic structures of an algorithm . . . . .	12
1.4	Programming languages . . . . .	13
<b>2</b>	<b>Numeral systems</b>	<b>16</b>
2.1	Numbers in different numeral systems . . . . .	16
2.2	Conversion between numeral systems . . . . .	17
2.2.1	Conversion to decimal numeral system . . . . .	17
2.2.2	Conversion from decimal numeral system . . . . .	18
2.2.3	Converting numbers between binary, octal and hexadecimal numeral systems	18
2.3	Binary negative numbers . . . . .	19
2.4	Binary arithmetic . . . . .	19
2.4.1	Addition . . . . .	19
2.4.2	Subtraction . . . . .	20
2.4.3	Bit shift . . . . .	20
<b>3</b>	<b>Data types and variables</b>	<b>21</b>
3.1	Data types and variables in Pascal . . . . .	22
3.2	Simple data types . . . . .	23
3.2.1	Integer data types . . . . .	23
3.2.2	Real number data types . . . . .	24
3.2.3	Type char . . . . .	24
3.2.4	Type boolean . . . . .	24
3.2.5	Enumerated data type . . . . .	24
3.2.6	Subrange data type . . . . .	25
3.3	Complex data types . . . . .	25
3.3.1	Type string . . . . .	25
3.3.2	Other complex data types . . . . .	25
3.4	Ordinal data types . . . . .	25
3.5	Type definition . . . . .	26

3.6	Variables . . . . .	27
3.6.1	Variables in Pascal . . . . .	27
3.6.2	Variables and data types . . . . .	28
3.7	Named Constants . . . . .	28
<b>4</b>	<b>Statements and expressions</b>	<b>30</b>
4.1	Expressions . . . . .	30
4.1.1	Operators . . . . .	30
4.2	Statements . . . . .	33
4.3	Simple statements . . . . .	34
4.3.1	Assignment statement . . . . .	34
4.3.2	Subroutine call . . . . .	34
4.3.3	Goto statement . . . . .	34
4.3.4	Empty statement . . . . .	35
4.4	Structured statements . . . . .	35
4.4.1	Compound statement . . . . .	35
4.4.2	Conditional statement . . . . .	35
4.4.3	Selective statement . . . . .	35
4.4.4	Repetitive statements . . . . .	36
4.4.5	Statement with . . . . .	37
4.5	Rewriting flowcharts into programming language . . . . .	37
<b>5</b>	<b>Structure of a program</b>	<b>39</b>
5.1	Parts of the program code in Pascal . . . . .	39
5.1.1	Basic symbols . . . . .	39
5.1.2	Identifiers . . . . .	39
5.1.3	Reserved words . . . . .	40
5.1.4	Comments . . . . .	40
5.2	Program blocks . . . . .	40
<b>6</b>	<b>Subroutines (subprograms)</b>	<b>42</b>
6.1	Parameters (arguments) . . . . .	44
6.1.1	Parameters declaration . . . . .	45
6.1.2	Formal and real parameters . . . . .	45
6.2	Procedures . . . . .	45
6.2.1	Procedure declaration . . . . .	45
6.3	Functions . . . . .	47
6.4	Local and global declarations . . . . .	48
<b>7</b>	<b>Files</b>	<b>49</b>
7.1	Working with files . . . . .	50
7.2	<i>Text files</i> . . . . .	51
7.3	Non-text files . . . . .	54
<b>8</b>	<b>Complex data types</b>	<b>55</b>
8.1	Arrays . . . . .	55
8.1.1	Array length . . . . .	56
8.1.2	Multidimensional arrays . . . . .	57
8.2	Sorting algorithms . . . . .	59

8.2.1	Selection sort . . . . .	59
8.2.2	Insertion sort . . . . .	60
8.2.3	Bubble sort . . . . .	60
8.2.4	Quick sort . . . . .	61
8.2.5	Comparison of sorting algorithms . . . . .	62
8.3	Data type record . . . . .	62
8.3.1	Statement with . . . . .	64
8.4	Sets . . . . .	65
8.4.1	Sets in Pascal . . . . .	65
<b>9</b>	<b>Algorithms related to functions and function values</b>	<b>68</b>
9.1	Tabulation of function values . . . . .	68
9.2	Computing function values based on function expansion into infinite series . . .	70
<b>10</b>	<b>Selected standard procedures and functions</b>	<b>72</b>
10.1	Converse functions . . . . .	72
10.2	Arithmetic functions . . . . .	73
10.3	Ordinal procedures and functions . . . . .	73
10.4	Procedures and functions for strings . . . . .	74
10.5	Other procedures and functions . . . . .	75
10.6	Input and output procedures and functions . . . . .	75
<b>11</b>	<b>Solved exercises</b>	<b>78</b>