
INDEX

The purpose of this index is to help you to search for information in this book. After each term mentioned in the index, there are page numbers that help you to locate the pages where the term is discussed. Each page number indicates a page on which the discussion of a term begins. In some cases, the discussion continues on the following pages.

The file names of the example programs (e.g. `first.cpp`, `sum.cpp`, `game.cpp`, etc.) are not mentioned in this index. To locate the example programs in this book, please use the alphabetical list on the introductory pages of this book.

Terms related to the imaginary computer (Chapter 4) are not widely listed in this index. Because the imaginary computer is a special subject that is discussed only in a single chapter, it should be possible to manage that information by using the table of contents.

Symbols

! NOT operator 130
 != not equal operator 119
 " double quote character 100, 177, 376, 575
 #define preprocessor directive 163
 #endif preprocessor directive 399, 420
 #ifndef preprocessor directive 399, 420
 #include <filename.h> vs. #include "filename.h" 376
 #include <iostream.h> vs. #include <iostream> 267
 #include <string> vs. #include <string.h> 500
 #include preprocessor directive 367
 % remainder operator 122, 243
 & address operator 194
 & bitwise AND operator 323, 411
 && logical AND operator 130
 (opening parenthesis 118
 () empty parentheses 104, 222, 229
) closing parenthesis 118
 * indirection operator 195, 377
 * multiplication operator 109
 */ terminates a comment 367
 *= multiply and assign operator 579
 + addition operator 109
 ++ increment operator 139
 += add and assign operator 242, 579
 - subtraction operator 109
 -- decrement operator 139
 -= subtract and assign operator 579
 -> arrow operator 284, 377, 492
 . dot operator 271, 353, 377
 ... means "some program lines" 12
 .bak, name extension for backup files 528
 .cfg, name extension for configuration files 21

.cpp, name extension for C++ files 10
 .exe, name extension for executable files 10
 .h, name extension for header files 114
 .obj, name extension for object files 10
 .txt, name extension for text files 308
 / division operator 109
 /* begins a comment 367
 // double slash, begins a comment line 17, 18, 71, 367
 : colon character 452, 456, 588
 :: scope operator 352, 488, 588
 ; semicolon 14, 18
 < less than operator 119
 < opening angle bracket 376, 441
 << left shift operator 323, 537
 << output operator 12, 101
 <= less than or equal operator 119
 <iostream.h> vs. <iostream> 267
 = basic assignment operator 109
 == equal operator 119
 > closing angle bracket 376, 441
 > greater than operator 119
 >= greater than or equal operator 119
 >> input operator 16, 584
 >> right shift operator 323, 535
 [opening (square) bracket 158
 [] empty brackets 588
 \ backslash character 177, 575
 \0 NULL character 575
 \a alert (BEL) character 575
 \b backspace character 177, 575
 \n newline character 100, 177, 575
 \r carriage return character 177, 309, 575
 \t tabulator character 177
] closing (square) bracket 158
 ^ exclusive OR operator 323
 _ underscore character 104
 { opening brace 12
 | bitwise OR operator 323
 || logical OR operator 130
 } closing brace 12
 ~ complement operator 323
 ~ tilde sign 357
 ` single quote character 125, 177, 575

Numerics

0x, prefix to form hexadecimal literals 113
 1.1.1970, beginning of time in C++ world 331
 10-finger typing system vii
 13th days that are Fridays 409
 24-hour time format 489

A

a.m./p.m. time format 489
 abbreviated names 17, 570, 573
 abstract classes 488, 490
 abstract member functions
 see "pure virtual functions"

- access functions 403, 410, 425
 - accessing files in C++ programs 519
 - Account_with_credit class 484
 - acres, unit of area 282
 - action statements 97, 98
 - actual arguments 228, 245
 - add and assign operator += 242, 579
 - add_new_collection_item() function 296
 - addition operator + 109
 - additive arithmetic operators 579
 - address operator & 194
 - addresses, numerical 49
 - advice for studying vii
 - age, calculation of 407
 - alert (BEL) character \a 575
 - algorithm for sorting numbers 238
 - allocation of dynamic memory 371
 - allocation of memory 250
 - American_time class 491
 - angle brackets <> 376, 441
 - Animal class 364
 - Apollo 11, landing on the moon 404
 - append() class string function 503, 506
 - appending text to file 521
 - application domain 556, 574
 - applications 9
 - Arabic numbers 30, 31
 - arguments 222
 - actual arguments 228, 245
 - arguments for function main() 256
 - formal arguments 228, 245
 - input arguments 237
 - output arguments 237
 - passing by address 223, 237, 295
 - passing by value 223
 - reference arguments 230, 294
 - arithmetic expressions 122, 578
 - in array references 159
 - arithmetic operators 109, 122, 258
 - Array_of_text_lines class 557
 - arrays
 - array as function argument 228, 295
 - array of pointers to objects 549
 - array overflow 163
 - arrays of integers 158–165
 - arrays of objects 377, 576
 - arrays of pointers to string 211
 - arrays of type char are strings 175
 - declaring arrays 158, 576
 - deleting arrays from the free store 374, 378
 - initialized array of objects 368, 429
 - initialized arrays 169
 - meaning of array name 200
 - multidimensional arrays 169, 474
 - pointers vs. arrays 206, 462
 - referring to array elements 159
 - sorting the elements of an array 242, 443
 - vector-based arrays 544, 549
 - Arrow Down key 28, 594
 - arrow operator -> 284, 377, 492
 - Arrow Up key 28, 594
 - ASCII codes 125, 142, 174, 309, 324
 - ASCII coding system 43
 - ascii_to_integer() function 586
 - asctime() function 335
 - assembly language 573
 - assembly languages are difficult 92
 - assign() class string function 506
 - assignment operator = 109
 - assignment statements 109, 578
 - assignment statements and l-values 578
 - associativity of operators 397
 - astronomical facts 286, 402
 - atoi(), ascii-to-integer conversion 259, 283, 586
 - attributes 387
 - automatic calls 456, 468
 - automatic data processing 269
 - automatically generated constructors 469
 - automatically generated operator=() functions 422, 423
 - auxiliary memory devices 5
- ## B
- Babbage, Charles 179
 - backslash character \ 177, 575
 - backspace character \b 177, 575
 - backup (.bak) files 528
 - backup copies of programs 598
 - balloons of text x
 - Bank_account class, better version 357
 - Bank_account class, simple version 352
 - base class 452
 - base-10 system, base-16 system, etc.
 - see "numbering systems"
 - basic types (built-in types) 274
 - basic_ostream standard class template 499
 - basic_string standard class template 500
 - bcc32.cfg configuration file 21
 - begin() function used with iterators 501, 505, 507, 545
 - BEL (alert) character \a 575
 - Better_date class 454
 - Bilingual_translation class 546
 - binary files 300, 301, 534
 - binary literals do not exist 322
 - binary numbering system 31
 - binary numbers 40
 - printing integers in binary form 328
 - binary-to-decimal conversion 34
 - birth and death of objects 356
 - birthdays, day of week 407
 - birthdays, planning celebrations 407
 - bit operators 323
 - bit, binary digit 38
 - bitwise AND operator & 323, 411, 535
 - bitwise OR operator | 323
 - blocks of statements 149, 251
 - body of function 235
 - Bonaparte, Napoleon 553

bool keyword 589
 bool type 102
 boolalpha, input/output manipulator 153
 Boole, George 118, 153
 boolean algebra 153
 boolean expressions 118, 124, 578
 boolean functions 293
 Borland C++ compiler 20
 compiling with 25
 downloading from Internet 20
 braces { }, rules for using 149
 break keyword 589
 break statements 131
 bug can mean any small insect 93, 340
 Bush, George W., and other U.S. presidents 433

C

C++ compilers, differences 98, 103
 C++ language standard 98, 103
 C-style strings
 comparing C-style strings 185, 186
 concatenating C-style strings 184
 copying C-style strings 184, 186
 declaring C-style strings 174
 length of string 185
 searching for substrings inside strings 190
 why C-style? 157
 c_str() class string function 507, 524, 586
 Caesar, Julius 215, 407, 500
 calculate_mean_value() function 237
 calendar reform 407
 call chart 291
 callee, a function that is called 220
 caller, a function that calls 220
 calling functions 218, 245
 calories, unit of energy 282
 capacities, storage capacities of variables 103
 capacity() class string function 507
 capitalization of words and names 570
 capitals of some countries 514
 Carnegie, Dale 568
 carriage return character `\r` 177, 309, 575
 case keyword 589
 case sensitivity 22
 catch keyword 589
 celebrations, planning 407
 centimeters, unit of distance 282
 .cfg files, Borland configuration files 21
 change_text(), class `Text_window` member function 478
 char keyword 589
 char type 102
 character literals 125, 575
 character_is_in_string() function 440
 chronological distance between dates 405, 417
 cin, standard input stream 16, 101, 498
 class keyword 589
 classes
 abstract classes 488, 490
 access functions 403, 410, 425
 automatically generated member functions 423
 base class 452
 class declarations 350, 351, 577, 587
 class hierarchy 472
 class scope 254
 class templates 445, 446
 classes vs. structures 361
 constant member functions 571
 constructor functions 356
 copy constructors 362
 default constructors 363
 default constructors, when needed 438
 designing classes 568
 destructor functions 356
 friend functions 400
 graphical class descriptions 425
 hierarchies of classes 469, 473, 483
 inheritance between classes 452
 initialization of data members 375
 inline member functions 370, 371
 member function calling member function 412
 member functions 370
 member functions inside class declaration 368
 naming of classes 570
 objects as data members 426
 private class members 461
 pure virtual member functions 490
 several constructors in a class 362
 subclasses and immediate subclasses 468
 superclass 452
 superclasses and immediate superclasses 468
 virtual member functions 482, 546
 clock signal 52
 close(), function to close files 312, 523, 528, 585
 clreol() function 339, 562
 clrscr() function 334, 339, 562
 Collection_item structure type 292
 colon character : 452, 456, 588
 Columbus, Christopher 404, 407
 command line
 command line arguments 256
 command line MS-DOS window 19
 directing screen output to file 467
 commands, MS-DOS operating system 19
 comments
 comments inside `/*` and `*/` 367
 double slash `//` comments 17, 71, 367
 text ignored by the compiler 17
 using comments in program testing 340
 compare() class string function 501, 507
 comparing C-style strings 185, 186
 comparing string objects 507, 515
 compilation errors, correcting 595
 compiler generated calls 456
 compiler generated operator=() functions 422, 423
 compiler, compilation (compiling) 8
 compiling C++ programs 25
 complement operator `~` 323
 complementing truth values 129

- compound interest 172
- computer system 9
- concatenating C-style strings 184
- concatenating string objects 502
- conio.h header file 334, 339, 562
- consoles 339
- const keyword 571, 589
- const_cast keyword 589
- constant member functions 571
- constants, see literals 113
- constants, textual constants 163, 575
- constructors 356, 362
 - automatic calling of superclass constructor 468
 - automatically generated copy constructors 423
 - constructors and inheritance 454, 456
 - copy constructors 362, 393
 - default constructors 363, 456, 469
 - implicit calling of constructors 456
 - initialization of data members of a class 375
- contents of this book xii
- continue keyword 589
- control structures 580, 581
- Control-C character 597
- conventions for writing function names 229
- conventions for writing hexadecimal numbers 37
- Conversion structure type 282
- conversions
 - ascii-to-integer with function atoi() 586
 - integer variables to ASCII strings 512
 - summary of some mechanisms 586
- conversions between units of measure 282
- convert_string_uppercase() function 327
- copy constructors 362, 393
 - automatically generated 423
- copying C-style strings 184, 186
- cout, standard output stream 12, 101, 415, 498
- .cpp files, C++ source program files 10
- .cpp files, naming of 593
- CR, carriage return character 309
- creator of C++ 498
- Current_date class 458, 516
- Current_time class 490
- cursor 337, 339, 346, 556, 557

D

- data processing 269
- Date class 410, 452
- date information, getting from operating system 331
- dates suitable for weddings and other events 518
- day(), class Date member function 410
- deallocation of dynamic memory 371
- deallocation of memory 250
- death of objects 356
- debugging, removing errors from programs 340
- dec, input/output manipulator 114, 115
- decimal numbering system 99
- decimal-to-binary conversion 35
- decisions, see "if constructs", "switch-case constructs"

- declarations
 - array declarations 158, 576
 - arrays of objects 576
 - C-style strings 576
 - class declarations 351, 577, 587
 - definitions vs. declarations 366
 - object declarations 355, 576
 - pointer declarations 195, 576
 - structure declarations 271, 577
 - variable declarations 98, 576
 - vs. executable statements 98
- declarators of functions 222, 238
- Decorated_text_window class 479
- decrement operator -- 139
- decrement(), class Date member function 416
- decryption of encrypted files 532
- default constructors 363, 456, 464
 - automatically generated 423, 469
 - called when constructing arrays of objects 438
- default keyword 589
- #define preprocessor directive 163
- definitions
 - typedef definitions 499, 577
- definitions vs. declarations 366
- degrees Celsius 170
- degrees Fahrenheit 170
- degrees, unit of angle 567
- delay_while_keys_not_pressed() function 336
- delays 336
- delete keyword 590
- delete operator 371, 373
- delete operator, deleting arrays vs. deleting objects 374
- deleting objects on the free store 549
- deposit_money() member function 353, 358
- designing classes 568
- designing programs 285
- destructors 356, 357
 - automatic calling of superclass destructor 468
 - destructors and inheritance 454
- digits 30
- dimensions, of arrays 169
- directing screen output to file 467
- display_simple_clock() function 337
- dividing by zero 258
- division operator / 109, 258
- do keyword 590
- do-while loops 146, 581
- dot operator . 271, 353, 377
- double keyword 590
- double quote character " 177, 376, 575
- double slash // begins a comment line 367
- double type 106
- downloading
 - .cfg and .cpp files 24
 - Borland C++ compiler 20
 - program editors 26
 - programs presented in this book 23
- dynamic memory 371
- dynamic memory allocation 380

dynamic objects 387
dynamic_cast keyword 590

E

e-mail 44
e.g. means "for example" 6
early binding 493
Earth, equatorial radius 106
Earth, length of equator 111
Edison, Thomas Alva 568
Edition class 557
Editor class 557
editor1.cpp, example of a large program 556
EditPad Lite editor 26
Einstein, Albert 455, 553
elements
 of structure-based table 279
 referring to array elements 158
else keyword 590
embed_text_in_window() member function 478
empty brackets [] 588
empty function 456
empty parentheses () 104, 222, 229
empty string 180, 529
empty.cpp 593
encapsulation of data 355, 461
encryption of files 532
end() function used with iterators 501, 505, 507, 545
endl input/output manipulator 115
endless loop 136
ends input/output manipulator 115
English_calendar class 462
enum keyword 590
eof(), end-of-file function 311, 522, 525, 526
equal operator == 119
equality of string objects 529
erase() class string function 503, 507
errors in programs
 correcting compilation errors 595
 typical logical errors 596
escape character, backslash \ 575
etc. means "et cetera", "and so on" ix
European_time class 491
evaluation of expressions 109, 159, 397
even numbers vs. odd numbers 171
Event class 550
example programs, downloading 23
example programs, list of xvi
exclusive OR operator ^ 323
.exe file, executable file 10
executable programs 8
executable statements (action statements) 98
execution speed of programs 334
exercises in this book, list of xix
exercises, practical advice for 593
explicit keyword 590
exponential notation 106
export keyword 590

expressions 578
 arithmetic expressions 122, 578
 boolean expressions 124, 578
 relational expressions 125
extended key codes 562
extern keyword 366, 577, 590
extern keyword, external data 254

F

factorial, mathematical term 229
fail() function 310, 522, 524
false keyword 590
feed(), class Animal member function 364
feet, unit of distance 282
file inclusion mechanism 367, 387
file name extension 5
file scope 254
file stream objects 520
files
 accessing files in C++ programs 519
 appending text to file 521
 close() function 312, 523, 528
 decryption of encrypted files 532
 encryption of files 532
 eof(), end-of-file function 311, 522, 525
 fail() function 310, 522, 524
 gcount() function 301, 306
 getline() function 313
 open() function 300, 301, 310, 520
 read() function 301, 306
 reading files in binary form 301, 535
 reading text from file 520
 storing objects in a binary file 538
 storing screen output to file 467
 summary of file handling in C++ 530, 585
 text files 308
 write() function 300, 305
 writing files in binary form 300, 537
 writing text to file 520
fill_with_character(), class Window member function 475
find() class string function 503, 508, 528
find_first_not_of() class string function 508, 517
find_first_of() class string function 508
find_last_not_of() class string function 509
find_last_of() class string function 509
find_smallest_number_in_array() function 241
find_smallest_number_in_array() function prototype 240
find_smallest_object_in_array() function template 442
finding errors in programs 595
Finland, date of independence 456
fixed, input/output manipulator 112
flip-flops 40
float keyword 590
float type 106
floating-point literals 113, 575
floating-point variables 106
floppy disk drive 5
flush input/output manipulator 115

- for keyword 590
- for loops 140, 581
- formal arguments 228, 245
- Fortran programming language 573
- Frame_window class 477
- free store memory 371, 372, 377, 381, 549
- Friday 13th dates 409
- friend functions 400
- friend keyword 590
- fstream standard class 498
- fstream.h standard header file 308, 524, 585
- function main()
 - arguments for function main() 256
 - operating system calls function main() 250
 - the return type of function main() 255
- function members 387
- function_aa() function 252
- function_bb() function 252
- function_xx() function 248
- function_yy() function 248
- function_zz() function 248
- functions
 - access functions 403, 410, 425
 - actual arguments 228, 245
 - an example of a call chart 291
 - arguments passed by address 223
 - arguments passed by value 223
 - array as function argument 228
 - body of function 235
 - boolean functions 293
 - calling a function 218, 245
 - conventions for writing function names 229
 - empty function 456
 - formal arguments 228, 245
 - function declarators 222, 238
 - function prototypes 238
 - function templates 441, 444
 - functions of type void 263
 - functions taking arguments 222
 - functions with return statements 231
 - general structure of C++ functions 235
 - general-purpose functions 428
 - input arguments 237
 - member function calling member function 412
 - member functions of classes 350, 370
 - output arguments 237
 - outputting data to caller 230
 - overloaded function names 260
 - pointers as function arguments 263
 - pure virtual functions 490
 - recursive function calls 263
 - reference arguments 230, 294
 - summary of C++ functions 582
 - typed functions 234
 - typeless void functions 234
 - virtual member functions 482

G

- g++, a C++ compiler in UNIX/Linux 22, 255
- gallons, units of capacity 282
- gcount() function 306, 535
- general-purpose functions 428
- Germany, date of reunification 456
- get() function 180, 310, 525, 584
- get_current_date() function 332
- get_current_time() function 332
- get_date_print_format() member function 410
- get_distance_to(), class Date member function 417
- get_week_number(), class Date member function 418
- get_year(), class Olympics member function 368
- getch() function 334, 339, 562, 584
- getche() function 339, 584
- getline() class string function 509, 513, 520, 522
 - reading from stringstream object 517
- getline() function 180, 293, 313, 522, 584
- GIF, Graphics Interchange Format 46
- gigabytes 195
- global data 251, 252, 292, 371
- global data can be harmful 254
- global variables 251, 292
- goto keyword 590
- gotoxy() function 334, 339, 562
- grams, unit of weight 282
- graphical class descriptions 425
- greater than operator > 119
- greater than or equal operator >= 119
- Gregorian Calendar 407, 413

H

- hard disk 5, 48
- hardware 4
- header files 114
- hectares, unit of area 282
- Hemingway, Ernest 292
- hex, input/output manipulator 114, 115, 196, 342
- hexadecimal integer literals 113, 145, 575
- hexadecimal keyboard input 586
- hexadecimal numbering system 31, 99
- hexadecimal numbers, conventions for writing 37
- hexadecimal-to-binary conversion 36, 326
- hexadecimal-to-decimal conversion 34
- hierarchies of classes 469, 472, 473, 483
- high-level programming languages 92
- High_class class 470
- hyphenation 104

I

- i.e. means "in other words" xi
- IBM Personal Computer 63
- ICOM, simulator for imaginary computer 78
- identifiers, see also "names" 104
- if constructs (statements) 118–127, 580
- if keyword 590

- if-else if-else constructs 124
 - ifstream standard class 301, 498, 520, 524, 530
 - ilink32.cfg configuration file 21
 - imaginary computer 52
 - imaginary processor 54
 - instruction decoding table 58
 - internal registers 54
 - machine instructions 57
 - simulator program called ICOM 78
 - state diagram of operation 65
 - vs. real computers 77
 - IML language 71
 - IML programming
 - address names 74
 - keywords STRING, DATA, CONSTANT 76
 - loop in a program 80
 - loop inside another loop 86
 - program that never terminates 93
 - reserving memory locations 76
 - stack and subroutine calls 84
 - subroutine is called 82
 - subroutine to read the keyboard 87
 - immediate access memory 5
 - immediate subclass 468
 - immediate superclass 468
 - implicit calling of constructors 456
 - inches, unit of distance 282
 - #include preprocessor directive 114
 - include guards 399, 420, 458, 577
 - included files 367, 376
 - increment operator ++ 139
 - increment(), class Date member function 415
 - incremental program development 598
 - incremental software development 598
 - indentation of statements 149
 - index variables 159, 475
 - index variables, naming of 168
 - index_for_day_of_week() member function 414
 - indexing 159
 - indexing, of C-style string 183
 - indirection operator * 195, 377
 - infinite (endless) loop 136
 - information processing 269
 - inheritance 452
 - automatic calling of superclass constructor 468
 - automatic calling of superclass destructor 468
 - constructors and inheritance 454, 456
 - destructors and inheritance 454
 - multiple inheritance 466
 - private class members 461
 - subclasses and immediate subclasses 468
 - superclasses and immediate superclasses 468
 - initialization
 - initialization of arrays 169
 - initialization of C-style strings 177
 - initialization of data members of a class 375
 - initialization of multidimensional arrays 173
 - initialization of string objects 500
 - initialization of structure-based tables 275
 - initialization of variables 137
 - initialized array of objects 429
 - initialize_account() member function 352
 - initialize_table_with_test_data() function 302
 - inline keyword 371, 590
 - inline member functions 370
 - input arguments 237
 - input operator >> 101, 584
 - input statements 113
 - input stream cin 14
 - input/output classes 498
 - input/output manipulators 115
 - inputting text from file 520
 - insert() class string function 502, 510
 - int keyword 590
 - int type 14, 15, 98
 - integer (integral) variables 98, 102
 - integer literals 109
 - integers, rounding of 122
 - integrated circuits 38
 - internal statements 135, 139, 235
 - international standard ISO 8601 414, 418
 - Internet Explorer browser 24
 - iomanip.h standard header file 110
 - ios standard class 498
 - ios::app standard constant 521, 531, 585
 - ios::binary standard constant 530, 531, 585
 - ios::noreplace standard constant 521
 - iostream standard class 498
 - iostream.h 12
 - iostream.h vs. iostream in file inclusion 267
 - is_last_day_of_month() member function 412
 - is_within_dates() member function 413
 - istream standard class 498
 - istringstream standard class 498
 - iterations, see "loops"
 - iterators 501, 545, 551
 - iterators used with string objects 505
- ## J
- Jagger, Mick 553
 - Jens' File Editor, JFE 26
 - joules, unit of energy 282
 - JPEG, the format of Joint Photographic Experts Group 46
 - Julian Calendar 407
 - Jupiter planet 286
- ## K
- kbhit() function 334, 339
 - Keller, Daniel 573
 - Kennedy, John Fitzgerald 438
 - keyboard input, function get() 180, 584
 - keyboard input, function getline() 180, 584
 - keyboard input, functions getch() and getche() 584
 - keyboard input, hexadecimal numbers 586
 - keyboard, extended key codes 562
 - keywords 104

keywords (reserved words), summary of 589
 kilobits 37
 kilograms, unit of weight 282
 kilometers, unit of distance 107, 282

L

l-values and assignments 578
 laptop computer 63
 late binding 493
 leap years 402, 413
 learning, discussion of 3
 least significant bit 36, 330
 least significant byte 99
 least significant digit 30
 left input/output manipulator 115
 left shift operator << 323, 537
 length of C-style string 185
 length() class string function 504, 507, 510, 528
 Lennon, John 553
 less than operator < 119
 less than or equal operator <= 119
 light, speed of 111
 lightyears, unit of distance 111, 282
 Line Feed (LF) character 309
 linking 10
 Linux operating system 4, 22, 309, 522, 556
 list, standard class template 542, 551
 lists, theoretical study 543
 literal constants 113
 literals 113

- binary literals do not exist 322
- character literals 125, 575
- floating-point literals 113, 575
- hexadecimal integer literals 113, 145, 575
- integer literals 109
- literals of type long 113, 575
- string literals 176, 575

 liters, unit of capacity 282
 load_collection_data_from_file() function 301
 local data 371
 local scope 254
 local variables 251
 localtime() function 331, 457
 locating errors in programs 595
 logical AND operator && 130
 logical errors in programs 596
 logical operators 129
 logical OR operator || 130
 long double type 106
 long keyword 590
 long type 102
 long type, literals 113, 575
 loops

- do-while loops 146, 581
- endless loop 136
- for loops 140, 581
- infinite (endless) loop 136
- loops that are never entered 136, 596
- while loops 135, 581

Low_class class 471
 lowercase letters 22, 324

M

machine instructions 57, 211, 247, 250
 Macintosh computers 4, 151
 Madonna 553
 magnetic disks 519
 main memory 5, 42, 48, 52

- physical memory addresses 194

 main storage 5
 main(), see "function main()"
 mainframe computers 63
 make_speak(), class Animal member function 364
 manipulators 115
 mantissa 106
 masks and bit operators 324, 411
 mean value, calculation of 146
 megabits 37
 megabytes 37, 42, 194
 member access operators 284
 member functions 350, 370, 412

- constant member functions 571
- inside class declaration 368
- static member functions 465
- virtual member functions 482

 member selection operators

- see "dot operator ." and "arrow operator ->"

 Member_class class 470
 memory

- allocation of dynamic memory 371
- allocation of memory 250
- array of integers in memory 162
- C-style string in memory 176
- deallocation of dynamic memory 371
- deallocation of memory 250
- detecting memory allocation problems 374
- int variable in memory 99
- objects in memory 354
- structure variables in memory 272
- structure-based table in memory 279

 memory addresses, numerical 49
 memory areas in main memory 211, 462
 memory cell 38, 42
 memory locations 49, 50
 memory occupied by variables 103
 menu-based program 303
 meters, unit of distance 111, 282
 methods 387
 Microsoft Visual C++ 6.0 compiler 255
 Microsoft Windows 4
 Microsoft Word 4
 Middle_class class 470
 miles, unit of distance 107
 minicomputers 63
 minutes, unit of angle 567
 minutes, unit of time 331

modulus operator %, see "remainder operator" 122
 Monroe, Marilyn 189, 553
 month(), class Date member function 410
 months, history of 215
 moon, Apollo 11 landing 404
 moon, distance from Earth 113
 Morse codes 544, 554
 most significant bit 328
 most significant digit 30
 move(), class Window member function 476
 move_objects() function template 441
 MPEG, Moving Pictures Experts Group 46
 MS-DOS operating system 4, 19, 522
 MS-DOS window 558
 MS-DOS window, opening and adjusting 19
 multidimensional arrays 169, 474
 multidimensional arrays, initialization of 173
 multiple inheritance 466
 multiplication operator * 109
 multiplicative arithmetic operators 579
 multiply and assign operator *= 579
 multiprint_character() function 226
 mutable keyword 590

N

nameless objects 429
 names, rules for writing a name 104
 namespace keyword 590
 namespace std 267
 namespaces 267
 naming

- .cpp files 593
- classes and other user-defined types 570
- function names 229
- index variables 168
- names of functions that are of type bool 412
- textual constants 570

 natural names 104, 105, 340, 570
 natural naming 573, 594
 Netscape browser 24
 new keyword 590
 new operator 371, 375, 383
 newline character \n 100, 177, 313, 575
 noboolalpha input/output manipulator 115
 noshowbase input/output manipulator 115
 noshowpoint input/output manipulator 115
 noshowpos input/output manipulator 115
 noskipws input/output manipulator 115
 not equal operator != 119
 NOT operator ! 130
 nouppercase input/output manipulator 115
 NULL character 174
 NULL character \0 575
 numbering systems 30

- binary numbers 31
- binary-to-decimal conversion 34
- comparison 32
- decimal numbers 99

decimal-to-binary conversion 35
 hexadecimal numbers 31, 99
 hexadecimal-to-binary conversion 36
 hexadecimal-to-decimal conversion 34
 octal numbers 31
 numbers, important in computing 33
 numbers, rounding of 122
 numerical constants, see literals 109, 113
 numerical memory addresses 49

O

.obj, object program file 10
 object programs 8, 25
 object-oriented design 556
 object-oriented programming, central ideas 355
 objects

- birth and death of objects 356
- deleting objects on the free store 549
- dynamic objects vs. static objects 387
- file stream objects 520
- initialization of objects 356
- nameless objects 429
- object declarations 355, 576
- object going out of scope 356
- objects in an array 368, 429, 438
- objects inside objects 426
- objects on the free store 377
- pointers to objects 493
- sizes of objects 355
- storing objects in a binary file 538

 oct input/output manipulator 115
 octal numbering system 31
 odd numbers vs. even numbers 171
 ofstream standard class 300, 498, 520, 530
 Olympic Games (summer) 276
 Olympic Games (winter) 368
 Olympics class 368
 Olympics structure type 276
 open(), function to open files 300, 310, 520
 operands 113, 390
 operating system, calling function main() 250
 operating system, the role of 6
 operating systems 4
 operator keyword 590
 operator!= member function 419
 operator+ member function 394
 operator< member function 419
 operator<< function 395, 420, 550
 operator= member function 395
 operator== member function 419
 operator> member function 419
 operator>> function 423
 operators

- addition operator + 109
- address operator & 194
- all used operators summarized 579
- arithmetic operators 109, 122, 258
- arrow operator -> 284, 377, 492

- assignment operator = 109
 - associativity of operators 397
 - bit operators 323
 - bitwise AND operator & 323, 535
 - bitwise OR operator | 323
 - complement operator ~ 323
 - decrement operator -- 139
 - delete operator 371, 373
 - division operator / 109
 - dot operator . 271, 353, 377
 - equal operator == 119
 - exclusive OR operator ^ 323
 - greater than operator > 119
 - greater than or equal operator >= 119
 - increment operator ++ 139
 - indirection operator * 195, 377
 - input operator >> 101, 584
 - left shift operator << 323, 537
 - less than operator < 119
 - less than or equal operator <= 119
 - logical AND operator && 130
 - logical operators 129
 - logical OR operator || 130
 - member access operators 284
 - modulus operator %, see "remainder operator" 122
 - multiplication operator * 109
 - new operator 371, 375, 383
 - not equal operator != 119
 - NOT operator ! 130
 - output operator << 101
 - precedence and associativity of operators 397
 - precedence of operators 129, 579
 - relational operators 119
 - remainder operator % 122
 - right shift operator >> 323, 535
 - scope operator :: 352, 488, 588
 - sizeof operator 280, 302, 355
 - subtraction operator - 109
 - unary operators 129, 390
 - operators overloaded for string objects 501
 - ostream class 415
 - ostream standard class 498
 - ostringstream standard class 498
 - ounces, unit of weight 282
 - output arguments 237
 - output manipulators 115
 - output operator << 101
 - output statements 12
 - output stream cout 14
 - outputting data to caller 230
 - outputting text to file 520
 - overflow of array 163
 - overloading
 - function overloading vs. virtual functions 483
 - overloading constructor functions 362
 - overloading function names 260
 - overloading operator != 419
 - overloading operator + 394, 397
 - overloading operator < 403, 419
 - overloading operator << 395, 401, 420
 - overloading operator = 395, 396, 398, 422, 423
 - overloading operator == 419
 - overloading operator > 419
 - overloading operator >> 423
 - use operator overloading sparingly 424
- P**
- palindromes 181
 - palmtop computer 63
 - paper copies of programs 598
 - parameters, see "arguments" 222
 - parentheses, meaning in expressions 109
 - Pascal programming language 244
 - PATH variable in Windows 21
 - Person structure type 273
 - physical memory addresses 194
 - Picasso, Pablo 292, 553
 - Place_on_earth class 566
 - Planet structure type 286
 - planets in the Solar System 286
 - pointers
 - accessing array elements with pointers 200
 - accessing C-style strings 207
 - arrays vs. pointers 206
 - declaration of pointers 195, 576
 - free store memory allocation 372
 - incrementing and decrementing pointers 201
 - pointer arithmetics 201, 288
 - pointer to pointer 462
 - pointer to type void 288, 341
 - pointers as function arguments 263
 - pointers to objects 493
 - pointers to structure-based objects 284
 - storing addresses to strings 211
 - polymorphism 496
 - pop() member function template 447
 - pop(), class Stack member function 384
 - Pope Gregory XIII 407
 - Position class 557
 - pounds, unit of weight 282
 - precedence of operators 129, 397, 579
 - precision, of floating-point variables 103
 - prefix 0x in hexadecimal literals 113
 - preprocessor directive #define 163
 - preprocessor directives 168
 - preprocessor directives #ifndef and #endif 399
 - President class 428, 538
 - President_info_application class 431, 538
 - presidents of the U.S.A. 431
 - presidents_in_file.cpp 538
 - print(), class American_time member function 491
 - print(), class English_calendar member function 463
 - print(), class European_time member function 491
 - print(), class Window member function 475
 - print_array() function (overloaded) 262
 - print_array_of_numbers() function 243
 - print_array_of_numbers() function prototype 240

- print_brief_president_info() member function 430
 - print_calculations() function 258
 - print_collection_table() function 295
 - print_data_of_collection_items() function 298
 - print_data_of_next_president() member function 436
 - print_data_of_one_collection_item() function 295
 - print_day_of_week() member function 415
 - print_full_president_data() member function 430
 - print_in_american_format() member function 455
 - print_in_binary_form() function 328
 - print_letters() function 221
 - print_list_of_all_presidents() member function 436
 - print_lowercase_letters() function 221
 - print_memory_contents() function 342
 - print_message() function 219
 - print_olympics_data() member function 368
 - print_person_data() function 273
 - print_sum() function 224
 - print_text_in_decorated_box() function 226
 - print_uppercase_letters() function 221
 - print_with_month_name() member function 454
 - printing programs on paper 598
 - private class members 461
 - private keyword 461, 591
 - processors 54
 - program control 220
 - program counter 246
 - program descriptions, structure of x
 - program development, incremental 598
 - program editor 9, 26
 - program listings 598
 - program not working, what to do 340, 596
 - program pointer register 246
 - program versions 598
 - programming exercises, list of xix
 - programming exercises, practical advice for 27, 593
 - programming languages 8
 - assembly languages 92
 - high-level languages 92
 - programming style
 - see also "natural naming"
 - indentation of statements 149
 - rules for using braces { } 149
 - while loops 593
 - programs
 - executable programs 8
 - list of programs in this book xvi
 - making backup copies 598
 - object programs 8, 25
 - printing on paper 598
 - source code 9
 - source programs 8
 - protected keyword 351, 461, 591
 - prototypes of functions 238
 - pseudo-code 285
 - public keyword 351, 461, 591
 - pure declarations 366
 - pure virtual functions 490
 - push() member function template 447
 - push(), class Stack member function 383
 - push_back() used with a list 551
 - push_back() used with vector-based array 544, 549
- Q**
- quotes, see "double quotes" or "single quotes"
- R**
- RAM, random access memory 5
 - read() function 306, 531
 - read_array_of_numbers() function 236, 241
 - read_array_of_numbers() function prototype 240
 - readability of programs 105
 - reading files in binary form 535
 - reading text from file 520
 - recursive function calls 263
 - reference arguments 230, 294
 - referring
 - referring to array elements 158
 - structure members 278
 - register keyword 591
 - registers, in imaginary processor 54
 - registers, in typical processor 246
 - reinterpret_cast keyword 591
 - relational expressions 125
 - relational operators 119
 - release of memory 371
 - remainder operator % 122, 243
 - remove_collection_item() function 297
 - repetitions, see "loops"
 - replace() class string function 503, 510, 528
 - replace_string_in_file() function 527
 - requirements of a software system 556, 568
 - reservation of memory 371
 - reserved words 104
 - reserved words (keywords), summary of 589
 - Restricted_account class 485
 - return keyword 591
 - return statement, in function main() 234
 - return statements 231
 - reuse of functions 235, 241
 - rfind() class string function 503, 511
 - right shift operator >> 323, 535
 - right, input/output manipulator 115, 420
 - Roman numbers 31
 - Roosevelt, F.D., and other U.S. presidents 433
 - root directory 5
 - rounding of numbers 122
 - run(), class President_info_application member function 437
- S**
- Schwarzenegger, Arnold 553
 - scientific, input/output manipulator 112, 115
 - scope categories
 - class scope 254

- file scope 254
- local scope 254
- scope of variables 251, 581
- scope operator :: 352, 488, 588
- Screen class 557
- screen output, directing to file 467
- search_collection_item() function 294
- search_largest_integer() function 232, 233
- search_president_by_name() member function 434
- search_president_for_given_date() member function 435
- search_string_in_file() function 316
- searching for errors in programs 340, 596
- seconds, unit of angle 567
- seconds, unit of time 331
- selections, see "if constructs", "switch-case constructs"
- semicolon ; 14, 18
- sequential file access 523
- server computer 63
- setfill() input/output manipulator 342, 420, 491
- setprecision() input/output manipulator 112
- setw() input/output manipulator 112, 342, 420, 491
- shift operations, shifting bits 326
- short keyword 591
- short type 102
- show_account_data() member function 352, 358
- showbase input/output manipulator 115
- showpoint input/output manipulator 115
- showpos input/output manipulator 115
- signed keyword 591
- Simple_string class 392
- simulation 78
- single quote character ' 125, 177, 575
- size() class string function 507
- sizeof keyword 591
- sizeof operator 108, 180, 280, 302, 355
- sizes of variable types 103
- skipws input/output manipulator 115
- SmallTalk programming language 379
- software 4
- software design methods 574
- software development project 557
- software development, a learning process 569
- software development, a linguistic process 574
- software development, how to begin 568
- software development, incremental 598
- Solar System 286
- sort(), sorting a list of objects 552
- sort_to_ascending_order() function 242
- sort_to_ascending_order() function prototype 240
- sort_to_ascending_order() function template 443
- sorting algorithm 238
- sorting of arrays 242, 443
- source code 9
- source programs 8
- source programs, downloading 23
- Spanish_calendar class 464
- speed of light 111
- splice() function and lists 552
- stack
 - class Stack_template 446
 - stack implemented with software 380
 - stack memory used by C++ programs 371, 462
 - stack pointer register 245
 - the role of stack in function calls 245
- Stack class 382, 539
- stack_in_file.cpp 539
- stack_is_not_empty() member function 384
- stack_is_not_empty() member function template 448
- Stack_template class template 446
- standard C++ classes 445
- standard input stream cin 14, 498
- standard input/output classes 498
- standard output stream cout 14, 498
- state variables 277
- statements
 - assignment statements 109, 578
 - break statements 131
 - do-while loops 146, 581
 - for loops 140, 581
 - function calls 220
 - if constructs 118, 580
 - input statements 113
 - internal statements 135, 139, 235
 - output statements 12
 - return statements 231
 - switch-case constructs 131, 580
 - the role of semicolon ; 98
 - while loops 135, 581
- static keyword 255, 462, 465, 591
- static member functions 465
- static objects 387
- static variables 255
- static_cast keyword 591
- std namespace 267
- stdlib.h standard header file 259, 586
- store_collection_data_to_file() function 300
- store_stringstream_to_file() function 526
- strcat() string concatenation function 184, 390, 583
- strcmp(), function for comparing strings 185, 583
- strcpy() string copy function 184, 239, 390, 429, 583
- string end character, see "NULL"
- string literals 176, 575
- string objects 500
 - accessing individual characters of string 504
 - comparing string objects 507, 515
 - concatenating string objects 502
 - constructors of class string 504
 - declaring string objects 502, 504
 - equality of string objects 529
 - finding substrings in string objects 508
 - initialization of string objects 500
 - iterators used with string objects 505
 - operators overloaded for string objects 501
 - taking substrings from string objects 511
- string, standard class 500, 566
 - member functions of class string 506
- string.h standard header file 184, 239
- string::npos, "no such position" constant 506, 508, 517,

528
 strings, C-style 174–190, 390, 576
 accessing with pointers 207
 initialization of strings 177
 why C-style? 157
 strings, empty string 180, 529
 stringstream objects 586
 as function argument 526
 detecting end of stream 526
 reading from stringstream object 515, 517
 writing to stringstream object 514
 stringstream standard class 498, 512, 514
 strlen() string length function 185, 583
 strncmp(), another comparison function 186, 583
 strncpy() another string copy function 186, 583
 strong typing 244
 Stroustrup, Bjarne 327, 498
 strstr() function 186, 190, 281, 316, 438, 583
 struct keyword 270, 591
 structure declarations 271, 274, 577
 structure members 271
 structure variables 271, 272
 structure-based tables 278
 structure-based tables, initialization of 275
 structures vs. classes 361
 subclasses 468
 subscripting, see "indexing"
 substr() class string function 511
 substrings in string objects 508
 subtract and assign operator -= 579
 subtraction operator - 109
 Sun, radius of 571
 superclass 452, 464
 supercomputers 63
 superstitious friends, how to help them 402
 swap() class string function 511
 switch keyword 591
 switch-case constructs 131, 580
 symbols, see also "names" 104
 systems 9

T

tab, see "tabulator character"
 table of contents xii
 tabulator character `\t` 177
 tabulator character, avoiding 105
 Task Manager in Windows 597
 Technical Research Centre of Finland, VTT 573
 template keyword 441, 591
 templates of classes 445, 446
 templates of functions 441, 444
 temporary output statements 597
 terminals 339
 text balloons x
 Text class 566
 text files 308
 Text_line class 557
 Text_window class 478

textual constants 163, 336, 571, 575, 577
 textual constants, general purpose 367
 textual constants, naming of 570
 this keyword 591
 this pointer 394, 398, 413, 455, 538
 this_is_a_leap_year() member function 413
 throw keyword 591
 TIFF, Tagged Image File Format 46
 tilde sign ~ 357
 time information, getting from operating system 331
 time measurement 492
 time printing formats 489
 time() function 331, 457, 490
 time.h standard header file 331
 time_t type 331, 490
 Titanic, sinking of 459
 tm_hour standard structure member 332
 tm_mday standard structure member 332, 458
 tm_min standard structure member 332
 tm_mon standard structure member 332, 458
 tm_sec standard structure member 332
 tm_wday standard structure member 332
 tm_year standard structure member 332, 458
 Torvalds, Linus 209
 transfer_money_to() member function 359
 transistors 38
 translate(), example of a virtual function 549
 travel.cpp 564
 Travel_application class 566
 travel_database.cpp 564
 Travel_database_application class 566
 Trilingual_translation class 548
 true keyword 591
 truth values 118, 153
 try keyword 591
 Turing machine 63
 Turing, Alan 183, 273
 .txt, name extension for text files 308
 typecasting 146, 213, 586, 589
 typed functions 234
 typedef definitions 499, 577
 typedef keyword 331, 591
 typeid keyword 591
 typeless void functions 234
 typename keyword 591
 typing with 10 fingers vii

U

UML, Unified Modeling Language 425
 describing inheritance between classes 460
 examples of class diagrams 460, 469, 473, 483
 has-a relationship between classes 559
 unary operators 129, 390
 undefined symbols 595
 Unicode character coding 44, 562
 union keyword 591
 units of measure 282
 UNIX operating system 4, 22, 309, 522, 556

unsigned integer variables 532
 unsigned keyword 102, 341, 591
 uppercase letters 22, 324
 uppercase, input/output manipulator 342
 useful_constants.h 367
 useful_functions.h 586
 user_confirms() function 293
 using keyword 267, 591

V

variable definitions 98
 variables
 argument variables 225
 bool type 102
 char type 102
 double type 106
 float type 106
 floating-point variables 106
 global variables 251
 initialization of variables 137
 int type 98
 local variables 251
 long double type 106
 long type 102
 short type 102
 static variables 255
 table of all types 103
 variable declarations 98, 576
 vector standard class template 540, 566
 vector-based arrays 544, 549
 versions of programs 598
 virtual function table 493
 virtual functions and polymorphism 496
 virtual functions vs. function overloading 483
 virtual keyword 490, 592
 virtual member functions 482, 490, 546
 void functions 263
 void keyword 592
 void type 341
 volatile keyword 592
 vs. means "versus" or "against" 244
 VTT, Technical Research Centre of Finland 573

W

warnings given by compiler 595
 was_president_on() member function 430
 Washington, George, and other U.S. presidents 431
 wchar_t keyword 592
 weak typing 244
 wedding dates (easy to remember) 518
 week numbers 418
 while keyword 592
 while loops 135, 581
 programming style 593
 white space 115, 501, 584
 whole numbers (integers) 14
 Window class 474

Windows 2000 21
 Windows NT 21
 Windows operating system 4
 Windows XP 21
 windows, character-based 472
 Windows/MS-DOS operating system 309, 522
 winter olympics 289
 withdraw_money() member function 359
 withdraw_money() redefined member function 484, 485
 workstation 63
 World Calendar 407
 write() function 532, 537
 write_new_collection_item_to_table() function 296
 writing files in binary form 537
 writing text to file 520

Y

yards, unit of distance 111, 282
 year(), class Date member function 410
 year, definition of 402

Z

.zip files, unzipping (extracting files) 23
 Zuse, Konrad 273