

# INDEX

## Special Characters & Numbers

#define statements, 257  
#hint text# element, 338  
#ifdef block, 258  
#ifdef/#else block, 258  
\$ idc\_array, 301, 331  
\$ prefix, 297  
*SHOME/.idapro/ida.key*, 192  
*SHOME/.idapro/ida.reg* file, 44, 207  
\* (asterisk key), 144  
: (colon) hotkey, 107  
; (semicolon) hotkey, 107  
{ } (bracing) syntax, 254  
>> (right-shift operator), 253, 458  
1 byte of storage (db), 97  
2 bytes of storage (dw), 97  
4 bytes of storage (dd), 97  
8-byte doubles, 136  
32-bit version, vs. 64-bit version, 38  
64-bit version, vs. 32-bit version, 38

## A

A hotkey, 122  
-A option, 197  
-a option, 218  
A suffix, ASCII strings, 447  
-a switch, 71  
Abort command, 205  
absolute jumps, 436–437  
accept\_file function, 359, 362,  
    365, 367  
ACCEPT\_FIRST flag, 359  
accept\_simpleton\_file function,  
    362, 367

accept\_simpleton\_loader function, 362  
access specifiers, IDC, 256  
Actions box, Breakpoint Settings  
    dialog, 526  
activation records, 65, 83  
ActiveSync, 517  
Add Breakpoint option, 463, 523  
Add standard structure button, Create  
    Structure/Union dialog,  
    143, 152  
Add Watch option, 529–530  
add\_auto\_stkpnt2 function, 392, 394  
add\_entry function, 364  
add\_segm functions, 308  
add\_segm\_ex function, 308  
add\_struct function, 307  
add\_struct\_member function, 307  
add\_til functions, 367  
add\_til2 function, 367  
AddBpt function, 531, 554  
AddBptEx function, 531  
AddEntryPoint function, 357  
AddHotkey function, 261  
Address box, Breakpoint Settings  
    dialog, 524  
Address field, Assemble Instruction  
    dialog, 240  
AddressOfEntryPoint field, 351  
ADDSEG\_XXX values, 308  
advanced mode toolbar, 53, 208  
aiSee, GDL viewer, 193  
AL register, 458  
algorithmic analysis, 416  
alias = register syntax, 105  
alignment, 352

All segments button, Memory snapshot confirmation dialog, 542  
*allins.hpp* file, 235, 303  
*allmake.mak* file, 289  
*allmake.unx* file, 289  
Allocate Heap Block option, Functions menu, 471  
Allocate Stack Block option, Functions menu, 471  
alphabetically sorting, in Functions window, 82  
ALT-B hotkey, 99  
alternate display format, selecting, 96  
ALT-F8 hotkey, 461  
ALT-H hotkey, 207  
ALT-K hotkey, 118  
ALT-L (Anchor) command, 243  
ALT-P hotkey, 230, 424  
ALT-Q hotkey, 147  
altset function, 300  
altnodes, 294–301  
ALT-x method, 191  
Amini, Pedram, 204  
ana function, 391  
*ana.cpp* file, 385  
*analysis.idc* script, 197  
analyzer, for processor modules, 385–390  
analyzing algorithms, 416  
    binary, for different platform, 455  
Anchor (ALT-L) command, 243  
android\_server server component, 570  
anterior and posterior lines, 108  
anti-debugging  
    hiding debugger, 555–560  
    technique, 452–454  
    and x86emu emulation-oriented de-obfuscation of binaries, 471–472  
anti-dynamic analysis techniques, 449–454  
    detecting debuggers, 452–453  
    detecting instrumentation, 451–452  
    detecting virtualization, 449–451  
    preventing debugging, 453–454  
antipiracy techniques, 32  
anti-reverse engineering techniques, 433–434  
anti-static analysis techniques, 434–449  
disassembly desynchronization, 434–437  
dynamically computed target addresses, 437–444  
imported function obfuscation, 444–448  
targeted attacks on analysis tools, 448–449  
Apache web server, 23  
API (Application Programming Interface), 289–314  
    header files, 290–294  
    iteration techniques using, 310–314  
    netnodes, 294–301  
        creating, 295–297  
        data storage in, 297–301  
        deleting, 301  
    SDK datatypes, 302–303  
    SDK functions, 304–309  
App TRK, 517  
Appcall feature, for Bochs, 578–580  
Appcall variable, 579  
Append Function Tail option, 115  
Application option, debugger process options dialog, 571  
Application Programming Interface.  
    See API  
Apply new signature option, Signatures window, 75  
AR\_LONG constant, 260  
AR\_STR constant, 260  
*ar2idt.exe* parser, 231  
architectures  
    of processor modules, 409–411  
    RISC-style, 387  
archive files, 155  
area control block, 310  
*area\_t* (*area.hpp*), datatypes for SDK, 291, 293, 302  
*areacb\_t* class, 310  
*areacb\_t* variables, 310  
*area.hpp*, 291, 310  
arg\_ prefix, 95  
argc, 422, 425  
argv, 422, 425  
arithmetic instructions, simple, 11  
ARM code, 410

armlinux\_server server component, 570  
array access operations, 135, 172  
array elements  
    accessing, 131  
    selecting size for, 125  
Array option, 125  
array tag parameter, 298  
Array-creation dialog, 124–125  
array-manipulation functions,  
    259–260  
arrays, 130–135  
    attributes for, 124–126  
    globally allocated arrays, 131–132  
    globally allocated structures, 137  
    heap-allocated arrays, 134–135  
    heap-allocated structures, 138–140  
    stack-allocated arrays, 132–134  
    stack-allocated structures, 138  
    structure member access, 135–137  
    of structures, 140–141  
arrows window, IDA text view, 65  
asc\_prefix, 123  
ASCII characters, 121, 447  
Ascii column, PDF Objects  
    window, 510  
ASCII dump, searching, 99  
ASCII printable characters, 27  
ASCII String Style option, Option  
    menu, 122  
ASCII strings, 447  
ash variable, 292, 399  
asize\_t get\_struct\_size function, 307  
AskFile function, 263, 265  
askfile\_c function, 305  
AskStr function, 263  
askstr function, 305  
AskUsingForm\_c dialogs, 340  
AskUsingForm\_c function, 305,  
    337–338, 341  
AskXXX functions, 263, 292  
askXXX interface functions, 334  
AskYN function, 263  
askyn\_c function, 305  
ASM files, generating, 242–243  
asm\_t struct, 380, 399, 402  
asms  
    data member, 402  
    field, 402  
ASPack program, 441  
ASProtect program, 441  
Assemble dialog, 239–241  
Assemble Instruction dialog, 240  
Assemble option, Patch Program  
    menu, 239  
assembler tool, 4  
assembly language call statement, 164  
assembly languages, 4  
Assume GCC v3.x names  
    checkbox, 163  
asterisk key (\*), 144  
asynchronous communications, 504  
asynchronous interaction, 536–537  
Asynchronous Sockets techniques,  
    Windows, 504  
AT&T assembly syntax, 9  
atoll function, 264  
Attach option, Debugger menu, 514,  
    518, 573  
Attach to Process option, Debugger  
    menu, 516, 574  
attributes  
    for arrays, 124–126  
    for functions, 115–118  
auto comments, 233  
Auto comments option, 110  
auto keyword, IDC, 252  
Autogenerated name option, for  
    named locations, 104  
autogenerated names  
    in Names window, 104  
    prefixes for, 73  
*auto.hpp*, for API, 291

## B

B (button) field, 339  
-B option, 197  
b parameter, 94, 160  
Bachaalany, Elias, 574  
backdoor-style communications  
    channels, 450  
backward navigation button, 83  
Bad instruction <BAD> marks option,  
    110–111  
bar function, 106  
base address, of array, 131  
BaseClass, 158–159  
basic blocks, 61–62, 176–177  
basic mode toolbar, 53, 208  
batch mode, 189, 196–198

BDS (Binary Diffing Suite), 485  
beginner mode, 206  
big-endian, CUP, 10  
*bin* directory  
    FLAIR tools, 217  
    for SDK, 287  
binaries  
    OS X Mach-O, 24  
    searches, 493  
    statically linked, 178  
    used in first-generation  
        languages, 4  
Binary Diffing Suite (BDS), 485  
binary executable files, 18, 434  
Binary File Descriptor library  
    (libbfd), 24  
Binary File entry, 45–46  
binary file obfuscation, 19  
binary files, 347–375  
    alternative loaders, 372–373  
    analysis of unknown files, 348–349  
    loader for, 47–48  
    loader modules for  
        overview, 358  
        pcap loader, 366–372  
        simpleton loader, 361–366  
        writing using SDK, 358–360  
    manually loading Windows PE file,  
        349–357  
    scripted loaders, 373–375  
binary form, plug-ins, 500  
Binary Search dialog, 99  
binary searches, of database, 99–100  
BINARY\_ADD byte code instruction, 379  
BinDiff, 485  
BinNavi, 280  
binutils tool suite, GNU, 24  
block statement, 160  
blocking operation, 286  
blocks, in disassembly window, 64  
Bochs, 574–580  
    Appcall feature for, 578–580  
    disk image mode for, 577  
    IDB mode for, 575–576  
    PE mode for, 576–577  
Bochs configuration dialog, 575  
Bochs control module, 576  
*bochsrc* file, 577

Borland  
    code, 419  
    tools, 404  
Borland’s Turbo Assembler  
    (TASM), 9  
Borland-style make files, 289  
BOUNDS problem, Problems  
    Window, 77  
BP based frame attribute,  
    117–118, 424  
BP equals to SP attribute, 118  
bpt\_NtContinue function, 567–568  
bracing ({ }) syntax, 254  
branches, 171  
Break checkbox, Breakpoint Settings  
    dialog, 526  
break statement, 279  
Breakpoint List option, Debugger  
    menu, 523  
breakpoint manipulation tools, 519  
Breakpoint Settings dialog, 523–526  
breakpoints, in debugger, 522–526  
bss section, 68, 356  
B-tree-style database, 49  
buffer array, 94  
Bug Reports forum, Hex-Rays bulle-  
tin board, 58  
bugs, reporting, 58  
*BugScam* scripts, 481  
build scripts, 461  
*BUILDING.txt* file, 503  
bulletin boards, Hex-Rays, 58  
bundled graphing applications, 176  
Burneye ELF encryption tool, 442,  
    455–459, 465, 467  
button (B) field, 339  
bximage tool, 577  
byte code, 4, 379  
Byte function, 262  
byte\_patched notification message, 322  
*bytes.hpp* file, 291, 399

C

C enum, Enums window, 70  
C hotkey, 48, 120  
C notation, 130  
-c option, 197

c parameter, 94  
C\_HEADER\_PATH option, 203  
C\_PREDEFINED\_MACROS option, 203  
C++, 156–166  
    calling conventions, 88  
    inheritance relationships, 164–165  
    name mangling in, 162–163  
    object life cycle in, 160–161  
    reverse engineering references, 165–166  
    RTTI, 163–164  
    this pointer in, 156–157  
    virtual functions and vtables, 157–160  
c++filt utility, 25–26  
calculator program, Windows, 25  
call esi instruction, 492  
call flow type, 62, 171  
call graphs, 178–180  
call instructions, 112, 272, 456, 467, 480  
Call Stack dialog, 529  
call statement, 437  
call\_vfunc function, 159  
call-by-reference, 255  
call-by-value, 255  
callflow function, 171  
calling conventions  
    compiler differences for, 430–432  
    for stack frames, 85–89  
call-style cross-references, 171  
callui function, 305  
canned search features, 98  
canonical feature (CF), 381  
Capture the Flag  
    binary, DEFCON, 278  
    network, DEFCON, 496  
Case-sensitive option, 99–100  
case-sensitive searches, 100, 493  
catalog, of named constants, 112–113  
cdecl calling convention, 85–86, 129  
cdecl functions, 116  
    \_cdecl modifier, 85  
CF (canonical feature), 381  
CF\_CALL flag, 381  
CF\_CHGn flag, 381  
CF\_STOP flag, 381  
CF\_USEn flag, 381  
  
cfg directory, 39  
Change Byte menu option, Patch Program, 238  
Change Color button, color selection dialog, 208  
Change exception definition, Exception Handling dialog, 564  
Change segment attributes dialog, 543  
Change Stack Pointer option, 118  
Character terminated strings, 122  
Characteristics field, 357  
charset function, 300  
charval function, 297, 300  
charval interface, 300  
CheckBptfunction, 531–532  
choose function, 305, 334  
Choose project to attach to dialog, 515  
choose2 dialog, 337  
choose2 function, 305, 334, 336, 566  
chooser dialog, 335  
chunked functions, 114–115, 272  
CL register, 431  
Clampi trojan, 442  
class constructor, 160  
.class file, 472  
Class Informer plug-in, 420, 506–508  
class relationships, deducing between, 165  
click-and-drag operation, 119  
C-like pseudocode, 500  
closing, IDA database files, 51–52  
cmd variable, 385, 394  
cmd.Operands array, 387, 390  
cnbits field, 385  
code  
    converting to data, 119–120  
    display options for, 109–111  
code argument, 339  
code bytes, distinguishing from data bytes, 48  
CODE class, 308  
code cross-references, 65, 168–169  
Code option, 435  
CODE XREF, 169  
coding scheme, used in Names window, 73  
COFF libraries, 219  
collabREate plug-in, 503–506

Collapse Group button, 187  
collapsed node demo, 187  
collapsed structures, 146, 153–154  
collapsing blocks, in disassembly window, 64  
Collect garbage option, 52  
collisions, 221, 223  
colon (:) hotkey, 107  
color key, 54  
color palettes, 192  
color selection dialog, 208  
coloring nodes, 186  
colorized disassembly listings, 245  
colors, customizing, 207–208  
Colors command, 54  
Columns menu option, Hex window, 67  
comma operator, 253  
COMMAND function, 536  
command history list, 40  
command-line  
    arguments, 22  
    tools  
        Borland, 418, 426  
        Exports window, 68  
        IDA, 251  
        Segments window, 74  
Comment directive, 232  
comment member, for plug-ins, 317  
*comment.cmt* file, 234–235  
CommentEx function, 270  
commenting  
    anterior and posterior lines, 108  
    augmenting information for, with loadint, 233–235  
    auto, 233  
    function comments, 108  
    overview, 106  
    regular comments, 107  
    repeatable comments, 107–108  
        virtual repeatable, 108  
comments option, 110  
common operations bar, console user interface, 190  
`compact_til` function, 369  
Compilation successful message, parsing header files, 150  
Compiler configuration dialog, Option menu, 151  
compiler differences, 415–432  
    alternative calling conventions, 430–432  
    debug vs. release binaries, 428–430  
    jump tables, 416–420  
    locating main, 421–428  
    RTTI implementations, 420  
    switch statements, 416–420  
compiler validation, reasons for disassembly, 7  
compilers  
    GNU, 86, 136  
    utilizing stack frames, 83  
compiling functions, 89  
computer licenses, 33  
concrete\_class object, 164  
Condition field, Breakpoint Settings dialog, 525  
conditional branching, 11, 171  
conditional breakpoints, 523  
conditional jumps, 436–437  
configuration dialog, Bochs, 575  
configuration files, 39  
configuring plug-ins, 330–331  
connect function, 69, 127  
console mode, 190–196  
    common features of, 190–191  
    specific features of  
        for Linux, 192–194  
        for OS X, 194–196  
        for Windows, 191  
consoles  
    I/O library, 190  
    limitations of, 190  
    mouse server, Linux, 192  
    user interface, 190  
constant index values, 137  
constants, formatting options for, 112  
CONTEXT record, 567  
CONTEXT structure, 440, 472, 568  
context-sensitive menus, 60, 102, 112, 501  
Continue button, toolbar buttons, 521  
Continue command, 521  
Continue with Unpacked Base option, 53  
control flow graphs, 169, 178, 185  
control module, Bochs, 576  
converting data, to code (and vice versa), 119–120

Cooper, Jeremy, 193, 195  
copyright notices, 218  
CPU flag, 437, 520  
CPU instructions  
    sets, 286  
    undocumented, 110  
CPU registers, 440  
`cpu_data` function, 394  
crashes, restarting after, 52–53  
CRC16 value, 220  
`crc16.cpp` file, 220  
Create as array option, 126  
Create C File option, File menu, 500  
Create EXE File command, 360, 365  
Create EXE File option, File  
    menu, 542  
create function, 296  
Create function tails loader option,  
    Kernel Options, 115  
Create name anyway option, for  
    named locations, 105  
Create Segment command, 353  
Create Structure/Union dialog,  
    143, 152  
Create union checkbox, Create  
    Structure/Union dialog, 143  
`CREATE_BACKUPS` option, 202  
`create_filename_cmt` function, 363  
`create_func_frame` function, 401  
`CreateArray` function, 260, 301  
`createImportLabel` function, 553–554  
`CreateNetnode` function, 332  
`CreateThread` function, 471  
`CRITICAL_SECTION` object, 121  
Cross References option, View  
    menu, 477  
cross-references (xrefs), 168–176  
    code cross-references, 169–171  
    data cross-references, 171–173  
    display window, 174  
    enumerating, using API, 311–314  
for function calls, 175–176  
graphs for, 180–185  
lists of, 173–175  
navigational purposes, 81  
subview, opening, 174  
text, mousing over, 173  
Cross-References tab, 172, 187  
cryptographic library, OpenSSL,  
    215–216, 229  
C-style strings, 71, 122  
C-style union, 143  
CTRL-B hotkey, 100  
CTRL-ENTER hotkey, 83  
CTRL-F1 hotkey, 203  
CTRL-F4 hotkey, 191  
CTRL-Q hotkey, 204  
CTRL-T hotkey, 99  
CTRL-X hotkey, 174  
current instruction location, 386  
current position indicator, 54  
custom cross-reference graphs, 183  
custom data  
    formats, 474  
    data types, 474  
`custom_ana` code, 408  
`custom_emu` code, 408  
`custom_mnem` code, 408  
`custom_out` code, 408  
`custom_outop` code, 408  
customizing, 201–210  
    colors, 207–208  
    configuration files, 201–207  
    toolbars, 208–210  
`cya` instruction, 408  
Cygwin environment, 17

## D

`D` command, 144  
`D` hotkey, 120, 122  
`d_out` function, 394, 398, 401  
dashed line break, 171  
data  
    converting to code, 119–120  
    specifying sizes for, 121–122  
data bytes, distinguishing from code  
    bytes, 48  
data carousel, 121–122  
`DATA` class, 308  
data cross-references, 168  
data displays, 55  
Data Format menu, Hex window, 67  
data storage, in netnodes, 297–301  
data structures. *See also* datatypes  
    arrays, 130–135  
    IDA structures, 142–146  
    importing new, 149–151  
    and TIL files, 154–156

data structures (*continued*)  
    using standard structures, 151–154  
    using structure templates, 146–149  
DATA XREF, 169  
database events, 321  
Database Restore dialog, 52–53  
data-flow analysis, 481  
DataRescue, 32  
datatype setup dialog, 121  
datatypes. *See also* data structures  
    custom, 474  
    Hex-Rays, 501  
    for SDK, 302–303  
    toggling through, 122  
db (1 byte of storage), 97  
`dbg_notification_t` enum, 536  
`dbg_step_until_ret` notification, 537  
`dbg_trace` notification, 537  
`dbg.hpp`, for API, 291  
dd (4 bytes of storage), 97  
dead listings, 79  
debug binaries, vs. release binaries,  
    428–430  
DEBUG flag, 330  
debug registers, 440  
debugger, 513–580  
    automating with plug-ins, 536–538  
    detecting, 452–453  
    displays, reasons for disassembly, 7  
    displays in, 518–521  
    handling exceptions with, 561–568  
    and IDA databases, 541–543  
    IdaStealth plug-in for, 560–561  
    instruction pointer warning, 549  
    launching, 514–518  
    preventing, 453–454  
    process control with, 521–530  
        breakpoints, 522–526  
        stack traces, 528–529  
        tracing, 526–528  
        watches, 529–530  
    process options dialog, 571–572  
    remote debugging with, 569–574  
        attaching to remote process,  
            573–574  
        exception handling during, 574  
        using Hex-Rays debugging  
            server, 570–573  
    using scripts and plug-ins  
        during, 574  
selection dialog, 515–516  
sessions, MyNav, 508  
setup dialog, 545–546, 562–563, 574  
scripting for, 530–535  
using Bochs, 574–580  
    Appcall feature for, 578–580  
    disk image mode for, 577  
    IDB mode for, 575–576  
    PE mode for, 576–577  
using with obfuscated code,  
    543–560  
decryption and decompression  
    loops, 546–550  
hiding debugger, 555–560  
import table reconstruction,  
    550–555  
launching process, 545–546  
    overview, 540–541  
warning message, 518  
Debugger menu  
    Attach option, 514, 518, 573  
    Attach to Process option, 516, 574  
    Breakpoint List option, 523  
    Debugger Options command, 562  
    Function Tracing option, 526  
    Instruction Tracing option, 526  
    Pause Process option, 516  
    Process Options command, 571  
    Refresh memory command, 579  
    Run option, 516  
    Run to Cursor option, 516  
    Select debugger option, 548  
    Stack Trace command, 528–529  
    Start Process option, 516, 518  
    Switch Debugger menu, 516  
    Take Memory Snapshot  
        command, 542  
    Terminate Process option, 517  
    Watch List option, 530  
DECISION problem, Problems  
    Window, 77  
declarations, in IDA text view, 65  
decoding function, Burneye,  
    456–459, 465  
decompiler editing options,  
    Hex-Rays, 501  
decompilers, 5  
dedicated frame pointer, 91  
.def files, 403

Default checkbox, Save Disassembly  
    Desktop dialog, 209

Default offset column, 136

`DEFAULT_FILE_FILTER` option, 206

DEFCON 18, Capture the Flag network, 496

Deflate (Pack database) option, 52

DelBpt function, 531

deltas, 392

Demangled Names, Options  
    menu, 162

Denial of Service attack, 168

de-obfuscation of binaries, static,  
    454–472

    script-oriented, 455–460

    x86emu emulation-oriented,  
        460–472

        and anti-debugging, 471–472

        de-obfuscation using, 465–470

        features of, 470–471

        initialization of, 462

        operation of, 463–465

de-obfuscation stub, 441–442, 446

destination buffer (`dest`), 273

destructor table, 492

destructors, 160–161

detecting  
    debuggers, 452–453

    instrumentation, 451–452

    virtualization, 449–451

DIF files, generating, 244

directory layout  
    overview, 38

    for SDK, 287–289

`sig` directory, 39

`til` directory, 40

Directory option, debugger process  
    options dialog, 572

disassembler analysis tool, 454

disassembly, 3–14  
    anti-static analysis techniques,  
        434–437

    first-generation languages, 4

    fourth-generation languages, 4

    how performed, 7–14  
        basic algorithm for, 8–9

        linear sweep disassembly, 9–10

        recursive descent disassembly,  
            11–14

    overview, 5

    reasons for, 6–7

    second-generation languages, 4

    theory of, 4

    third-generation languages, 4

disassembly line display options, 109

disassembly line parts, 109

disassembly location, jumping to, 82

Disassembly tab  
    color selection dialog, 208

    Options menu, 109

disassembly view  
    IDA desktop, 55

    synchronizing with hex view, 67

disassembly window, 60–65  
    IDA graph view in, 61–64

    IDA text view in, 64–65

disassembly window scroll bar, 82

disclosure, of vulnerability, 483

disclosure event, 483

discovery event, 483

disk image mode, for Bochs, 577

*diskio.hpp* file, 359, 362

dispatcher functions, 305

Display at startup checkbox, 44

Display Disassembly Line Parts section, Disassembly tab, 110

display format, selecting, 96

Display Graphs option, 487

Display indexes option, 126

Display only defined strings option,  
    Strings window, 71

display options, disassembly line, 109

`DISPLAY_COMMAND_LINE` option, 204,  
    206, 251

`DISPLAY_PATCH_SUBMENU` option, 204, 206

displays, 59–77  
    context-sensitive menu actions in, 60

    in debugger, 518–521

principal, 60–66  
    disassembly window, 60–65

    Functions window, 66

    Output window, 66

secondary, 66–70  
    Enums window, 70

    Exports window, 68

    Hex View window, 67–68

    Imports window, 68–69

    Structures window, 69

displays (*continued*)  
tertiary, 70–77  
    Function Calls window, 76  
    Names window, 72–74  
    Problems window, 76–77  
    Segments window, 74  
    Signatures window, 74–75  
    Strings window, 70–72  
    Type Libraries window, 75  
and undo, 59  
DisplayWelcome value, 44  
diStorm utility, 28  
divide-by-zero error, 440  
DLL (Dynamic Link Library), 462  
*dll2idt.exe* parser, 231  
dnbits field, 385  
Dfirst function, 268  
DfirstB function, 268  
Dnext function, 268  
DnextB function, 268  
Do not display this dialog box again option, 207  
Does not return attribute, 117  
Don't pack database option, 51  
DON'T SAVE database option, 52  
*dos.ldw* (MS-DOS EXE loader), 45  
doStruct function, 369  
DOT language, 176  
dotty tool, 176  
double word. *See* 4 bytes of storage (dd)  
double-click navigation, 80–81, 185  
double-clicking  
    cross-reference address, 173  
    in Function Calls Window, 76  
    function chunks, 115  
    hexadecimal values, 81  
    listed scripts, 250  
    in Names window, 72  
    in Output window, 81  
    in Segments window, 74  
    strings, in Strings windows, 70  
    structure names, 146  
    symbol names, 175  
download page, Hex-Rays, 499  
DR0–3 registers, 523  
DR0–7 registers, 523  
dt\_xxx values, 388  
dummy names, 102, 104, 128, 214  
Dump Embedded PE option, File menu, 471  
Dump option, File menu, 470  
Dump Typeinfo to IDC File command, 155  
dumpbin utility, 25  
dup2 function, 498  
dw (2 bytes of storage), 97  
Dword function, 262, 269, 456  
dynamic analysis, of malware, 6  
Dynamic Link Library (DLL), 462  
dynamic linking, 22  
dynamic memory allocation function, 134  
dynamic\_cast operator, 163  
dynamically computed target addresses, anti-static analysis techniques, 437–444

## E

-e command-line argument, 28  
e\_lfanew field, 350  
EAX register, 89, 94, 436, 439, 559–560  
EBP (extended base pointer) register, 91, 439, 451  
*ebc.py*, 411  
ebx register, 552  
Edit Breakpoint option, 523  
Edit Exceptions button, Debugger Setup dialog, 562  
Edit menu, Plugins menu, 485, 508  
editing imported functions, 230  
EIP instruction pointer, 462  
Element width attribute, 126  
ELF binaries, 17  
ELF encryption tool, Burneye, 455–458  
ELF libraries, 219  
ELF-specific parsing, 24  
empty structure definition, 143  
emu function, 390–391  
*emu.cpp* file, 391  
Emulate menu, Switch Thread option, 471  
emulation, advantage of over debugging, 461  
emulators, 390–394. *See also* x86emu emulator, de-obfuscation of binaries using  
Enabled checkbox, Breakpoint Settings dialog, 524

EnableTracing function, 533  
enabling line prefixes, 63  
End address attribute, 116  
ENTRY symbol, 575  
*entry.hpp*, for API, 291  
Enumerate Heap option, View  
    menu, 471  
enumerated datatype, C enum, 70  
enumerating  
    cross-references, 311–314  
    functions, 310  
    single stack frame, 490  
    structure members, 311  
Enums window, 70  
envp array, 422  
epilogue, of functions, 85  
Erdelyi, Gergely, 250, 280  
error handling, in IDC language,  
    258–259  
error messages, 258  
error strings, 218  
Esc key, 60, 82  
ESI register, 457  
ESP-based stack frame, 90–92  
*etc* directory, for SDK, 288  
event notification, for plug-ins,  
    321–322  
exact matches binary searches, 493  
exception confirmation dialog,  
    564–565  
Exception Editing dialog, 563  
exception handlers, 438–440, 472, 565  
Exception Handling dialog, 564  
exceptions  
    handling during remote  
        debugging, 574  
    handling with debugger, 561–568  
Exceptions dialog, 562–563  
*exceptions.cfg* file, 563, 574  
EXE files, generating, 243–244  
exec\_request\_t function, 286  
execstack command, 38  
executable files  
    Exports window, 68  
    using strings on, 28  
executable statements, grouping, 83  
execute\_sync function, 286  
execution  
    of plug-ins, 322–324  
    of scripts, 250–251  
execution control commands, 522  
execution traces, 526  
*exe.sig* file, 421  
\_exit function, 422  
Expand Struct Type option, Edit  
    menu, 145  
expanding collapsed structures, 153  
exploit-development, 6, 488–495  
    finding useful virtual addresses,  
        494–495  
    locating instruction sequences,  
        492–494  
    stack frame breakdown, 488–492  
export entry, 231  
export ordinal number, 68  
Exports window, 68, 545  
expressions, in IDC language, 253  
*expr.hpp* file, 292, 331  
extended base pointer (EBP) register,  
    91, 439, 451  
extending IDC, with plug-ins,  
    331–333  
extern keyword, 252  
extern section, 477–478  
external (global) symbols, 20  
external mode graphs, 177  
external-style graph, 176  
extract\_address function, 401

## F

f argument, 129  
f\_LOADER type, 410  
F2 hotkey, 523  
F12 hotkey, 177  
fake interrupt descriptor table, 462  
Falliere, Nicolas, 453, 555–558  
far addresses, 169  
Far function attribute, 117  
Fast Library Acquisition for Identifi-  
cation and Recognition  
    (FLAIR), 216–217, 583  
Fast Library Identification and  
    Recognition Technology  
    (FLIRT) signatures. *See*  
        FLIRT signatures  
fastcall calling convention, 157  
fastcall convention for x86, 87–88  
fastcall modifier, 88  
fclose function, 265

feature field, 381  
FF\_XXX constants, 307  
fgetc function, 265  
field names, 135  
file classification, 16–20  
    file, 16–18  
    PE Tools, 18–19  
    PEiD, 19–20  
File column, FLIRT signature  
    selection, 214  
file command, 16  
File dialog, 45  
file extensions, 16  
file loading, 45–48  
File menu  
    Create C File option, 500  
    Create EXE File option, 542  
    Dump Embedded PE option, 471  
    Dump option, 470  
    Script File option, 554  
File offset value, 239  
File Open dialog, 44  
File Save dialog, 365  
FILE stream pointer, 365  
FILE type, 359  
file utility, 16–18, 218–219  
FILE\_EXTENSIONS option, 205–206  
file2base function, 364–365  
FileAlignment field, 352  
FileAlignment value, 352  
fileformatname parameter, 359,  
    362, 365  
filelength function, 265  
file-loading dialog, 358  
FilemonClass class, 452  
filename pattern, 205  
FILEREG\_PATCHABLE, 364  
Find all occurrences checkbox, Text  
    Search dialog, 99  
FindBinary function, 269, 493  
FindCode function, 269, 272  
FindData function, 269  
FindText function, 269  
FindWindow function, 452  
FindXXX functions, 269  
first\_from function, 313  
first\_to function, 313  
first-generation languages, 4  
fix\_proc utility, 404  
fixed-length instructions, 9  
f1\_CF-type cross-references, 273  
flag field, 385  
flags field, for plug-ins, 317  
flags field for loaders, 359  
FLAIR (Fast Library Acquisition for  
    Identification and Recognition  
    Technology), 216–217, 583  
*flair* directory, 216  
*flair57.zip* version, 216  
Flake, Halvar, 481  
flat memory model, 117  
FLIRT (Fast Library Identification  
    and Recognition Technology)  
    signatures, 211–225  
        applying, 212–216  
        creating signature files, 216–225  
            creating pattern files, 219–221  
            static libraries for, 217–219  
        overview, 212  
        startup signatures, 224–225  
flowcharts, 177–178  
flowchart-style graph, graph view, 55  
flows, 62  
Follow system keyboard layout option,  
    Preferences dialog, 196  
Follow TCP Stream command, 496  
-fomit-frame-pointer compiler  
    option, 91  
Font command, 57  
Font menu, 519  
foo function, 12  
foobar subroutine, 82  
footer function, 401  
fopen function, 265  
for loops, 254  
forking existing projects,  
    CollabREate, 505  
form argument, 338  
form parameter, 305  
form function, 264  
formal parameter names, 228  
format strings, 305, 492  
formatting  
    constants, options for, 112  
    global variables, as structures, 149  
    instruction operands, 112–113  
    stack-allocated structures, 148  
formcb\_t function, 339

forward navigation button, 83  
fourth-generation languages, 4  
*fprintf* function, 265, 490–492  
*fpro.h*, for API, 292  
*fputc* function, 265  
frame pointer, 84, 118  
Frame pointer delta attribute, 117  
*frame.hpp*, 292, 306  
*free\_til* function, 369  
FreeBSD application, 213, 224, 422, 498  
freeware versions, of IDA, 33  
from address, in cross-references, 168  
*frregs* field, 311  
*frsize* field, 311  
FS register, 439  
full-line comments, 108  
*func\_t* (*funcs.hpp*), datatypes for SDK, 302, 308, 310  
*FuncItems* generator, 283  
*funcs* control block, 310  
*funcs.hpp*, 292, 310  
function call  
    graphs, 76, 169, 178  
    instructions, 12  
    tree, 76  
Function Calls window, 76  
function comments, 108  
Function editing dialog, 116  
function parameters, 83, 85  
function tails, 115  
Function Tracing option, Debugger menu, 526  
functions, 113–119  
    attributes for, 115–118  
    augmenting information for, 228–233  
    calling, 84–85  
    chunks of, 114–115  
    compiling, 89  
    creating new, 114  
    deleting, 114  
    emulated by x86emu, 467  
    enumerating, using API, 310  
    in IDC language  
        code cross-reference, 267  
        data cross-reference, 268  
        database manipulation, 268–269  
        database search, 269–270  
dealing with functions, 266–267  
disassembly line  
    components, 270  
file input/output, 264–265  
manipulating database  
    names, 266  
reading and modifying data, 262–263  
string-manipulation, 264  
    for user interaction, 263–264  
oriented control flow graph, 185  
overloading, C++, 162  
overview of, 83  
for SDK, 304–309  
signatures for, 229  
stack pointer adjustments, 118–119  
tracing, 526  
types, setting, 129  
    **undefined**, 119  
Functions data display, 55  
Functions list generator, 282  
Functions menu, 471  
Functions window, 56, 60, 66, 82, 175, 443  
fuzzing technique, 6

## G

G hotkey, 82, 207  
g++ compiler, GNU, 86, 156  
g++ versions, 163  
Gaobot worm, 19  
Gas (GNU Assembler), 9  
gcc compiler, GNU, 86  
GCC tags, 219  
gdb(GNU Debugger), 454, 517  
GDB Configuration dialog, 572–573  
gdb sessions, 569  
gdb\_server, 569, 572–573  
gdbserver component, GNU Debugger, 517  
GDL (Graph Description Language), 176, 193  
*gdl.hpp*, for API, 292  
General dialog, 60, 123  
General Registers view, 519–520  
General Registers window, 520, 525  
general-purpose searches, 98  
Generate serial names option, 124

generating signatures, 39  
Get prefix, 262  
get\_byte function, 304  
get\_first\_cref\_from function, 309  
get\_first\_cref\_to function, 309  
get\_first\_dref\_from function, 309  
get\_first\_dref\_to function, 309  
get\_frame function, 306  
get\_frame\_retsize function, 401  
get\_func function, 306  
get\_func\_name function, 306  
get\_func\_qty function, 306  
get\_long function, 304  
get\_next\_func function, 306  
get\_many\_bytes function, 304  
get\_member function, 307  
get\_member\_by\_name function, 307  
get\_name function, 306  
get\_name\_ea function, 306  
get\_next\_area function, 310  
get\_next\_cref\_from function, 309  
get\_next\_cref\_to function, 309  
get\_next\_dref\_from function, 309  
get\_next\_dref\_to function, 309  
get\_original\_byte function, 304  
get\_original\_long function, 304  
get\_original\_word function, 304  
get\_original\_XXX functions, 304  
get\_reg\_val function, 538  
get\_screen\_ea function, 305  
get\_segm\_by\_name function, 307  
get\_segm\_name function, 308  
get\_struc function, 307  
get\_struc\_id function, 307  
get\_true\_segm\_name function, 308  
get\_word function, 304  
GetArrayElement function, 301  
GetBptAttr function, 531  
GetBptEA function, 531  
GetBptQty function, 531  
GetCommandLine function, 426–427  
GetCommandLineA function, 552  
GetDebuggerEvent function, 532–533,  
    538, 556  
GetDisasm function, 270  
GetEntryPointQty function, 275  
GetEnvironmentStrings function, 427  
GetEventXXX function, 533–535  
GetFrameLvarSize function, 490  
GetFrameRegsSize function, 490  
getFuncAddr function, 479  
GetFunctionAttr function, 266, 272  
GetFunctionFlags function, 277  
GetFunctionName function, 266  
GetInputFile function, 275  
getline function, 334  
getmainargs library function, 425  
GetMemberName function, 482  
GetMemberOffset function, 271  
GetMemberSize function, 482–483  
GetMnem function, 270  
GetModuleHandleA function, 444  
GetOpnd function, 270  
getn\_area function, 310  
getn\_func function, 306  
getnseg function, 308  
*getopcode.c* program, 493  
GetOperandValue function, 270  
GetOpType function, 270  
GetProcAddress function, 445–446, 448,  
    468–469, 550, 552, 554  
GetRegValue function, 525, 530  
getseg function, 307, 363  
GetStrucSize function, 271  
Gigapede, 541  
gl\_comm variable, 397  
global (external) symbols, 20  
global array, 534  
global offset table (GOT), 274, 492,  
    494–495  
global persistent arrays, 259  
global variables, formatting as  
    structures, 149  
globally allocated arrays, 131–132  
globally allocated structures, 137  
gnome-terminal, Gnome, 193  
GNU Assembler (Gas), 9  
GNU binutils tool suite, 24  
GNU compilers, 86, 136, 156  
GNU Debugger (gdb), 454, 517  
GNU linker, 404  
Go button, 45  
GOT (global offset table), 274, 492,  
    494–495  
got section, 477–478, 495  
goto statements, 502  
graph components, 168  
Graph Description Language (GDL),  
    176, 193  
graph mode, 185

graph node, 178  
Graph Overview data display, 55, 62, 185  
Graph tab, 60  
graph view, 55, 185–186  
graph viewer, qwingraph, 176  
graph view-style display, 55  
GRAPH\_FORMAT variable, 176  
GRAPH\_VISUALIZER option, 176, 193, 194, 202  
graph-based display mode, IDA freeware 5.0, 583  
graphing, 176–187  
    integrated graph view, 185–188  
    third-party graphing, 176–185  
        call graphs, 178–180  
        cross-reference graphs, 180–182  
        custom cross-reference graphs, 182–185  
        flowcharts, 177–178  
graphing applications, 176  
graphs  
    grouping nodes in, 187  
    used in Function Calls Window, 76  
graphviz project, 176  
grep-style search, 290  
Group Nodes option, 64, 187  
grouping  
    blocks, in disassembly window, 64  
    executable statements, 83  
    nodes, within graphs, 187  
GUI configuration file, 39  
GUI versions, of IDA, 197  
gunzip archive, 37

**H**

.h suffix, 290  
Hall of Shame, Hex-Rays website, 32  
handling exceptions  
    with debugger, 561–568  
    during remote debugging, 574  
Hardware Breakpoint checkbox,  
    Breakpoint Settings dialog, 524  
Hardware breakpoint mode radio buttons, Breakpoint Settings dialog, 524  
hardware breakpoints, 523, 524, 544, 546  
HAS\_CALL flags, 389  
HAS\_JABS flag, 389  
HAS\_JREL flag, 389  
hash function, 447  
hashset function, 300  
hashstr function, 300  
hashval function, 300  
hashval\_long function, 300  
hashvals, 297, 300  
hashXXX functions, 300  
head command, 212  
header fields, PE Tools, 19  
header files, for API, 290–294  
    *area.hpp*, 291  
    *auto.hpp*, 291  
    *bytes.hpp*, 291  
    *dbg.hpp*, 291  
    *entry.hpp*, 291  
    *expr.hpp*, 292  
    *fpro.h*, 292  
    *frame.hpp*, 292  
    *funcs.hpp*, 292  
    *gdl.hpp*, 292  
    *ida.hpp*, 292  
    *idp.hpp*, 292  
    *kernwin.hpp*, 292  
    *lines.hpp*, 292  
    *loader.hpp*, 292  
    *name.hpp*, 293  
    *netnode.hpp*, 293  
    *pro.h*, 293  
    *search.hpp*, 293  
    *segment.hpp*, 293  
    *struct.hpp*, 293  
    *typeinf.hpp*, 293  
    *ua.hpp*, 293  
    *xref.hpp*, 293–294  
header function, 401  
header structure, MS-DOS, 152  
.headers program segment, 462  
.headers section, 354  
.heap database segment, 462  
heap program, 134  
heap\_array variable, 135  
HeapAlloc function, 468  
heap-allocated arrays, 134–135  
heap-allocated structures, 138–140  
help files, 204  
help member, for plug-ins, 318

Help menu, IDA, 34  
HELPFILE option, 203  
hex dumps, 99, 191  
hex editor, 67  
hex searches, conducting, 100  
hex values, two-digit, 99  
Hex View window, 40, 67–68, 99, 519  
hexadecimal constant, 112  
hexadecimal values, 81  
Hex-Rays  
    blog, 579  
    bulletin boards, posting on, 58  
    debugging server, remote debugging using, 570–573  
    download page for, 499  
    plug-in, 500–502  
    stance on piracy, 32  
    support page and forums, 35  
hidden messages, restoring, 44  
Hide Casts option, 501  
Hide Group option, 187  
hide\_wait\_box function, 323  
*HideDebugger.idc* script, 560–561  
hiding debugger, 555–560  
History subkey, IDA Windows registry key, 45  
HKEY\_CURRENT\_USER\ Software\Hex-Rays\  
    IDA registry key, 44, 207  
HKEY\_CURRENT\_USER\Software\Hex-Rays\  
    IDAHidden Messages registry key, 207  
hook\_to\_notification\_point function, 321, 399, 536  
Hostname option, debugger process options dialog, 572  
hotkey field, 331  
hotkey reassignment, in  
    *idogui.cfg*, 204  
hotkeys, 40, 261  
.hpp suffix, 290  
HT\_DBG function, 537  
HT\_DBG notification type, 536  
HTI\_PAK1 constant, 368  
HTI\_XXX values, 368  
HTML document, 16  
HTML files, 204, 245  
HTTP response packet, 371  
hyperlinks, vs. names, 80  
HyperUnpackMe2, 472–473

|

icebp instruction, 564  
id field for processors, 385  
.id0 file, 49  
.id1 file, 49  
IDA command line, 251  
IDA comments, using semicolon prefix in, 107–108  
IDA  
    configuration file, 37  
    crashes, restarting after, 52–53  
    cross-references, 76  
    database, as virtual memory, 460–461  
    database files  
        closing, 51–52  
        creation of, 50–51  
        and debugger, 541–543  
        overview, 48–50  
        reopening, 52–53  
        searching, 98–100  
    desktop  
        behavior of during analysis, 56–57  
        overview, 53–56  
        tips and tricks for, 57  
directory, 36  
download page, 190  
executables, 36  
extensions, loaders directory, 39  
freeware 5.0, 581–583  
graph view, in disassembly window  
    creating additional disassembly windows, 64  
grouping and collapsing blocks in, 64  
overview, 61  
panning in, 62–63  
rearranging blocks in, 64  
IDA Palace, 36  
IDA Sync, Windows Asynchronous Sockets techniques used by, 504  
installer, 34  
loader, 50  
modules, plug-ins directory, 39  
notifications, CollabREate, 504  
parser, 150  
scripting, 256, 455

as software  
  licenses, 33  
  purchasing, 34  
  upgrading, 34  
  user interface of, 40  
  versions, 33  
stack-pointer analysis, 230  
Strings options, 123  
structures, 142–146  
  creating new, 142–143  
  editing structure members,  
    144–146  
  stack frames as, 146  
text view, in disassembly window,  
  64–65  
View-EIP disassembly window,  
  519–520  
View-ESP disassembly window, 520  
Windows registry key, 45  
workspace, 44  
*ida\_export* function, 294  
*IDA\_SDK\_VERSION* macro, 293  
*idaapi* module, 281, 579  
*idaapi.processor\_t* class, 411  
*ida.cfg* file, 39, 111, 176, 193, 202–203  
<*IDADIR*> install location, 36  
*idag64.exe*, 38  
IDA-generated variable names,  
  mapping, 96–97  
*idag.exe*, 36  
*idagui.cfg* configuration file, 39,  
  203–206, 238, 251  
*IDA.HLP* file, 338  
*ida.hpp* file, 290, 292  
*ida.idc* file, 261  
*ida.int* file, 233  
*idaidp.hpp* 380  
*idainfo* (*ida.hpp*), datatypes for  
  SDK, 303  
*idainfo* structure, 292  
*ida.int* comment file, 234  
*ida.key* file, 32  
*idamake.pl*, 324  
IdaPdf plug-in, 509–510  
IDA Python plug-in, 37, 503  
examples, 281–284  
  enumerating cross-  
    references, 283  
  enumerating exported  
    functions, 283–284  
enumerating functions, 282  
enumerating instructions,  
  282–283  
*idaq64.exe*, 38  
*idaq.exe*, 36  
*idasdk61.zip* file, 286  
IDAStealth configuration dialog, 561  
IdaStealth plug-in, for debugger,  
  560–561  
.idata section, 241  
*idatui.cfg* file, 39, 206–207  
*idauser.cfg* file, 203  
*idauserg.cfg* file, 206  
*idausert.cfg* file, 206  
*idautils* module, 281–282  
IDA-View window, 55, 60  
*idaw.exe*, 36  
ida-x86emu plug-in, 342, 461–462, 506  
.idb extension, 51  
.idb files, 229, 504  
IDB mode, for Bochs, 575–576  
IDB\_2\_PAT utility, 221  
*idb\_event::byte\_patched*, 321  
*idb\_event::cmt\_changed*, 321  
IDC command dialog, 255  
*idc* directory, 39  
IDC functions, SDK implementation,  
  586–608  
IDC language  
  error handling in, 258–259  
  examples, 270–280  
    emulating assembly language  
      behavior, 278–280  
    enumerating cross-references,  
      272–274  
    enumerating exported  
      functions, 275  
    enumerating functions, 270–271  
    enumerating instructions,  
      271–272  
    finding and labeling function  
      arguments, 275–277  
  expressions, 253  
  functions  
    code cross-reference, 267  
    data cross-reference, 268  
    database manipulation, 268–269  
    database search, 269–270  
    dealing with functions, 266–267  
    disassembly line components, 270

IDC language (*continued*)  
functions (*continued*)  
    file input/output, 264–265  
    manipulating database  
        names, 266  
    reading and modifying data,  
        262–263  
    string-manipulation, 264  
    for user interaction, 263–264  
objects, 256–257  
persistent data storage in, 259–260  
programs, 257–258  
SDK cross-reference for, 585–608  
statements, 254  
variables, 252–253  
*idc* module, 281  
IDC script, 455  
IDC slices, 253  
IDC statements, 553  
*idc\_create\_netnode* function, 332  
*idc\_func\_t* datatype, 331  
*idc\_value\_t* (*expr.hpp*), datatypes for  
    SDK, 302, 332  
IDC-based loader, 373  
*idc.idc* file, 257  
Identical Functions, PatchDiff2, 486  
Identifier search, 99  
*IDP\_INTERFACE\_VERSION* constant, 316  
*idp.def* file, 404  
*idp.hpp* file, 292, 400  
*ids* directory, 39  
IDS files  
    augmenting information for  
        functions, 230–233  
    IDA parlance, 39  
*ids* hierarchy, 231  
IDS utilities, 228–229  
*idsnames* file, 233  
*idsutils*, 229  
.idt file, 275  
.idt generator script, 283  
Ignore instructions/data definitions  
    option, Strings window, 71–72  
*IMAGE\_DOS\_HEADER* structure,  
    152–154, 350  
*IMAGE\_NT\_HEADERS* structure, 152–154,  
    350, 352  
*IMAGE\_SECTION\_HEADER* structure, 352  
*IMAGE\_SECTION\_HEADER* template, 352  
ImageBase field, 351  
Import REConstruction (ImpREC)  
    utility, 541  
import table, 68  
import\_node netnode, 294  
import\_type function, 369  
imported functions  
    editing, 230  
    obfuscation, anti-static analysis  
        techniques, 444–448  
Imports window, 68–69, 443–444  
ImpREC (Import REConstruction)  
    utility, 541  
in instruction, 451  
include (INC) files, generating, 243  
include directive, 151, 261  
include directory, 288  
include files, 151  
Include in names list option, for  
    named locations, 104  
include statement, 261  
indent parameter, 397  
INDENTATION option, 202  
index function, 222  
Index of IDC functions, 252, 261  
Indexes radio buttons, 126  
inf.mf flag, 400  
inheritance hierarchy,  
    determining, 164  
inheritance relationships, in C++,  
    164–165  
init member, for plug-ins, 317  
init method, 536  
init\_loader\_options function, 360, 363  
initialization, of plug-ins, 320–321  
inline constructors, 164  
inline functions, 164  
Input file option, debugger process  
    options dialog, 572  
Input File options, 47  
*ins.cpp* file, 381  
INSERT key, 143, 152, 155  
Insert option, 149  
*insn\_t* (*ua.hpp*), datatypes for SDK,  
    293, 303, 385  
*install\_make.txt* file, 289  
*install\_visual.txt* file, 326  
*install\_xxx.txt* files, 288, 324  
installation of 32-bit Python,  
    IDAPython, 503

installing, 36–40  
32-bit vs. 64-bit, 38  
directory layout, 38–40  
on Linux, 37–38  
on OS X, 37–38  
plug-ins, 329–330  
and SELinux, 38  
on Windows, 36–37  
instruction emulator, 380, 460–461  
instruction operands, formatting,  
112–113  
Instruction Pointer (IP), 527  
instruction sets, CPU, 286  
Instruction Tracing option, Debugger  
menu, 526  
Instructions constant, 383  
instrumentation, detecting, 451–452  
`int 3` instruction, 439, 523, 564  
`int get_segm_qty` function, 308  
`int set_segm_name` function, 308  
`int type`, 128  
integer index, 230  
Intel syntax, 9  
`intel_data` function, 398  
internal heap implementation, 468  
interpreter, for Python byte code, 379  
`invoke_callbacks` function, 400  
I/O functions, 292  
IP (Instruction Pointer), 527  
`iret` instruction, 435  
`is_far_jump` function, 401  
`is_sp_based` function, 401  
`is_switch` function, 401  
`iscode` member, 313  
`IsDebugged` field, PEB, 556  
`IsDebuggerPresent` function, 452,  
468, 556  
`isLoaded` function, 262, 263, 304  
Items on line attribute, 125  
iteration techniques, using API,  
310–314  
enumerating cross-references,  
311–314  
enumerating functions, 310  
enumerating structure  
members, 311  
`iTERM`, 194  
`itype` field, 386

**J**  
`j` suffix, 171  
`ja` instruction, 418  
Java byte code, 379  
Java Database Connectivity  
(JDBC), 505  
Java loader, 372  
Java virtual machine, 472  
JDBC (Java Database  
Connectivity), 505  
`jmp esi` instruction, 492  
`jmp esp` instruction, 492–493  
`jmp statement`, 10  
Jump command, 477  
jump flow type, 62, 171  
Jump function, 263, 264, 428  
jump tables, compiler differences for,  
416–420  
Jump to Address command, 477  
Jump to Address dialog, 82  
Jump To Cursor button, x86emu  
Emulator dialog, 464  
Jump to Next Position option, 83  
Jump to Previous Position  
operation, 82  
Jump to Problem command, 204  
`JumpQ` option, 204  
jump-style cross-references, 171  
`jumpto` function, 305  
junk strings, 71  
`jz` instruction, 436

**K**  
Kernel Options, 46, 115  
`kernel32_GetCommandLineA`, 552  
`kernel32_VirtualAlloc` function,  
578–579  
`kernel32.dll`, 446, 448, 520, 546,  
552, 559  
`kernwin.hpp`, for API, 292  
key file, safeguarding, 34  
keyboards  
different layouts, 194  
zoom control, 62  
Kiel OMF 166 object files, 219  
konsole, KDE's, 193  
Koret, Joxean, 508

## L

-L option, 23  
label component, 338  
launching, 44–48  
  debugger, 514–518  
  Go button, 45  
  New button, 44  
  Previous button, 45  
  process, 517  
  Windows installer, 36  
ldd (list dynamic dependencies)  
  utility, 22–23  
*ldr* directory, for SDK, 288  
LDRF\_RELOAD flag, 359  
LDSC (loader description) object, 359  
leave instruction, 93, 408  
legacy mode graphs, 193  
len function, 283  
letter codes, 21  
Levine, John R., 22  
*lib* directory, for SDK, 288  
libbfd (Binary File Descriptor  
  library), 24  
*libc\_FreeBSD80.exe* file, 222  
*libc\_FreeBSD80.pat* file, 220  
libc\_start\_main function, 423–424, 427  
libc.a version, 213  
Library func attribute, 117  
library handle, 468  
Library name column, FLIRT signa-  
  ture selection, 214  
license agreement dialog, 197  
license enforcement, 32  
licenses, for IDA, 33  
life cycle, of plug-ins, 318–319  
limitations  
  of consoles, 190  
  of IDA freeware 5.0, 582  
line prefixes, enabling, 63  
Line prefixes option, 110  
linear sweep disassembly, 9–10  
*lines.hpp* file, 292, 395  
link libraries, 343  
linking, 22  
*linput\_t* (loader input type), 359  
Linux  
  based IDA installation, 193  
  console mode for, 192–194  
  console mouse server for, 192  
installing on, 37–38  
terminal programs on, 192  
text display in, 192  
linux\_server server component, 570  
linux\_serverx64 server component, 570  
list dynamic dependencies (ldd)  
  utility, 22–23  
list\_callers function, 313  
listing view, 55  
listing-style display, 55  
Litchfield, David, 493  
little-endian, CUP, 10  
lnames data member, 402  
Load a New File dialog, 46  
Load Desktop command, 57  
Load desktop option, Windows  
  menu, 209  
Load from file radio button, x86emu  
  Set Memory Values dialog, 465  
Load type library option, in Type  
  Libraries window, 75  
load\_file function, 359, 372, 410  
load\_pcap\_file function, 369–370  
load\_simpleton\_file, 363  
loader description (LDSC) object, 359  
loader input type (*linput\_t*), 359  
loader modules, for binary files  
  overview, 358  
  pcap loader, 366–372  
  simpleton loader, 361–366  
  writing using SDK, 358–360  
Loader segment checkbox, Change  
  segment attributes dialog, 543  
Loader segments button, Memory  
  snapshot confirmation  
  dialog, 542  
loader warnings, 49  
LOADER\_EXT variable, 366  
loader\_failure function, 359  
loader\_t structure, 292, 358  
loader-generated informational  
  messages, 49  
*loader.hpp* file, 292, 316, 358  
loaders directory, 39, 45  
loadfile function, 265  
loading files, 45–47, 155  
Loading Offset field, 46  
loading process, 358  
Loading Segment field, 46  
loadint utilities, 233–235

*loadint57.zip* version, 233  
LoadLibrary function, 445–446, 550  
LoadLibraryA function, 447, 468  
Local Bochs debugger, 575  
local debugging, 517  
Local name option, for named locations, 104  
Local Types command, 149  
Local Types entry dialog, 150  
Local Types window, 149–150  
local variables  
    layout, in stack frames, 89  
    naming, 102–103  
Local variables area attribute, 116  
locations, renaming, 104  
LocByName function, 267, 274  
LocByNameEx function, 266  
lodsb instruction, 458  
Log if same IP option, Tracing Options dialog, 527  
logical addresses, 242  
loopne instruction, 10  
lowercase letter codes, 21  
LPH struct, 380, 385  
lpSubKey parameter, 229  
lread4bytes function, 362  
*LST* files, generating, 243  
ltoa function, 264

**M**

Mac keyboard, vs. PC keyboard, 194  
mac\_server server component, 570  
mac\_serverx64 server component, 570  
Machine field, 351  
machine languages, 4, 111  
Mach-O loader, 410  
MackT, 541  
MACRO keyword, 207  
macros, 206–207, 249  
magic files, 16  
magic numbers, 16  
main method, compiler differences for, 421–428  
Main toolbar, turning off, 208  
make files, plug-ins, 500  
Make imports section option, 244  
make\_data notification, 401  
MakeByte function, 269  
MakeCode function, 268  
makecode parameter, 364  
MakeComm function, 269  
MakeFunction function, 269  
MakeLine function, 395, 397  
MakeNameEx function, 266  
MakeStr function, 269  
MakeUnkn function, 268  
malicious PDF files, 509  
malloc function, 66, 134, 477  
malware analysis, reasons for disassembly, 6  
mangled names, 163  
manipulating disassembly, 101–126  
    arrays, attributes for, 124–126  
    code display options, 109–111  
    commenting, 106–108  
    converting data to code (and vice versa), 119–120  
    data transformations, 121–124  
    formatting instruction operands, 112–113  
    functions, 113–119  
    naming, 102–105  
Manual load option, for file headers, 152  
manually overriding purged bytes, 230  
*MAP* files, generating, 242  
mapping, IDA-generated variable names, 96–97  
Mark as autogenerated option, 124  
Mark consecutive traced events with same IP option, Tracing Options dialog, 527–528  
MASM (Microsoft Assembler), 9  
master list of structures, 152  
Matched Functions, PatchDiff2, 486–487  
MAX\_NAMES\_LENGTH option, 202  
Maximum possible size attribute, 125  
MAXSTR constant, 586  
MD5 value, CollabREate, 505  
mem2base function, 370  
member\_t (*struct.hpp*), datatypes for SDK, 303, 307  
members array, 311  
.memcpy, 274  
Memory Organization dialog, 48  
Memory snapshot confirmation dialog, 542  
memory usage parameters, 202

`memqty` field, 311  
`memset` operation, 430, 495  
menu bar, console user interface, 190  
Message function, 254, 263, 579  
MessageBoxA function, 444  
messages  
    loader-generated informational, 49  
    restoring hidden, 44  
Metasploit project, 493, 496  
Micallef, Steve, 35, 289  
Microsoft, Patch Tuesday cycle, 476  
Microsoft Assembler (MASM), 9  
Microsoft Developer Network  
    (MSDN), 25  
Microsoft linker, 404  
Microsoft Visual C++ compiler, 114  
Microsoft Visual Studio suite, 25  
Minimum offset column, 136  
MIPS binary, 278  
MIPS processor module, 240  
Misc tab, color selection dialog, 208  
mitigation, of vulnerability, 483  
mitigation event, 483  
`mkidp` syntax, 404  
`mkidp.exe` utility, 404  
mnemonics, 4  
modal dialogs, 174, 337  
modeless dialogs, 174, 337  
Modify menu item, 520  
`module` directory, for SDK, 288  
Modules view, 519  
Modules window, 520–521  
mouse support, 190  
`mov` instructions, 12, 92, 234  
`mov` statements, 275–276  
Move Current Segment  
    command, 354  
`move_segm` function, 360  
`movsb` instruction, 527  
MSDN (Microsoft Developer Network), 25  
MS-DOS 8.3 name-length convention, 221  
MS-DOS EXE loader (*dos.Idw*), 45  
MS-DOS executable file, 18  
MS-DOS header structure, 152  
MS-DOS stub, 403–405  
`msfpescan` tool, Metasploit project, 493  
`msg` function, 305  
mutual ptrace technique, 453  
`my_func` function, 255  
MyNav plug-in, 508–509  
`mynav.py` script, 508  
MZ magic number, 16, 152

## N

N hotkey, 102–103, 105  
-n option (`sigmake`), 224  
-n option (`loadint`), 234  
`nalt.hpp` file, 294  
`.nam` file, 49  
Name conflict dialog, 105  
name decoration, 162  
Name directive, 231  
Name generation area, 123  
name mangling, 26, 162–163  
Name of function attribute, 115  
Name function, 266  
name parameter, 308, 364  
name-change dialog, 102  
NameChars set, 202  
NameEx function, 266  
named constants, catalog of, 112–113  
named licenses, 33  
named locations, 103–105  
    Autogenerated name option, 104  
    Create name anyway option, 105  
    Include in names list option, 104  
    Local name option, 104  
    Public name option, 104  
    Weak name option, 105  
name-demangling options, 162  
`name.hpp`, 293  
name-length convention,  
    MS-DOS 8.3, 221  
names, vs. hyperlinks, 80  
Names window, 72–74, 102  
naming, 102–105  
    conventions, Hex-Rays, 501  
    import table entries, 552  
    parameters and local variables,  
        102–103  
    register names, 105  
NASM (Netwide Assembler), 9, 28  
navigating disassembly  
    double-click navigation, 80–81  
    jump to address, 82  
    navigation history, 82–83  
    searching database, 98–100

navigation band, 54, 443–444  
navigation history list, 185  
`ncol` parameter, 336  
`ndisasm` utility, 28  
`NEF_XXX` flags, 359  
`neflags` parameter, 359  
negative deltas, 392  
`netnode` class, 259, 293–295, 301  
`netnode` index value, 331  
`netnode.hpp` file, 293–295  
`netnodenumber` member, 294, 296  
`netnodes`, 294–301, 585  
    creating, 295–297  
    data storage in, 297–301  
    deleting, 301  
Netwide Assembler (NASM), 9, 28  
network attack sessions, 496  
network connection, X.25-style, 113  
New button, 44  
new operator, 159–160  
New Project dialog, Visual Studio,  
    326–327  
new vertices, introducing, 64  
Newger, Jan, 560  
Next Sequence of Bytes option,  
    Search menu, 100  
NextFunction function, 266  
`nm` utility, 20–21  
No edge arrow, 62  
no operation (NOP) instructions,  
    240, 494  
`NO_OBSOLETE_FUNCS` macro, 316  
`nodeidx_t` operator, 296  
nodes, 168, 187  
`noGPM` option, TVision, 192  
nonmodal dialog, 337  
nonstandard structures, 142  
NOP (no operation) instructions,  
    240, 494  
NOP slides, 494, 496–497  
Normal edge arrow, 62  
normal flow, 62  
notification event, 483  
notification of vulnerability, 483  
notify field, 399  
notify function, 400  
`NOVICE` option, 206  
`NtContinue` function, 567  
`ntdll_NtQueryInformationProcess`  
    function, 557

`ntdll.dll`, 546, 557–558, 567  
`NtGlobalFlags` field, PEB, 556–557  
`NtQueryInformationProcess`  
    function, 557–558  
`NtSetInformationThread` function, 558  
`NTSTATUS` code, 558  
NULL pointer, 299  
Number of elements attribute, 125  
Number of opcode bytes option, 111  
`NumberOfSections` field, 352

## O

`o_displ` type, 392  
`o_imm` type, 392  
`o_mem` type, 392  
`o_near` type, 392  
obfuscated code analysis, 433–474  
    anti-dynamic analysis techniques,  
        449–454  
    detecting debuggers, 452–453  
    detecting instrumentation,  
        451–452  
    detecting virtualization, 449–451  
    preventing debugging, 453–454  
anti-static analysis techniques,  
    434–449  
disassembly desynchronization,  
    434–437  
dynamically computed target  
    addresses, 437–444  
imported function obfuscation,  
    444–448  
targeted attacks on analysis  
    tools, 448–449  
static de-obfuscation of binaries,  
    454–472  
    script-oriented, 455–460  
    x86emu emulation-oriented,  
        460–472  
using debugger with, 543–560  
    decryption and decompression  
        loops, 546–550  
    hiding debugger, 555–560  
    import table reconstruction,  
        550–555  
    launching process, 545–546  
        overview, 540–541  
    virtual machine-based, 472–474  
obfuscation process, 19, 541

obfuscators, 540, 548  
objdump utility  
    debugging information, 24  
    disassembly listing, 24  
    private headers, 23  
    section headers, 23  
    symbol information, 24  
object class, 256  
object life cycle, in C++, 160–161  
objects, in IDC language, 256–257  
OEP (original entry point)  
    recognition, 540  
offset column, 90  
offset cross-reference, 172–173  
*OllyDbg*, 540  
*OllyDump*, 541  
OMF libraries, 219  
op\_t (*ua.hpp*), datatypes for SDK, 293,  
    303, 387  
opcode bytes, 202  
opcodes (operation codes), 4  
Open command, file loading, 45  
Open Register Window menu  
    item, 520  
Open Subviews command, 57, 521  
Open Subviews menu, 55, 60, 191  
OpenRCE, 35, 280, 453, 499  
OpenSSL cryptographic library,  
    215–216, 229  
operand values, 303  
operation codes (opcodes), 4  
optimization, 428  
Options checkboxes, 47  
options for constants, formatting, 112  
Options menu, Font menu, 519  
otype\_t constants, 388  
OR operation, 458  
ord function, 264  
ord parameter, 364  
ordinal number, 230  
ordinary flow type, 62, 170  
original entry point (OEP)  
    recognition, 540  
Original value field, 239  
OS X  
    console mode for, 194–196  
    installing on, 37–38  
OS X Mach-O binaries, 24  
Other option, IdaPdf, 510  
otool utility, 23–24  
out function, 395–396  
out instruction, 456  
out\_line function, 396  
out\_one\_operand function, 394, 395, 397  
out\_register function, 396  
out\_snprintf function, 395  
out\_symbol function, 396  
out\_tagoff function, 396  
out\_tagon function, 396  
*out.cpp* file, 394  
OUTDIR variable, 366  
OutLine function, 396  
OutMnem function, 395  
outop function, 394, 398  
output generator, 380  
Output window, 56, 60, 66, 469  
OutputDebugString function, 546  
OutputDebugStringA function, 559–560  
outputter, for processor modules,  
    394–399  
OutValue function, 396  
overlapping windowing capability,  
    TVision library, 190  
overriding purged bytes,  
    manually, 230  
Overview Navigator, 54, 215  
overview navigator, IDA desktop, 54

## P

p suffix, 171  
\_\_p\_environ library function, 425  
-P<password> command-line option, 571  
-p<port number> command-line  
    option, 571  
Pack database (Deflate) option, 52  
Pack database (Store) option, 52  
pack pragma, 136  
packed data, restoring from, 53  
*PaiMei* framework, 177  
panning, in disassembly window,  
    62–63  
para parameter, 308  
parameters  
    names, formal, 228  
    naming, 102–103  
    passing, 255  
    recognition, automating, 277  
Parameters option, debugger process  
    options dialog, 572

parsing errors, 258  
Pascal directive, 231–232  
Pascal-style strings, 71  
Password option, debugger process options dialog, 572  
patch application event, 484  
patch availability event, 484  
Patch Bytes dialog, 238  
Patch Program menu, 238–241  
    changing individual database bytes, 238–239  
    changing word in database, 239  
    using Assemble dialog, 239–241  
Patch Tuesday cycle, Microsoft, 476  
Patch Word dialog, 239  
patch\_byte function, 304  
patch\_long function, 304  
patch\_many\_bytes function, 304  
patch\_word function, 304  
patchable parameter, 364  
PatchByte function, 262, 280, 458, 556  
PatchDbgByte function, 556  
*PatchDiff2*, 485–487  
    graphical function comparison, 487  
    Identical Functions, 486  
    Matched Functions, 486–487  
    Set Match dialog, 486  
    Set Match feature, 486  
    Unmatched Functions, 486–487  
PatchDword function, 262, 279  
patched files, 484  
patching binaries, 237–245  
    after discovering vulnerability, 484–487  
Patch Program menu, 238–241  
Produce File menu, 241–245  
    ASM files, 242–243  
    DIF files, 244  
    EXE files, 243–244  
    HTML files, 245  
    INC (include) files, 243  
    LST files, 243  
    MAP files, 242  
PatchWord function, 262  
PatchXXX functions, 262, 465  
pattern files, for FLIRT signature files, 219–221  
pattern-matching, 39, 212  
*pat.txt* file, FLAIR, 220  
Pause button, toolbar buttons, 522  
Pause Process option, Debugger menu, 516  
PC keyboard, vs. Mac keyboard, 194  
*pcap* file format, 366  
*pcap* loader, 366–372  
*pcap\_file\_header* structure, 366, 369  
*pcap\_types* string, 368  
*pc.cmt* file, 234  
PDB (Program Database) file, 49  
PDF files, 509  
PDF Objects window, 510  
PE (Portable Executable) format, 8, 19, 45, 224, 410, 545  
    binaries, Windows, 462  
    files, Windows, 467  
    mode, for Bochs, 576–577  
    signatures, 224  
PE Sniffer utility, 19  
PE Tools, 18–19  
pe\_prefix, 224  
*pe.\*.pat* file, 224  
*pe\_gcc.pat* file, 224  
*pe\_sections.idc* script, 244  
*pe\_vc.pat* file, 224  
PEB (process environment block), 462, 555–557, 576  
PEID, 19–20  
*pe.Idw* (Windows PE loader), 45  
persistent data storage, in IDC language, 259–260  
persistent named objects, 259  
personal settings directory, 192  
*pe.sig* file, 421  
pfn pointer, 392  
ph variable, 292  
phrase field, 396  
piracy, Hex-Rays stance on, 33  
Pistelli, Daniel, 342  
PlayStation PSX libraries, Sony, 219  
*plib.exe* parser, 220  
*plib.txt* file, 220  
Please confirm dialog, 542  
PLT (procedure linkage table), 274  
.plt section, 478  
plug-in configuration values, Visual Studio, 328–329  
PLUGIN object, 316  
PLUGIN\_ENTRY function, 344–345  
PLUGIN\_EXT variable, 366  
*plugin\_file* field, 330

PLUGIN\_FIX bit, 318  
PLUGIN\_FIX flag, 319–320, 329  
PLUGIN\_KEEP value, 319  
PLUGIN\_OK value, 319  
PLUGIN\_PROC bit, 319  
PLUGIN\_PROC flag, 319–320  
PLUGIN\_SKIP value, 319  
plugin\_t class, 292, 316, 344, 359  
PLUGIN\_UNL flag, 319  
PLUGIN\_XXX constants, 316  
PLUGIN.flags, 318  
PLUGIN.init function, 319–320  
PLUGIN.run function, 319, 323  
PLUGIN.term function, 319, 322  
PLUGIN.wanted\_hotkey, 331  
plug-ins, 315–346, 499–510  
    building, 324–329  
    class informer, 506–508  
    collabREate, 503–506  
    configuring, 330–331  
    for debugger, 536–538  
    directory for, 39, 288  
    event notification for, 321–322  
    execution of, 322–324  
    extending IDC with, 331–333  
    Hex-Rays, 500–502  
    IdaPdf, 509–510  
    IDAPython, 503  
    ida-x86emu, 506  
    initialization of, 320–321  
    installing, 329–330  
    life cycle of, 318–319  
    MyNav, 508–509  
    scripted, 344–346  
    user interface options for, 333–344  
        customized forms with SDK,  
            337–341  
        with Qt, 342–344  
        using SDK chooser dialogs,  
            334–337  
    Windows-only, 341–342  
using during remote  
    debugging, 574  
writing, 316–324  
    comment member, 317  
    flags field, 317  
    help member, 318  
    init member, 317  
    run member, 317

term member, 317  
version field, 317  
wanted\_hotkey member, 318  
wanted\_name member, 318  
plug-ins configuration file, 201  
Plugins menu, Edit menu, 485, 508  
*plugins.cfg* file, 201, 330  
PointerToRawData field, 353, 355  
polymorphism, 163  
pop instruction, 392, 436  
popa instruction, 459, 547–548  
popf instruction, 459, 564  
pop-up windows, tool tip-style, 129  
Port option, debugger process  
    options dialog, 572  
Portable Executable (PE) format. *See*  
    PE format  
positive deltas, 392  
POSIX wait function, 454  
POSIX-style regular expressions, 99  
PR\_XXX flags, 385  
pragma pack directive, 150  
predecessor instruction, 177  
Predefined symbols section, 258  
Preferences dialog, X11, 196  
prefixes, for autogenerated names, 73  
Preserve case, 124  
preventing debuggers, 453–454  
PrevFunction function, 267  
Previous button, 45  
print function, 263  
Print recursion dots, 184  
print\_type function, 164  
printable characters, ASCII, 27  
printf function, 87  
printf\_line function, 397  
printf-style format string, 263  
Problems window, 76–77  
procedure linkage table (PLT), 274  
process control tools, 519  
process control, with debugger,  
    521–530  
    breakpoints, 522–526  
    stack traces, 528–529  
    tracing, 526–528  
    watches, 529–530  
process environment block (PEB),  
    462, 555–557, 576  
process image, 541–542

Process Monitor, 451  
Process Options command, Debugger menu, 571  
Process Stalker component, PaiMei framework, 177  
process tracing, 454  
ProcessDebugPort function, 557–558  
processes, attaching debuggers to, 514–515  
ProcessInformation parameter, 557  
ProcessInformationClass parameter, 557–558  
processor modules  
    architecture of, 409–411  
    building, 403–407  
    customizing existing, 407–409  
    and Python byte code, 378–379  
    scripting, 411–412  
    using SDK, 380–403  
        analyzer, 385–390  
        emulator, 390–394  
        initialization of LPH structure, 381–385  
        outputter, 394–399  
    processor notifications, 399–401  
    processor\_t members, 401–403  
    processor\_t struct, 380–381  
processor notifications, 321  
Processor Options button, 47  
Processor options section, 203  
Processor Type drop-down menu, 46  
PROCESSOR\_ENTRY function, 411  
processor\_t object, 320  
processor\_t struct, 380–381  
processor\_t.newprc notification, 402  
*procs* directory, 39, 46  
*procs* file, 403  
*proctemplate.py*, 411  
Produce File menu, 241–245  
    ASM files, 242–243  
    DIF files, 244  
    EXE files, 243–244  
    HTML files, 245  
    INC (include) files, 243  
    LST files, 243  
    MAP files, 242  
Produce file submenu, File menu, 177  
Program Database (PDB) file, 49  
program entry point, 8  
programs, in IDC language, 257–258  
*pro.h*, for API, 290, 293  
project properties dialog, Visual Studio, 328  
Project Selection dialog, CollabREate, 505  
prologue, of functions, 85  
Propagate option, Set Match dialog, 487  
Properties dialog, 66  
protected binary, Burneye, 467  
pseudocode, Hex-Rays, 502  
Pseudocode option, View menu, 500  
pseudocode window, 501  
ptrace API, 454  
Public name option, for named locations, 104  
purchasing IDA, 34  
purecall function, 159  
Purged bytes attribute, 116–117  
Purged bytes field, 230  
Push Data button, Set Memory Values dialog, 465  
push instruction, 91, 392  
push operations, 86  
Push Stack Data dialog, 465  
push statements, 275  
pusha instruction, 459  
pushf instruction, 459, 466  
puts function, 181  
.pyc files, 378, 393  
Python byte code, 378–379  
Python function, 481–482  
Python interpreter, 378  
Python script, 495, 549  
Python website, IDAPython, 503  
python\_data function, 394  
PYTHON\_LAST constant, 382

## Q

QApplication class, 343  
qfopen function, 291–292  
qfprintf function, 291  
qnumber macro, 383  
qsnprintf function, 291, 343  
qstrlen function, 343  
qstrncpy function, 291  
qstrXXXX function, 291

QT namespace, 342–343  
Qt port, 176  
Qt socket classes, 504  
QuickEdit mode, 191  
QuickUnpack, 442  
Quit action, 205  
`qwingraph` graph viewer, 176  
`qword` field, 140

**R**

`r` value, 98  
radio buttons, 339–340  
RCE forums, 35, 499  
.rdata section, 355, 419  
`rdtsc` instruction, 471–472  
read cross-reference, 172  
read function, POSIX, 363  
`readelf` utility, 24  
`readlong` function, 265  
`readshort` function, 265  
*README* file, `tilib` utility, 156  
*readme.txt* file

- FLAIR, 219
- `idsutils`, 231
- SDK, 287, 380

readstr function, 265  
read/write traces, 526  
realcvt function, 401  
rearranging blocks, in disassembly window, 64  
reasons, for disassembly

- compiler validation, 7
- debugging displays, 7
- malware analysis, 6
- software interoperability, 7
- vulnerability analysis, 6–7

Rebase Program menu option, 351  
Recent Scripts menu option, 250  
Recent Scripts window, 250  
recovering source code, 5  
recursive descent algorithm, 13  
recursive descent disassembly, 11–14

- conditional branching instructions, 11
- function call instructions, 12
- return instructions, 12–14
- sequential flow instructions, 11
- unconditional branching instructions, 11

Recursive option, 183  
`recvfrom` function, 498  
Red Hat distributions, 219  
redefine process, 436  
referenced variables, stack frame view, 97  
references, in C++, 165–166  
Refresh memory command, Debugger menu, 579  
*reg.cpp* file, 383  
register names, naming, 105  
register-renaming dialog, 105  
registry key, Windows, 45  
`RegNames` array, 383  
`RegOpenKey` function, 127, 228–229  
regular comments, 107  
regular expressions, POSIX-style, 99  
relationships, deducing between classes, 165  
relative virtual address (RVA), 351–352  
release binaries, vs. debug binaries, 428–430  
Remote debugger configuration dialog, 573–574  
remote debugging, 569–574

- attaching to remote process, 573–574
- exception handling during, 574
- using Hex-Rays debugging server, 570–573
- using scripts and plug-ins during, 574

Remove Function Tail option, 115  
`remove` option (`qwingraph`), 194  
Rename and Set Type option, 502  
Rename option, context-sensitive menu, 102  
renaming

- import table entries, 553
- locations, 104–105

*renimp.idc* script, 552–554  
reopening, IDA database files, 52–53  
REP prefix, 527  
repair option, Database Repair dialog, 53  
repeatable comments, 107–108  
reporting bugs, 58  
`request_COMMAND` function, 536

res->num field, 332  
res->set\_string, 333  
Research & Resources forum,  
    Hex-Rays, 288  
Reset Desktop command, 57  
Reset desktop option, Windows  
    menu, 209  
restarting IDA, after crashes, 52–53  
restoring  
    hidden messages, 44  
    from packed data, 53  
ResumeProcess macro, 533  
RET instruction, 87  
ret instruction, 91, 129  
RET N variant, 117  
return instructions, 12–14  
return statement, 255–256, 466, 537  
reversing engineer programs, 5  
Rfirst function, 267  
RfirstB function, 267  
right-click options  
    constants, 112  
    data items, 121  
    and name changing, 102  
    in Segments window, 74  
    in Signatures window, 75  
    in Type Libraries window, 75  
right-shift operator (>>), 253, 458  
RISC-style architectures, 387  
Rnext function, 267  
RnextB function, 267  
Roberts, J. C., 221  
Rolles, Rolf, 378, 473  
ROM images, 29, 348  
RTCx, 428  
RtlUserThreadStart function, 546  
RTTI (Runtime Type Identification)  
    implementations  
        in C++, 163–164  
        compiler differences for, 420  
RTTICreateObjectLocator structure, 164  
rules, for working with malware in  
    debugging environment, 543  
Run button  
    exception confirmation dialog, 565  
    x86emu Emulator dialog, 464  
Run command, 521  
run function, 333, 536  
run member, for plug-ins, 317  
Run option, Debugger menu, 516  
Run to Cursor button  
    toolbar buttons, 522  
    x86emu Emulator dialog, 463, 466  
Run to Cursor command, in  
    Burneye, 467  
Run to Cursor option, Debugger  
    menu, 516  
Run Until Return button, toolbar  
    buttons, 522  
run\_requests function, 536–537  
runtime errors, 258  
Runtime Type Identification imple-  
    mentations. *See* RTTI imple-  
    mentations  
RunTo function, 532  
Rutkowska, Joanna, 451  
RVA (relative virtual address),  
    351–352

## S

-s option (IDA), 197  
Sabanal, Paul Vincent, 165  
safeguarding key file, 34  
sandbox environments, 443  
Save Database dialog, 51  
Save Desktop command, 57  
Save Desktop option, Windows  
    menu, 519  
Save Disassembly Desktop dialog, 209  
save\_file function, 360, 365  
Saved registers attribute, 116  
savefile function, 265  
ScreenEA function, 263, 272  
Script cancellation dialog, 258  
script de-obfuscation of binaries,  
    455–460  
script entry dialog, 251  
Script File option, File menu, 554  
script-based behavior, 576  
scripting, 249–284  
    associating IDC scripts with  
        hotkeys, 261  
    for debugger, 530–535  
    execution of, 250–251  
    IDAPython, 280–281  
    IDAPython examples, 282–284  
    IDC examples, 270–280  
        emulating assembly language  
            behavior, 278–280

scripting (*continued*)  
IDC examples (*continued*)  
enumerating cross-references,  
272–274  
enumerating exported  
functions, 275  
enumerating functions, 270–271  
enumerating instructions,  
271–272  
finding and labeling function  
arguments, 275–277  
IDC functions, 261–270  
code cross-reference, 267  
data cross-reference, 268  
database manipulation, 268–269  
database search, 269–270  
dealing with functions, 266–267  
disassembly line  
components, 270  
file input/output, 264–265  
manipulating database  
names, 266  
reading and modifying data,  
262–263  
string-manipulation, 264  
for user interaction, 263–264  
IDC language, 251–260  
error handling in, 258–259  
expressions, 253  
functions, 254–256  
objects, 256–257  
persistent data storage in,  
259–260  
programs, 257–258  
statements, 254  
variables, 252–253  
loaders, 373–375  
plug-ins, 344–346  
processor modules, 411–412  
using during remote  
debugging, 574  
scripting functions, Hex-Rays, 532  
SDK (software development kit),  
285–314  
API (Application Programming  
Interface), 289–314  
header files, 290–294  
iteration techniques using,  
310–314  
netnodes, 294–301  
SDK datatypes, 302–303  
SDK functions, 304  
configuring build environment, 289  
creating loader modules using,  
358–360  
creating processor modules using,  
380–403  
analyzer, 385–390  
emulator, 390–394  
initialization of LPH structure,  
381–385  
outputter, 394–399  
processor notifications, 399–401  
processor\_t members, 401–403  
processor\_t struct, 380–381  
directory layout  
*bin* directory, 287  
*etc* directory, 288  
*include* directory, 288  
*ldr* directory, 288  
*lib* directory, 288  
*module* directory, 288  
*plug-ins* directory, 288  
*top-level* directory, 288–289  
functions, 587  
IDC language cross-reference for,  
585–608  
implementation, IDC functions,  
586–608  
installing, 287  
support, Hex-Rays, 58  
*sdk* directory, 36  
*sdk\_versions.h* file, 293  
search features, Search menu, 82  
SEARCH\_DOWN flag, 270  
*search.hpp*, for API, 293  
second-generation languages, 4  
section:address portion, 110  
SectionAlignment field, 352  
SectionAlignment value, 352  
*SecureCRT*, 193  
segend function, 401  
Segment Configuration dialog, 464  
segment\_t (*segment.hpp*), datatypes for  
SDK, 293, 302  
segment-creation dialog, 353  
segmented addresses, 169  
*segment.hpp* file, 293, 307, 353

Segments button, x86emu Emulator dialog, 464  
Segments window, 74, 543  
segstart function, 401  
SEH (structured exception handling) process, 472  
Chain plug-in, 566  
exceptions, Windows, 565  
handlers, 565–566  
Select a debugger dialog, 516  
Select Command dialog, CollabREate, 505  
Select Debugger option, Debugger menu, 515–516, 548  
SELinux, 38  
semaphore, 438  
semicolon (;) hotkey, 107  
semicolon prefix, used for IDA comments, 107–108  
Sequence of Bytes option, 99, 493  
sequential flow instructions, 11  
Set Breakpoint option, 463  
Set Function Type command, 128, 579  
Set Import Address Save Point option, 470  
Set Match dialog  
    PatchDiff2, 486  
    Propagate option, 487  
Set Match feature, PatchDiff2, 486  
Set Match option, 487  
Set Memory button, x86emu Emulator dialog, 464–465  
Set Memory Values dialog, 465  
Set node color to default option, 186  
Set specific options button, 572  
Set Video Mode menu option,  
    Window menu, 191  
set\_idc\_func\_ex function, 331  
set\_idp\_options function, 401  
set\_name function, 306  
set\_processor\_type function, 410  
set\_reg\_val function, 538  
set\_segm\_addressing function, 363  
SetArrayLong function, 301  
SetArrayString function, 301  
SetBptAttr function, 531  
SetBptCnd function, 531, 554  
SetRegValuefunction, 531  
setting function type, 129  
Setup Data Types dialog, Options menu, 121, 144  
Setup long names button, 163  
Setup option, Strings window, 458  
Setup short names button, 163  
Setup Strings window, 70–71  
shared library, 516  
sharing TIL files, 155–156  
shell script (`#!/bin/sh`), 16  
shellcode, 29, 495–498  
SHIFT-down arrow, 243  
SHIFT-up arrow, 243  
Shiva ELF obfuscation tool, 453  
Shiva process, 454  
*Shiva* program, 434–435, 437, 442  
shnames data member, 401  
SHOW\_SP option, 202  
show\_wait\_box function, 323  
SHOW\_XREFS option, 202  
shr instruction, 458  
shrd instruction, 458  
Shrink Struct Type option, Edit menu, 145  
sidt instruction, 451  
Siemens C166 microcontroller application, 349  
sig directory, 39  
.sig file, 214  
sigmake documentation file, 221  
*sigmake.exe* utility, FLAIR, 221  
*sigmake.txt* file, 222  
signature selection dialog, 214  
signature selection, FLIRT, 214  
signatures  
    function type, 229  
    generating, 39  
    Signatures Window, 74–75  
Signatures window, 74–75  
Signed elements option, 126  
signed shifts, 458  
simple arithmetic instructions, 11  
Simpleton file format, 373  
simpleton loader, 361–366  
simplex method, 230  
Simplified Wrapper Interface Generator (SWIG), IDAPython, 503  
Sirmabus, 420, 506  
size field, 386  
size parameter, 307

SizeOfRawData field, 354  
sizer function, 334  
sizer parameter, 334  
Skip button, x86emu Emulator dialog, 463–464  
Skochinsky, Igor, 165, 420, 507  
slice operator, 253  
sockaddr data structure, 69  
socket descriptor, 489  
*SoftIce*, 452  
software breakpoints, 453, 523, 544, 546  
software development kit. *See* SDK  
software interoperability, reasons for disassembly, 7  
Solaris 10 x86 system, 219  
solid arrows, 65  
Sony PlayStation PSX libraries, 219  
sorting alphabetically, in Functions window, 82  
source code recovery, 5  
SPARC code, 410  
sparse arrays, 259  
splash screen, 44  
sprintf function, 264, 273, 477  
*ssleay32.dll* library, 232  
*SSLEAY32.idt* file, 232  
stack adjustments, 118  
stack cleanup, 228  
.stack database segment, 462  
stack frames, 83–98  
calling conventions for, 85–89  
examples of, 89–93  
as IDA structures, 146  
local variable layout in, 89  
viewing, 93–98  
Stack pointer option, 110  
stack pointers, adjustments for, 118–119  
Stack Trace command, Debugger menu, 528–529  
stack traces, in debugger, 528–529  
stack variables, 95, 102  
Stack View window, 519  
stack-allocated arrays, 132–134  
stack-allocated structures, 138, 148  
stack-based buffer overflow, 488  
stack-manipulation operations, 11  
standard calling convention, 87  
standard structures, 151–154  
standard template library (STL), 486  
Start address attribute, 116  
start function, 213, 443  
Start Process option, Debugger menu, 516, 518  
start symbol, 546  
STARTITEM directives, 340  
*startup* directory, FLAIR, 217, 224  
startup routine, 224  
startup signatures, 224–225  
*startup.bat* file, 224  
*startup.idc*, 577  
statements, in IDC language, 254  
static analysis, of malware, 6  
static de-obfuscation of binaries, 454–472  
script-oriented, 455–460  
x86emu emulation-oriented, 460–472  
and anti-debugging, 471–472  
de-obfuscation using, 465–470  
features of, 470–471  
initialization of, 462  
operation of, 463–465  
Static func attribute, 117  
static keyword, 254–255  
static libraries, for FLIRT signatures, 217–219  
static linking function, 22  
statically linked binaries, 178  
stats netnode, 537  
stdcall calling convention, 87, 118, 230, 294, 468  
stdcall functions, 116, 228, 464, 467, 558–559  
\_stdcall modifier, 87  
Step button, x86emu Emulator dialog, 463  
Step command, 521  
Step Into button, toolbar buttons, 522  
Step Over button, toolbar buttons, 522  
StepInto function, 532  
StepOver function, 532–533  
StepUntilRet function, 532  
STL (standard template library), 486

Stop on debugging message option,  
    Debugger Setup dialog, 546  
Stop on debugging start option,  
    Debugger Setup dialog, 546  
Stop on library load/unload option,  
    Debugger Setup dialog, 546  
Stop on process entry point option,  
    Debugger Setup dialog, 546  
Stop on thread start/exit option,  
    Debugger Setup dialog, 546  
`STOP_CODE` constant, 383  
storage, of bytes, 97  
Store (Pack database) option, 52  
`store_til` function, 369  
`stosb` instruction, 458  
`strcat` function, 253  
`strcpy` function, 175, 253, 273,  
    477–478, 480  
 `strdup` function, 253  
stream argument, 491  
stream disassemblers, 28  
string data configuration, 72, 123  
string scanning, 70  
strings  
    C-style null-terminated, 122  
    displaying in Strings windows, 70  
    double-clicking, 70  
    options for, 122–124  
    Unicode, 99  
    using on executable files, 28  
    utility, 27–28  
`strings` command, 71, 212  
`strings` utility, 446  
Strings window  
    Display only defined strings  
        option, 71  
    Ignore instructions/data definitions option, 71–72  
    overview, 70  
`strip` utility, 18  
stripping binary executable files, 18  
`strlen` function, 264  
`strstr` function, 264  
`struc_t` (*struct.hpp*), datatypes for SDK,  
    293, 303, 306, 308, 311  
`Struct Var` option, Edit menu, 147  
*struct.hpp* (`struc_t`), datatypes for  
SDK, 303  
*struct.hpp*, for API, 293  
structure definition  
    collapsed, 146  
    empty, 143  
structure members, enumerating, 311  
Structure name field, Create  
    Structure/Union dialog, 143  
structure notation, 149  
structure offset, applying, 147  
structure selection dialog, 147  
structure templates, using, 146–149  
structured exception handling (SEH)  
    process, 472  
structures  
    collapsing, 154  
    expanding, 153  
    fields, changing name of, 144  
    formatting global variables as, 149  
    master list of, 152  
Structures window, 69, 142–143  
stubs, 403–405  
`substr` function, 264  
successor instruction, 177  
summary stack view, 97  
superclass constructors, 164  
support  
    Hex-Rays support page and  
        forums, 35  
    IDA Palace, 36  
    Ilfak's blog, 36  
    official help documentation, 35  
    OpenRCE.org, 35  
    RCE forums, 35  
`subset` function, 299  
`supstr` function, 299  
`supval` function, 299  
`supvals`, 297–298  
`swidth` component, 338  
SWIG (Simplified Wrapper Interface Generator), IDAPython, 503  
Switch Debugger menu, Debugger menu, 516  
`switch` statements, compiler differences for, 416–420  
Switch Thread option, Emulate menu, 471  
switch variable, 417

symbols  
    appearing in comments, 175  
    displayed on Imports window, 69  
    global (external), 20  
symbol-selection dialog, 113  
Synchronize to idb option, 150  
synchronizing activities, using  
    CollabREate, 504  
synchronous debugger function, 532  
synchronous interaction, 536–537  
system calls, 89

**T**

-t command-line argument  
    (strings), 28  
tabs, IDA desktop, 55  
tags, 297  
Take Memory Snapshot command,  
    Debugger menu, 542  
.tar file, 36  
Target assembler, 243  
target assembly language syntax, 243  
TASM (Borland's Turbo  
    Assembler), 9  
TCP session, 496  
TEB (thread environment block),  
    439, 462, 556, 565, 576  
*tClock* program, 438, 440, 442  
Tenable Security, 342  
term member, for plug-ins, 317  
term method, 536  
term\_output\_buffer function, 395  
Terminal application, Mac, 194  
Terminal keyboard settings dialog,  
    Mac, 195  
terminal programs, Linux, 192  
Terminate button, toolbar  
    buttons, 522  
Terminate Process option, Debugger  
    menu, 517  
text display, Linux, 192  
Text option, Hex window, 67  
Text Search dialog, 99  
text searches, of database, 99  
.text section, 241, 353, 355, 423  
text view, switching to graph view, 185  
text-mode user interface configura-  
    tion file, 39  
The initial autoanalysis has been  
    finished message, 57, 211

third-generation languages, 4  
third-party graph viewer, 176  
this pointer, in C++, 156–157  
This type of output file is not  
    supported message, 243  
thiscall calling convention, 88, 156  
thread environment block (TEB),  
    439, 462, 556, 565, 576  
thread information block (TIB), 556  
Thread Local Storage (TLS) callback  
    functions, 545–546, 556  
ThreadInformationClass parameter, 559  
Threads view, 519  
thunk functions, 428–429  
ThunRTMain function, 427  
TIB (thread information block), 556  
TIB[NNNNNNNN] database section, 565  
*til* directory, 40  
TIL files, 49  
    loading new, 155  
    overview, 154  
    sharing, 155–156  
til2idb function, 367  
*tilib* tool, Hex-Rays, 155  
time stamp counter (TSC), 471  
timelimit option, 194  
tips and tricks, for IDA Desktop, 57  
Title case, 124  
TLS (Thread Local Storage) callback  
    functions, 545–546, 556  
tmainCRTStartup function, 426  
to address, in cross-references, 168  
toggling values, 520  
tool tip-style pop-up window, 129  
toolbar  
    area, IDA desktop, 53  
    arrangements, 208  
    buttons, 208, 521–522  
    configuration menu, 209  
    customizing, 208–210  
Toolbars command, 53  
tools  
    *c++filt* utility, 25–26  
    for deep inspection, 27–29  
    *dumpbin* utility, 25  
    for file classification, 16–20  
    *ldd* utility, 22–23  
    *nm* utility, 20–21  
    *objdump* utility, 23–24  
    *otool* utility, 24

Tools menu, PE Tools, 19  
top-level directory, for SDK, 288–289  
TouchArg function, 391  
Trace buffer size option, Tracing  
    Options dialog, 526  
Trace checkbox, Breakpoint Settings  
    dialog, 526  
trace option, 526  
Trace over debugger segments option,  
    Tracing Options dialog, 528  
Trace over library functions option,  
    Tracing Options dialog, 528  
trace\_level parameter, 533  
tracing, in debugger, 526–528  
Tracing Options dialog, 526–528  
trampoline, 493  
translate function, 401  
TriMedia libraries, 219  
TSC (time stamp counter), 471  
TTY console, 197  
Turbodiff, 485  
turn color off tag, 396  
turn color on tag, 396  
TVHEADLESS environment variable, 197  
*TVision* library, 190  
TVision port, 193  
TVOPT settings, 193  
*tvtuning.txt*, 193  
two-digit hex values, 99  
type component, 338  
type field, 303, 338, 388  
Type Libraries window, 75  
typedef statement, 151  
TypeDescriptor structure, 164  
typeid operator, 163  
*typeinf.hpp*, 293  
*typinf.hpp*, 367

**U**

U hotkey, 119, 144  
u\_ana member, 385  
u\_emu member, 391  
u\_out member, 394  
u\_outspec function, 401  
ua\_next\_xxx functions, 386  
*ua.hpp* file, 293, 385  
ui\_notification\_t constants, 305  
uname command, 326  
uncollapsing nodes, 187

uncompressing UPX binary, using  
    emulator, 467  
unconditional branching  
    instructions, 11  
Undefine option, 119, 435  
undefine process, 436  
undefining functions, 119  
undetected string data, 72  
undo command, absence of, 59  
undo feature, 40  
 undocumented CPU instructions, 110  
Ungroup Nodes option, 187  
Unicode strings option, 71, 99, 447  
universal unpacker, Hex-Rays, 550  
Unix-style make files, 289  
Unmatched Functions, PatchDiff2,  
    486–487  
unsigned shifts, 458  
untar archive, 37  
upgrading, 34  
uppercase letter codes, 21  
UPX  
    decompression routine, 547–548  
    decompression stub, 442  
    packer, 442  
    program, 441, 548, 552–553  
UPX-packed binaries, 540  
Use “dup” construct option, 126  
Use graph view by default checkbox,  
    Graph tab, 55  
Use option key as meta key checkbox,  
    Terminal application, 194  
USE\_DANGEROUS\_FUNCTIONS macro, 290  
USE\_STANDARD\_FILE\_FUNCTIONS macro,  
    291, 365  
User cross-reference graph dialog, 183  
user interface  
    of IDA Pro, 40  
    for plug-ins, 333–344  
        customized forms with SDK,  
            337–341  
        with Qt, 342–344  
        using SDK chooser dialogs,  
            334–337  
            Windows-only, 341–342  
    user interface notifications, 321  
User xref charts, 182  
User xref graph, 184  
User Xrefs Chart option, Graphs  
    menu, 182

`_usercall` calling convention, 431  
user-generated cross-reference  
    graphs, 185  
`utilities` directory, 36

**V**

- v command-line option (debugging server), 571
- `va_arg` macro, C++, 322
- `var_` prefix, 95
- variables
  - in IDC language, 252–253
  - index values of, 132
  - names, IDA-generated, 96–97
- `vc32rtf` signatures, 75
- `vcsample` file, 289
- Veracode, 476
- version field, 317, 385
- version member, 359
- versions, 33
- vertices, 64, 168
- VGA font, 193
- View menu
  - Cross References option, 477
  - Enumerate Heap option, 471
  - Pseudocode option, 500
- View window, 530
- viewing machine language bytes, 111
- virtual addresses, 64
- virtual functions, 157–160, 173
- virtual machine-based obfuscation, 472–474
- virtual repeatable comment, 108
- `VirtualAddress` field, 353
- `VirtualAlloc` function, 468, 477, 576, 578–579
- virtualization
  - detecting, 449–451
  - processor-specific behavioral changes, 451
  - specific behaviors, 450–451
  - specific hardware, 450
  - specific software, 450
- software, 449
- virtualizing obfuscator, 442
- Visual C++ compiler, Microsoft, 114
- Visual Studio suite, Microsoft, 25

Visual Studio Win32 Application Wizard, 327

VMProtect, 442, 472

VMware Tools collection, 450–451

`VPAGESIZE` option, 202

`vtables`, in C++, 157–160

vulnerability advisory, 484

vulnerability analysis, 475–498

- analyzing shellcode, 495–498
- discovering vulnerabilities, 476–483

exploit-development process, 488–495

- finding useful virtual addresses, 494–495
- locating instruction sequences, 492–494
- stack frame breakdown, 488–492

handling after-fact discoveries, 483–487

reasons for disassembly, 6–7

vulnerability discovery, 6

**W**

- w suffix, 172, 447
- Wait For Next Event (WFNE)
  - flags, 532
- `wait_for_next_event` function, 538
- `wanted_hotkey` data member, 318, 330
- `wanted_hotkey` value, 318
- `wanted_name` data member, 318, 330
- Warning function, 263, 272
- warning function, 305
- warnings, for loaders, 49
- `wasBreak` function, 323
- Watch Address dialog, 530
- Watch List option, Debugger
  - menu, 530
- watch lists, 529
- watch points, 529
- watches, in debugger, 529–530
- Weak name option, for named locations, 105
- weak symbol, marking, 105
- web server, Apache, 23
- Welcome dialog, 44

WFNE (Wait For Next Event)  
  flags, 532  
WFNE\_CONT flag, 533  
WFNE\_SUSP event type, 533  
Whittaker, Andy, 349  
width characters, 395  
width component, 338  
width field, 124  
widths parameter, 336  
wildcards, 205  
Win32 Application Wizard, Visual Studio, 327  
Win32 Project template, 327  
win32\_remote.exe server  
  component, 570  
win64\_remotex64.exe server  
  component, 570  
wince\_remote\_arm.dll server  
  component, 570  
Windows  
  console mode for, 191  
  installing on, 36–37  
  launching installer, 36  
“Windows Anti-Debug Reference” article, 555–558  
Windows Asynchronous Sockets techniques, 504  
Windows calculator program, 25  
Windows CE ARM, 517  
Windows library handle, 468  
Windows menu, Save Desktop option, 519  
Windows PE binaries, ida-x86emu plug-in, 462  
Windows PE file, manually loading, 349–357  
Windows PE loader (*pe.Idw*), 45  
Windows registry key, 45  
Windows SEH exceptions, 565  
Windows SEH handlers, 565  
*wingraph32* application, 176  
WinGraph32 window, 180  
WinHelp-style help files, 204  
*wininet.dll* file, 516  
WinLicense, 442, 448  
WinMain function, 422  
WinMain variation, 421  
Wireshark, 366, 451, 496  
word. *See* 1 byte of storage (db)  
Word function, 262  
word-patching capability, 239  
wrapper code, 180  
write cross-references, 172  
write traces, 526  
write4 capability, 488  
writeln function, 265  
writeshort function, 265  
writestr function, 265  
ws2\_32 networking library, 553

## X

X Windows consoles, 193  
X11, installing, 195  
X.25-style network connection, 113  
x86 code, 410  
x86 compiler, 87  
x86 hardware-debug registers, 472  
x86 instruction, 204  
x86 processor module, 47  
x86emu breakpoints, 463  
x86emu emulator, de-obfuscation of binaries using, 460–472  
  and anti-debugging, 471–472  
  de-obfuscation using, 465–470  
  features of, 470–471  
  initialization of, 462  
  operation of, 463–465  
x86emu Emulator dialog  
  Jump To Cursor button, 464  
  Push Data button, 465  
  Run button, 464  
  Run To Cursor button, 463, 466  
  Segments button, 464  
  Set Memory button, 464–465  
  Skip button, 463–464  
  Step button, 463  
x86emu library function dialog, 469  
x86emu plug-in, 461  
x86emu Set Memory Values dialog, 465  
.xinitrc file, 195  
XML templates, 360  
xmodmap command, 196  
.Xmodmap file, 195

xmodmap utility, 195  
xor instruction, 436  
`xrefblk_t` structure, 283, 309, 312–313  
`xref.hpp` file, 293–294, 309, 392  
xrefs (cross-references).  
    *See* cross-references  
Xrefs From graph, 181–182  
Xrefs To graph, 180–181  
*XrefsFrom* generator, 283  
`xrefType` function, 267–268, 273, 309  
`xterm`, running, 193  
`xtol` function, 264  
`xxxset` function, 298  
`xxxval` function, 298

## Y

Y hotkey, 128  
`y` variable, 91, 94  
Yason, Mark Vincent, 165  
*Yes edge* arrow, 62  
You may start to explore the input file  
    right now message, 57

## Z

Zbikowski, Mark, 16  
zoom control, keyboard, 62  
`ZwContinue` function, 567