

ISO/IEC TR 24772:2013-03 (E)

Information technology - Programming languages - Guidance to avoiding vulnerabilities in programming languages through language selection and use

Contents		Page
Foreword		xv
Introduction		xvi
1. Scope		1
2. Normative references		1
3. Terms and definitions, symbols and conventions		1
3.1 Terms and definitions		1
3.2 Symbols and conventions		5
4. Basic concepts		6
4.1 Purpose of this Technical Report		6
4.2 Intended audience		6
4.3 How to use this document		7
5 Vulnerability issues		8
5.1 Predictable execution		8
5.2 Sources of unpredictability in language specification		9
5.2.1 Incomplete or evolving specification		9
5.2.2 Undefined behaviour		10
5.2.3 Unspecified behaviour		10
5.2.4 Implementation-defined behaviour		10
5.2.5 Difficult features		10
5.2.6 Inadequate language support		10
5.3 Sources of unpredictability in language usage		10
5.3.1 Porting and interoperation		10
5.3.2 Compiler selection and usage		11
6. Programming Language Vulnerabilities		11
6.1 General		11
6.2 Terminology		11
6.3 Type System [IHN]		12
6.4 Bit Representations [STR]		14
6.5 Floating-point Arithmetic [PLF]		16
6.6 Enumerator Issues [CCB]		18
6.7 Numeric Conversion Errors [FLC]		20
6.8 String Termination [CJM]		22
6.9 Buffer Boundary Violation (Buffer Overflow) [HCB]		23
6.10 Unchecked Array Indexing [XYZ]		25
6.11 Unchecked Array Copying [XYW]		27
6.12 Pointer Casting and Pointer Type Changes [HFC]		28
6.13 Pointer Arithmetic [RVG]		29
6.14 Null Pointer Dereference [XYH]		30
6.15 Dangling Reference to Heap [XYK]		31
6.16 Arithmetic Wrap-around Error [FIF]		34
6.17 Using Shift Operations for Multiplication and Division [PIK]		35
6.18 Sign Extension Error [XZI]		36
6.19 Choice of Clear Names [NAI]		37
6.20 Dead Store [WXQ]		39

6.21	Unused Variable [YZS]	40
6.22	Identifier Name Reuse [YOW]	41
6.23	Namespace Issues [BJL]	43
6.24	Initialization of Variables [LAV]	45
6.25	Operator Precedence/Order of Evaluation [JCW]	47
6.26	Side-effects and Order of Evaluation [SAM]	49
6.27	Likely Incorrect Expression [KOA]	50
6.28	Dead and Deactivated Code [XYQ]	52
6.29	Switch Statements and Static Analysis [CLL]	54
6.30	Demarcation of Control Flow [EOJ]	56
6.31	Loop Control Variables [TEX]	57
6.32	Off-by-one Error [XZH]	58
6.33	Structured Programming [EWD]	60
6.34	Passing Parameters and Return Values [CSJ]	61
6.35	Dangling References to Stack Frames [DCM]	63
6.36	Subprogram Signature Mismatch [OTR]	65
6.37	Recursion [GDL]	67
6.38	Ignored Error Status and Unhandled Exceptions [OYB]	68
6.39	Termination Strategy [REU]	70
6.40	Type-breaking Reinterpretation of Data [AMV]	72
6.41	Memory Leak [XYL]	74
6.42	Templates and Generics [SYM]	76
6.43	Inheritance [RIP]	78
6.44	Extra Intrinsic [LRM]	79
6.45	Argument Passing to Library Functions [TRJ]	80
6.46	Inter-language Calling [DJS]	81
6.47	Dynamically-linked Code and Self-modifying Code [NYY]	83
6.48	Library Signature [NSQ]	84
6.49	Unanticipated Exceptions from Library Routines [HJW]	86
6.50	Pre-processor Directives [NMP]	87
6.51	Suppression of Language-defined Run-time Checking [MXB]	89
6.52	Provision of Inherently Unsafe Operations [SKL]	90
6.53	Obscure Language Features [BRS]	91
6.54	Unspecified Behaviour [BQF]	92
6.55	Undefined Behaviour [EWF]	94
6.56	Implementation-defined Behaviour [FAB]	95
6.57	Deprecated Language Features [MEM]	97
7.	Application Vulnerabilities	98
7.1	General	98
7.2	Terminology	99
7.3	Unspecified Functionality [BVQ]	99
7.4	Distinguished Values in Data Types [KLK]	100
7.5	Adherence to Least Privilege [XYN]	101
7.6	Privilege Sandbox Issues [XYO]	102
7.7	Executing or Loading Untrusted Code [XYS]	103
7.8	Memory Locking [XZX]	104
7.9	Resource Exhaustion [XZP]	105
7.10	Unrestricted File Upload [CBF]	107
7.11	Resource Names [HTS]	108
7.12	Injection [RST]	109
7.13	Cross-site Scripting [XYT]	112
7.14	Unquoted Search Path or Element [XZQ]	115
7.15	Improperly Verified Signature [XZR]	115
7.16	Discrepancy Information Leak [XZL]	116
7.17	Sensitive Information Uncleared Before Use [XZK]	117
7.18	Path Traversal [EWR]	118
7.19	Missing Required Cryptographic Step [XZS]	120
7.20	Insufficiently Protected Credentials [XYM]	121
7.21	Missing or Inconsistent Access Control [XZN]	122
7.22	Authentication Logic Error [XZO]	122
7.23	Hard-coded Password [XYP]	124

8.	New Vulnerabilities	125
8.1	General	125
8.2	Terminology	125
8.3	Concurrency - Activation [CGA]	125
8.4	Concurrency - Directed termination [CGT]	127
8.5	Concurrent Data Access [CGX]	129
8.6	Concurrency - Premature Termination [CGS]	130
8.7	Protocol Lock Errors [CGM]	132
8.8	Inadequately Secure Communication of Shared Resources [CGY]	134
Annex A (informative) Vulnerability Taxonomy and List		136
A.1	General	136
A.2	Outline of Programming Language Vulnerabilities	136
A.3	Outline of Application Vulnerabilities	138
A.4	Vulnerability List	138
Annex B (informative) Language Specific Vulnerability Template		141
Annex C (informative) Vulnerability descriptions for the language Ada		143
C.1	Identification of standards and associated documentation	143
C.2	General terminology and concepts	143
C.3	Type System [IHN]	149
C.4	Bit Representation [STR]	149
C.5	Floating-point Arithmetic [PLF]	150
C.6	Enumerator Issues [CCB]	150
C.7	Numeric Conversion Errors [FLC]	151
C.8	String Termination [CJM]	151
C.9	Buffer Boundary Violation (Buffer Overflow) [HCB]	152
C.10	Unchecked Array Indexing [XYZ]	152
C.11	Unchecked Array Copying [XYW]	152
C.12	Pointer Casting and Pointer Type Changes [HFC]	152
C.13	Pointer Arithmetic [RVG]	153
C.14	Null Pointer Dereference [XYH]	153
C.15	Dangling Reference to Heap [XYK]	153
C.16	Arithmetic Wrap-around Error [FIF]	153
C.17	Using Shift Operations for Multiplication and Division [PIK]	154
C.18	Sign Extension Error [XZI]	154
C.19	Choice of Clear Names [NAI]	154
C.20	Dead store [WXQ]	155
C.21	Unused Variable [YZS]	155
C.22	Identifier Name Reuse [YOW]	156
C.23	Namespace Issues [BJL]	156
C.24	Initialization of Variables [LAV]	156
C.25	Operator Precedence/Order of Evaluation [JCW]	157
C.26	Side-effects and Order of Evaluation [SAM]	157
C.27	Likely Incorrect Expression [KOA]	158
C.28	Dead and Deactivated Code [XYQ]	159
C.29	Switch Statements and Static Analysis [CLL]	159
C.30	Demarcation of Control Flow [EOJ]	160
C.31	Loop Control Variables [TEX]	160
C.32	Off-by-one Error [XZH]	160
C.33	Structured Programming [EWD]	161
C.34	Passing Parameters and Return Values [CSJ]	161
C.35	Dangling References to Stack Frames [DCM]	162
C.36	Subprogram Signature Mismatch [OTR]	162
C.37	Recursion [GDL]	163
C.38	Ignored Error Status and Unhandled Exceptions [OYB]	163
C.39	Termination Strategy [REU]	164
C.40	Type-breaking Reinterpretation of Data [AMV]	164

C.41	Memory Leak [XYL]	165
C.42	Templates and Generics [SYM]	165
C.43	Inheritance [RIP]	166
C.44	Extra Intrinsic [LRM]	166
C.45	Argument Passing to Library Functions [TRJ]	166
C.46	Inter-language Calling [DJS]	167
C.47	Dynamically-linked Code and Self-modifying Code [NYY]	167
C.48	Library Signature [NSQ]	167
C.49	Unanticipated Exceptions from Library Routines [HJW]	167
C.50	Pre-Processor Directives [NMP]	168
C.51	Suppression of Language-defined Run-time Checking [MXB]	168
C.52	Provision of Inherently Unsafe Operations [SKL]	168
C.53	Obscure Language Features [BRS]	169
C.54	Unspecified Behaviour [BQF]	169
C.55	Undefined Behaviour [EWF]	170
C.56	Implementation-Defined Behaviour [FAB]	171
C.57	Deprecated Language Features [MEM]	172
C.58	Implications for standardization	172
Annex D (informative) Vulnerability descriptions for the language C		174
D.1	Identification of standards and associated documents	174
D.2	General terminology and concepts	174
D.3	Type System [IHN]	177
D.4	Bit Representations [STR]	178
D.5	Floating-point Arithmetic [PLF]	179
D.6	Enumerator Issues [CCB]	180
D.7	Numeric Conversion Errors [FLC]	181
D.8	String Termination [CJM]	183
D.9	Buffer Boundary Violation (Buffer Overflow) [HCB]	183
D.10	Unchecked Array Indexing [XYZ]	185
D.11	Unchecked Array Copying [XYW]	185
D.12	Pointer Casting and Pointer Type Changes [HFC]	186
D.13	Pointer Arithmetic [RVG]	186
D.14	Null Pointer Dereference [XYH]	187
D.15	Dangling Reference to Heap [XYK]	187
D.16	Arithmetic Wrap-around Error [FIF]	189
D.17	Using Shift Operations for Multiplication and Division [PIK]	190
D.18	Sign Extension Error [XZI]	190
D.19	Choice of Clear Names [NAI]	190
D.20	Dead Store [WXQ]	191
D.21	Unused Variable [YZS]	191
D.22	Identifier Name Reuse [YOW]	191
D.23	Namespace Issues [BJL]	192
D.24	Initialization of Variables [LAV]	192
D.25	Operator Precedence/Order of Evaluation [JCW]	193
D.26	Side-effects and Order of Evaluation [SAM]	193
D.27	Likely Incorrect Expression [KOA]	194
D.28	Dead and Deactivated Code [XYQ]	195
D.29	Switch Statements and Static Analysis [CLL]	196
D.30	Demarcation of Control Flow [EOJ]	197
D.31	Loop Control Variables [TEX]	198
D.32	Off-by-one Error [XZH]	199
D.33	Structured Programming [EWD]	199
D.34	Passing Parameters and Return Values [CSJ]	200
D.35	Dangling References to Stack Frames [DCM]	201
D.36	Subprogram Signature Mismatch [OTR]	201
D.37	Recursion [GDL]	202
D.38	Ignored Error Status and Unhandled Exceptions [OYB]	202
D.39	Termination Strategy [REU]	203
D.40	Type-breaking Reinterpretation of Data [AMV]	203
D.41	Memory Leak [XYL]	204

D.42	Templates and Generics [SYM]	204
D.43	Inheritance [RIP]	204
D.44	Extra Intrinsic [LRM]	204
D.45	Argument Passing to Library Functions [TRJ]	205
D.46	Inter-language Calling [DJS]	205
D.47	Dynamically-linked Code and Self-modifying Code [NYY]	205
D.48	Library Signature [NSQ]	206
D.49	Unanticipated Exceptions from Library Routines [HJW]	206
D.50	Pre-processor Directives [NMP]	207
D.51	Suppression of Language-defined Run-time Checking [MXB]	208
D.52	Provision of Inherently Unsafe Operations [SKL]	208
D.53	Obscure Language Features [BRS]	208
D.54	Unspecified Behaviour [BQF]	209
D.55	Undefined Behaviour [EWF]	209
D.56	Implementation-defined Behaviour [FAB]	210
D.57	Deprecated Language Features [MEM]	210
D.58	Implications for standardization	211
 Annex E (informative) Vulnerability descriptions for the language Python		214
E.1	Identification of standards and associated documents	214
E.2	General Terminology and Concepts	215
E.3	Type System [IHN]	219
E.4	Bit Representations [STR]	221
E.5	Floating-point Arithmetic [PLF]	222
E.6	Enumerator Issues [CCB]	222
E.7	Numeric Conversion Errors [FLC]	223
E.8	String Termination [CJM]	224
E.9	Buffer Boundary Violation [HCB]	224
E.10	Unchecked Array Indexing [XYZ]	224
E.11	Unchecked Array Copying [XYW]	224
E.12	Pointer Casting and Pointer Type Changes [HFC]	224
E.13	Pointer Arithmetic [RVG]	224
E.14	Null Pointer Dereference [XYH]	224
E.15	Dangling Reference to Heap [XYK]	224
E.16	Arithmetic Wrap-around Error [FIF]	225
E.17	Using Shift Operations for Multiplication and Division [PIK]	225
E.18	Sign Extension Error [XZI]	225
E.19	Choice of Clear Names [NAI]	225
E.20	Dead Store [WXQ]	227
E.21	Unused Variable [YZS]	228
E.22	Identifier Name Reuse [YOW]	228
E.23	Namespace Issues [BJL]	230
E.24	Initialization of Variables [LAV]	233
E.25	Operator Precedence/Order of Evaluation [JCW]	233
E.26	Side-effects and Order of Evaluation [SAM]	234
E.27	Likely Incorrect Expression [KOA]	235
E.28	Dead and Deactivated Code [XYQ]	236
E.29	Switch Statements and Static Analysis [CLL]	237
E.30	Demarcation of Control Flow [EOJ]	237
E.31	Loop Control Variables [TEX]	238
E.32	Off-by-one Error [XZH]	239
E.33	Structured Programming [EWD]	239
E.34	Passing Parameters and Return Values [CSJ]	240
E.35	Dangling References to Stack Frames [DCM]	242
E.36	Subprogram Signature Mismatch [OTR]	242
E.37	Recursion [GDL]	242
E.38	Ignored Error Status and Unhandled Exceptions [OYB]	242
E.39	Termination Strategy [REU]	243
E.40	Type-breaking Reinterpretation of Data [AMV]	243
E.41	Memory Leak [XYL]	243
E.42	Templates and Generics [SYM]	244

E.43	Inheritance [RIP]	244
E.44	Extra Intrinsic [LRM]	244
E.45	Argument Passing to Library Functions [TRJ]	245
E.46	Inter-language Calling [DJS]	245
E.47	Dynamically-linked Code and Self-modifying Code [NYY]	246
E.48	Library Signature [NSQ]	246
E.49	Unanticipated Exceptions from Library Routines [HJW]	247
E.50	Pre-processor Directives [NMP]	247
E.51	Suppression of Language-defined Run-time Checking [MXB]	247
E.52	Provision of Inherently Unsafe Operations [SKL]	247
E.53	Obscure Language Features [BRS]	248
E.54	Unspecified Behaviour [BQF]	250
E.55	Undefined Behaviour [EWF]	251
E.56	Implementation-defined Behaviour [FAB]	252
E.57	Deprecated Language Features [MEM]	253
Annex F (informative) Vulnerability descriptions for the language Ruby		254
F.1	Identification of standards and associated documents	254
F.2	General Terminology and Concepts	254
F.3	Type System [IHN]	255
F.4	Bit Representations [STR]	256
F.5	Floating-point Arithmetic [PLF]	257
F.6	Enumerator Issues [CCB]	257
F.7	Numeric Conversion Errors [FLC]	258
F.8	String Termination [CJM]	258
F.9	Buffer Boundary Violation (Buffer Overflow) [HCB]	258
F.10	Unchecked Array Indexing [XYZ]	258
F.11	Unchecked Array Copying [XYW]	258
F.12	Pointer Casting and Pointer Type Changes [HFC]	258
F.13	Pointer Arithmetic [RVG]	259
F.14	Null Pointer Dereference [XYH]	259
F.15	Dangling Reference to Heap [XYK]	259
F.16	Arithmetic Wrap-around Error [FIF]	259
F.17	Using Shift Operations for Multiplication and Division [PIK]	259
F.18	Sign Extension Error [XZI]	259
F.19	Choice of Clear Names [NAI]	259
F.20	Dead Store [WXQ]	260
F.21	Unused Variable [YZS]	260
F.22	Identifier Name Reuse [YOW]	260
F.23	Namespace Issues [BJL]	261
F.24	Initialization of Variables [LAV]	261
F.25	Operator Precedence/Order of Evaluation [JCW]	261
F.26	Side-effects and Order of Evaluation [SAM]	262
F.27	Likely Incorrect Expression [KOA]	263
F.28	Dead and Deactivated Code [XYQ]	263
F.29	Switch Statements and Static Analysis [CLL]	264
F.30	Demarcation of Control Flow [EOJ]	264
F.31	Loop Control Variables [TEX]	264
F.32	Off-by-one Error [XZH]	264
F.33	Structured Programming [EWD]	265
F.34	Passing Parameters and Return Values [CSJ]	265
F.35	Dangling References to Stack Frames [DCM]	266
F.36	Subprogram Signature Mismatch [OTR]	266
F.37	Recursion [GDL]	267
F.38	Ignored Error Status and Unhandled Exceptions [OYB]	267
F.39	Termination Strategy [REU]	267
F.40	Type-breaking Reinterpretation of Data [AMV]	267
F.41	Memory Leak [XYL]	267
F.42	Templates and Generics [SYM]	268
F.43	Inheritance [RIP]	268
F.44	Extra Intrinsic [LRM]	268

F.45	Argument Passing to Library Functions [TRJ]	268
F.46	Inter-language Calling [DJS]	268
F.47	Dynamically-linked Code and Self-modifying Code [NYY]	269
F.48	Library Signature [NSQ]	269
F.49	Unanticipated Exceptions from Library Routines [HJW]	269
F.50	Pre-processor Directives [NMP]	269
F.51	Suppression of Language-defined Run-time Checking [MXB]	270
F.52	Provision of Inherently Unsafe Operations [SKL]	270
F.53	Obscure Language Features [BRS]	270
F.54	Unspecified Behaviour [BQF]	270
F.55	Undefined Behaviour [EWF]	270
F.56	Implementation-defined Behaviour [FAB]	271
F.57	Deprecated Language Features [MEM]	271
Annex G (informative) Vulnerability descriptions for the language SPARK		272
G.1	Identification of standards and associated documentation	272
G.2	General terminology and concepts	272
G.3	Type System [IHN]	273
G.4	Bit Representation [STR]	274
G.5	Floating-point Arithmetic [PLF]	274
G.6	Enumerator Issues [CCB]	274
G.7	Numeric Conversion Errors [FLC]	274
G.8	String Termination [CJM]	274
G.9	Buffer Boundary Violation (Buffer Overflow) [HCB]	274
G.10	Unchecked Array Indexing [XYZ]	274
G.11	Unchecked Array Copying [XYW]	274
G.12	Pointer Casting and Pointer Type Changes [HFC]	275
G.13	Pointer Arithmetic [RVG]	275
G.14	Null Pointer Dereference [XYH]	275
G.15	Dangling Reference to Heap [XYK]	275
G.16	Arithmetic Wrap-around Error [FIF]	275
G.17	Using Shift Operations for Multiplication and Division [PIK]	275
G.18	Sign Extension Error [XZI]	275
G.19	Choice of Clear Names [NAI]	275
G.20	Dead store [WXQ]	275
G.21	Unused Variable [YZS]	276
G.22	Identifier Name Reuse [YOW]	276
G.23	Namespace Issues [BJL]	276
G.24	Initialization of Variables [LAV]	276
G.25	Operator Precedence/Order of Evaluation [JCW]	276
G.26	Side-effects and Order of Evaluation [SAM]	276
G.27	Likely Incorrect Expression [KOA]	276
G.28	Dead and Deactivated Code [XYQ]	276
G.29	Switch Statements and Static Analysis [CLL]	277
G.30	Demarcation of Control Flow [EOJ]	277
G.31	Loop Control Variables [TEX]	277
G.32	Off-by-one Error [XZH]	277
G.33	Structured Programming [EWD]	277
G.34	Passing Parameters and Return Values [CSJ]	277
G.35	Dangling References to Stack Frames [DCM]	278
G.36	Subprogram Signature Mismatch [OTR]	278
G.37	Recursion [GDL]	278
G.38	Ignored Error Status and Unhandled Exceptions [OYB]	278
G.39	Termination Strategy [REU]	278
G.40	Type-breaking Reinterpretation of Data [AMV]	279
G.41	Memory Leak [XYL]	279
G.42	Templates and Generics [SYM]	279
G.43	Inheritance [RIP]	279
G.44	Extra Ininsics [LRM]	279
G.45	Argument Passing to Library Functions [TRJ]	279
G.46	Inter-language Calling [DJS]	279

G.47	Dynamically-linked Code and Self-modifying Code [NYY]	280
G.48	Library Signature [NSQ]	280
G.49	Unanticipated Exceptions from Library Routines [HJW]	280
G.50	Pre-Processor Directives [NMP]	280
G.51	Suppression of Language-defined Run-time Checking [MXB]	280
G.52	Provision of Inherently Unsafe Operations [SKL]	280
G.53	Obscure Language Features [BRS]	280
G.54	Unspecified Behaviour [BQF]	281
G.55	Undefined Behaviour [EWF]	281
G.56	Implementation-Defined Behaviour [FAB]	281
G.57	Deprecated Language Features [MEM]	281
G.58	Implications for standardization	281

Annex H (informative) Vulnerability descriptions for the language PHP 282

H.1	Identification of standards and associated documentation	282
H.2	General Terminology and Concepts	283
H.3	Type System [IHN]	284
H.4	Bit Representations [STR]	285
H.5	Floating-point Arithmetic [PLF]	286
H.6	Enumerator Issues [CCB]	286
H.7	Numeric Conversion Errors [FLC]	287
H.8	String Termination [CJM]	288
H.9	Buffer Boundary Violation (Buffer Overflow) [HCB]	289
H.10	Unchecked Array Indexing [XYZ]	289
H.11	Unchecked Array Copying [XYW]	289
H.12	Pointer Casting and Pointer Type Changes [HFC]	289
H.13	Pointer Arithmetic [RVG]	289
H.14	Null Pointer Dereference [XYH]	290
H.15	Dangling Reference to Heap [XYK]	290
H.16	Arithmetic Wrap-around Error [FIF]	290
H.17	Using Shift Operations for Multiplication and Division [PIK]	291
H.18	Sign Extension Error [XZI]	292
H.19	Choice of Clear Names [NAI]	292
H.20	Dead Store [WXQ]	293
H.21	Unused Variable [YZS]	294
H.22	Identifier Name Reuse [YOW]	294
H.23	Namespace Issues [BJL]	295
H.24	Initialization of Variables [LAV]	296
H.25	Operator Precedence/Order of Evaluation [JCW]	296
H.26	Side-effects and Order of Evaluation [SAM]	297
H.27	Likely Incorrect Expression [KOA]	298
H.28	Dead and Deactivated Code [XYQ]	299
H.29	Switch Statements and Static Analysis [CLL]	300
H.30	Demarcation of Control Flow [EOJ]	300
H.31	Loop Control Variables [TEX]	301
H.32	Off-by-one Error [XZH]	301
H.33	Structured Programming [EWD]	302
H.34	Passing Parameters and Return Values [CSJ]	303
H.35	Dangling References to Stack Frames [DCM]	303
H.36	Subprogram Signature Mismatch [OTR]	303
H.37	Recursion [GDL]	304
H.38	Ignored Error Status and Unhandled Exceptions [OYB]	304
H.39	Termination Strategy [REU]	305
H.40	Type-breaking Reinterpretation of Data [AMV]	306
H.41	Memory Leak [XYL]	306
H.42	Templates and Generics [SYM]	306
H.43	Inheritance [RIP]	307
H.44	Extra Intrinsic [LRM]	307
H.45	Argument Passing to Library Functions [TRJ]	307
H.46	Inter-language Calling [DJS]	307
H.47	Dynamically-linked Code and Self-modifying Code [NYY]	308

H.48	Library Signature [NSQ]	308
H.49	Unanticipated Exceptions from Library Routines [HJW]	308
H.50	Pre-processor Directives [NMP]	309
H.51	Suppression of Run-time Checking [MXB]	309
H.52	Provision of Inherently Unsafe Operations [SKL]	309
H.53	Obscure Language Features [BRS]	309
H.54	Unspecified Behaviour [BQF]	310
H.55	Undefined Behaviour [EWF]	311
H.56	Implementation-defined Behaviour [FAB]	312
H.57	Deprecated Language Features [MEM]	312
Bibliography		313
Index		316