ISO/IEC 19507:2012-04 (E)

Information technology - Object Management Group Object Constraint Language (OCL)

Contents

Page

Foreword ix

Introduction x

1 Scope 1

2 Conformance 1

3 References 2
3.1 Normative References 2
3.2 Informative References 2

4 Terms and Definitions 3

5 Notational Conventions 3

6 Additional Information 3
6.1 Changes to Adopted OMG Specifications 3
6.2 Structure of the Specification 3
6.3 Acknowledgements 4

7 OCL Language Description 5
7.1 General 5
7.2 Why OCL? 5
7.2.1 Where to Use OCL 5
7.3 Introduction 6
7.3.1 Legend 6
7.3.2 Example Class Diagram 6
7.3.3 Character Set 7
7.4 Relation to the UML Metamodel 7
7.4.1 Self 7
7.4.2 Specifying the UML Context 7
7.4.3 Invariants 8
7.4.4 Pre- and Postconditions 8
7.4.5 Package Context 9
7.4.6 Operation Body Expression 9
7.4.7 Initial and Derived Values 9
7.4.8 Other Types of Expressions 10
7.5 Basic Values and Types 10
7.5.1 Types from the UML Model 11
7.5.2 Enumeration Types 11
7.5.3 Let Expressions 11
7.5.4 Additional operations/attributes through «definition» expressions 12
7.5.5 Type Conformance 12
7.5.6 Re-typing or Casting 13
7.5.7 Precedence Rules 14
7.5.8 Use of Infix Operators 14
7.5.9 Keywords 15
7.5.10 Comment 16
7.5.11 Invalid Values 16
7.6 Objects and Properties 16

7.6.1 Properties: Attributes 17
7.6.2 Properties: Operations 17
7.6.3 Properties: AssociationEnds and Navigation 18
7.6.4 Navigation to Association Classes 20
7.6.5 Navigation from Association Classes 21
7.6.6 Navigation through Qualified Associations 21
7.6.7 Using Pathnames for Packages 21
7.6.8 Accessing overridden properties of supertypes 22
7.6.9 Predefined properties on All Objects 22
7.6.10 Features on Classes Themselves 23
7.6.11 Collections 24
7.6.12 Collections of Collections 25
7.6.13 Collection Type Hierarchy and Type Conformance Rules 25
7.6.14 Previous Values in Postconditions 25
7.6.15 Tuples 26
7.7 Collection Operations 27
7.7.1 Select and Reject Operations 27
7.7.2 Collect Operation 28
7.7.3 ForAll Operation 29
7.7.4 Exists Operation 30
7.7.5 Closure Operation 30
7.7.6 Iterate Operation 31
7.8 Messages in OCL 32
7.8.1 Calling operations and sending signals 32
7.8.2 Accessing result values 33
7.8.3 An example 33
7.9 Resolving Properties 34

8 Abstract Syntax 35
8.1 Introduction 35
8.2 The Types Package 35
8.2.1 Type Conformance 38
8.2.2 Operations and Well-formedness Rules for the Types Package 40
8.3 The Expressions Package 42
8.3.1 Expressions Core 43
8.3.2 FeatureCall Expressions 45
8.3.3 If Expressions 47
8.3.4 Message Expressions 48
8.4 Literal Expressions 49
8.4.1 Let Expressions 52
8.4.2 Well-formedness Rules of the Expressions package 53
8.4.3 Additional Operations on UML metaclasses 60
8.4.4 Additional Operations on OCL Metaclasses 62
8.4.5 Overview of class hierarchy of OCL Abstract Syntax metamodel 64

9 Concrete Syntax 65
9.1 General 65
9.2 Structure of the Concrete Syntax 65
9.3 A Note to Tool Builders 67
9.3.1 Parsing 67
9.3.2 Visibility 67
9.4 Concrete Syntax 67
9.4.1 ExpressionInOclCS 68
9.4.2 OclExpressionCS 68
9.4.3 VariableExpCS 69
9.4.4 simpleNameCS 69
9.4.5 restrictedKeywordCS 70
9.4.6 unreservedSimpleNameCS 71
9.4.7 pathNameCS 71
9.4.8 LiteralExpCS 72
9.4.9 EnumLiteralExpCS 72
9.4.10 CollectionLiteralExpCS 73

9.4.11 CollectionTypeIdentifierCS 73
9.4.12 CollectionLiteralPartsCS 74
9.4.13 CollectionLiteralPartCS 74
9.4.14 CollectionRangeCS 74
9.4.15 PrimitiveLiteralExpCS 75
9.4.16 TupleLiteralExpCS 76
9.4.17 UnlimitedNaturalLiteralExpCS 76
9.4.18 IntegerLiteralExpCS 76
9.4.19 RealLiteralExpCS 77
9.4.20 StringLiteralExpCS 77
9.4.21 BooleanLiteralExpCS 78
9.4.22 TypeLiteralExpCS 78
9.4.23 CallExpCS 79
9.4.24 LoopExpCS 79
9.4.25 IteratorExpCS 80
9.4.26 IterateExpCS 83
9.4.27 VariableDeclarationCS 84
9.4.28 TypeCS 85
9.4.29 primitiveTypeCS 85
9.4.30 oclTypeCS 86
9.4.31 collectionTypeCS 86
9.4.32 tupleTypeCS 87
9.4.33 variableDeclarationListCS 87
9.4.34 FeatureCallExpCS 88
9.4.35 OperationCallExpCS 88
9.4.36 PropertyCallExpCS 91
9.4.37 NavigationCallExpCS 93
9.4.38 AssociationClassCallExpCS 93
9.4.39 isMarkedPreCS 94
9.4.40 argumentsCS 94
9.4.41 LetExpCS 95
9.4.42 LetExpSubCS 95
9.4.43 OclMessageExpCS 96
9.4.44 OclMessageArgumentsCS 97
9.4.45 OclMessageArgCS 97
9.4.46 IfExpCS 98
9.4.47 NullLiteralExpCS 98
9.4.48 InvalidLiteralExpCS 99
9.4.49 Comments 99
9.5 Environment Definition 99
9.5.1 Environment 99
9.5.2 NamedElement 102
9.5.3 Namespace 102
9.6 Concrete to Abstract Syntax Mapping 102
9.7 Abstract Syntax to Concrete Syntax Mapping 103

10 Semantics Described Using UML 105
10.1 Introduction 105
10.2 The Values Package 106
10.2.1 Definitions of Concepts for the Values Package 107
10.2.2 Well-formedness Rules for the Values Package 111
10.2.3 Additional Operations for the Values Package 113
10.2.4 Overview of the Values Package 114
10.3 The Evaluations Package 115
10.3.1 Definitions of Concepts for the Evaluations Package 116
10.3.2 Well-formedness Rules of the Evaluations Package 125
10.3.3 Additional Operations of the Evaluations Package 132
10.3.4 Overview of the Values Package 133
10.4 The AS-Domain-Mapping Package 134
10.4.1 Well-formedness rules for the AS-Domain-Mapping.type-value Package 135
10.4.2 Additional Operations for the AS-Domain-Mapping.type-value Package 137
10.4.3 Well-formedness rules for the AS-Domain-Mapping.exp-eval Package 137

11 OCL Standard Library 145
11.1 Introduction 145
11.2 The OclAny, OclVoid, OclInvalid, and OclMessage Types 146
11.2.1 OclAny 146
11.2.2 OclMessage 146
11.2.3 OclVoid 146
11.2.4 OclInvalid 146
11.3 Operations and Well-formedness Rules 146
11.3.1 OclAny 146
11.3.2 OclVoid 148
11.3.3 OclMessage 148
11.4 Primitive Types 148
11.4.1 Real 148
11.4.2 Integer 148
11.4.3 String 149
11.4.4 Boolean 149
11.4.5 UnlimitedNatural 149
11.5 Operations and Well-formedness Rules 149
11.5.1 Real 149
11.5.2 Integer 150
11.5.3 String 151
11.5.4 Boolean 153
11.5.5 UnlimitedNatural 154
11.6 Collection-Related Types 155
11.6.1 Collection 156
11.6.2 Set 156
11.6.3 OrderedSet 156
11.6.4 Bag 156
11.6.5 Sequence 156
11.7 Operations and Well-formedness Rules 156
11.7.1 Collection 156
11.7.2 Set 159
11.7.3 OrderedSet 161
11.7.4 Bag 163
11.7.5 Sequence 165
11.8 Predefined Iterator Expressions 168
11.8.1 Extending the Standard Library with Iterator Expressions 168
11.9 Mapping Rules for Predefined Iterator Expressions 168
11.9.1 Collection 168
11.9.2 Set 170
11.9.3 Bag 171
11.9.4 Sequence 172
11.9.5 OrderedSet 173

12 The Use of OCL Expressions in UML Models 175
12.1 Introduction 175
12.2 The ExpressionInOcl Type 175
12.2.1 ExpressionInOcl 176
12.3 Well-formedness Rules 176
12.3.1 ExpressionInOcl 176
12.4 Standard Placements of OCL Expressions 177
12.4.1 How to Extend the Use of OCL at Other Places 177
12.5 Definition 177
12.5.1 Well-formedness Rules 177
12.6 Invariant 178
12.6.1 Well-formedness rules 178
12.7 Precondition 179
12.7.1 Well-formedness rules 179
12.7.2 Postcondition 180
12.7.3 Well-formedness rules 180
12.8 Initial Value Expression 180

12.8.1 Well-formedness rules 181
12.9 Derived Value Expression 182
12.10 Operation Body Expression 182
12.11 Guard 182
12.11.1 Well-formedness rules 183
12.12 Concrete Syntax of Context Declarations 183
12.12.1 packageDeclarationCS 184
12.12.2 contextDeclarationCS 184
12.12.3 propertyContextDeclCS 184
12.12.4 initOrDerValueCS 184
12.12.5 classifierContextDeclCS 184
12.12.6 invOrDefCS 184
12.12.7 defExpressionCS 185
12.12.8 operationContextDeclCS 185
12.12.9 prePostOrBodyDeclCS 185
12.12.10 operationCS 185
12.12.11 parametersCS 185

13 The Basic OCL and Essential OCL 187
13.1 Introduction 187
13.2 OCL Adaptation for Metamodeling 187
13.3 Diagrams 188

Annex A - Semantics 193

Annex B - Bibliography 229

Annex C - Legal Information 231