## FindBugs for Java

```
module FindBugs
 Class is final but declares protected field
 @param class the class
def CI_CONFUSED_INHERITANCE(class : ClassConcept) : Void = {
 assert class.isFinal == true
 member := class.member
 assert member instanceOf FieldDeclaration
                                                                                                    11
  assert member.visibility instanceOf ProtectedVisibility
 Abstract class defines covariant equals() method
                                                                                                    16
 Oparam class the class
def EQ_ABSTRACT_SELF(class : ClassConcept) : Void = {
                                                                                                    20
 method := class.member
                                                                                                    21
 assert method instanceOf InstanceMethodDeclaration
                                                                                                   23
 // check method name and return type
 name := method.name
                                                                                                    25
 assert method.returnType instanceOf BooleanType
                                                                                                    26
 assert eval(name.equals("equals"))
                                                                                                   27
                                                                                                   28
  // assert that the method has only one parameter
 assert count getParameters(method) == 1
                                                                                                    30
 // and check that the parameter's type is the same as the class
 parameter := getParameters (method)
                                                                                                    33
 parameterType := parameter.type
 assert parameterType instanceOf ClassifierType
                                                                                                    35
  assert class == parameterType.classifier
                                                                                                    37
                                                                                                    39
 Class defines covariant compareTo() method
                                                                                                    40
 @param class the class
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def CO_SELF_NO_OBJECT(class : ClassConcept) : Void = {
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 // check that the class implements the Comparable interface
                                                                                                    45
 assert def comparables(class)
                                                                                                    47
 method := class.member
 assert method instanceOf InstanceMethodDeclaration
                                                                                                    49
                                                                                                    50
  // check method name and return type
                                                                                                    51
 name := method.name
                                                                                                    52
  assert method.returnType instanceOf IntegerType
  assert eval(name.equals("compareTo"))
                                                                                                    54
 // assert that the method has only one parameter
 count := count getParameters(method)
  assert eval(count == 1)
                                                                                                    59
  // and check that the parameter's type is not Object
 parameter := getParameters (method)
                                                                                                   61
 parameterType := parameter.type
  assert parameterType instanceOf ClassifierType
                                                                                                   63
  assert eval(!parameterType.classifier.name.equals(Object.class.getSimpleName()))
                                                                                                   64
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 Class is Serializable but its superclass doesn't define a void constructor
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 @param class the class
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def SE_NO_SUITABLE_CONSTRUCTOR(class : ClassConcept) : Void = {
                                                                                                     72
 superClass := class.superclass.classifier
                                                                                                     73
 assert def serializables(class)
 assert undef serializables(superClass)
                                                                                                     75
 assert undef noArgConstructor(superClass)
                                                                                                     76
                                                                                                     77
 Enumerates methods which performdDubious catching of IllegalMonitorStateException
                                                                                                     80
                                                                                                     81
  @param method the method
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                                                                                                     83
def IMSE_DONT_CATCH_IMSE(method : BaseMethodDeclaration) : Void = {
 assert catchClause instanceOf CatchClause
                                                                                                     85
 type := catchClause.throwable.type
 assert eval(type.isInstanceOf(ClassifierType) && type : ClassifierType.classifier.name.equals(|sr
   IllegalMonitorStateException.class.getSimpleName()))
 method := eval(catchClause.ancestor<concept = BaseMethodDeclaration>)
                                                                                                     89
                                                                                                     90
                                                                                                     91
 Enumerates unused fields
                                                                                                     93
 @param field the field
                                                                                                     94
                                                                                                     95
def UUF UNUSED FIELD(field : FieldDeclaration) : Void = {
                                                                                                     96
 assert undef referencedVariables(field)
                                                                                                     98
                                                                                                     99
/**
                                                                                                     100
 A class's finalize() method should have protected access, not public.
                                                                                                     101
                                                                                                     102
 @param class the class
                                                                                                     103
                                                                                                     104
def FI_PUBLIC_SHOULD_BE_PROTECTED(class : ClassConcept) : Void = {
                                                                                                     105
 method := class.member
                                                                                                     106
 assert method instanceOf InstanceMethodDeclaration
                                                                                                     107
                                                                                                     108
  // check method name and return type
 name := method.name
                                                                                                     110
 type := method.returnType
                                                                                                     111
  assert eval(name.equals("finalize") && type.isInstanceOf(VoidType))
                                                                                                     112
                                                                                                     113
  // assert that the method has no parameter
                                                                                                     114
 assert count getParameters(method) == 0
                                                                                                     115
                                                                                                     116
  // assert that the method's visibility is public
                                                                                                     117
  assert method.visibility instanceOf PublicVisibility
                                                                                                     118
                                                                                                     119
                                                                                                     120
 Method invokes dangerous method runFinalizersOnExit
                                                                                                     122
                                                                                                     123
  @param class the class which contains the method
                                                                                                     124
                                                                                                     125
def DM_RUN_FINALIZERS_ON_EXIT(class : ClassConcept) : Void = {
 assert call instanceOf StaticMethodCall
                                                                                                     127
 assert eval(call.staticMethodDeclaration.name.equals("runFinalizersOnExit"))
                                                                                                     128
  classifier := call.classConcept
                                                                                                     129
 assert eval(classifier.name.equals(Runtime.class.getSimpleName()) || classifier.name.equals(
                                                                                                     130
    System.class.getSimpleName()))
  class := eval(call.ancestor<concept = ClassConcept>)
                                                                                                     131
```

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}
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                                                                                                      133
/**
                                                                                                      134
 Class defines equals() and does not define Object.hashCode()
                                                                                                      136
 Oparam class the class
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                                                                                                      138
def HE EOUALS USE HASHCODE(class : ClassConcept) : Void = {
                                                                                                      139
 assert def getEqualsMethod(class)
                                                                                                      140
 assert undef getHashCodeMethod(class)
                                                                                                      141
                                                                                                      142
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                                                                                                      144
 Enumerates binary operations which compare String objects using == or !=
                                                                                                      146
 @param op the binary operation
                                                                                                      148
def ES_COMPARING_STRINGS_WITH_EQ(op : BinaryOperation) : Void = {
                                                                                                      149
 assert def ES_COMPARING_STRINGS_WITH_EQ_0 (op)
                                                                                                      150
 assert op instanceOf NotEqualsExpression
                                                                                                      151
} alt {
                                                                                                      152
 assert def ES COMPARING STRINGS WITH EO 0 (op)
                                                                                                      153
 assert op instanceOf EqualsExpression
                                                                                                      155
                                                                                                      156
                                                                                                      157
 Helper function of ES_COMPARING_STRINGS_WITH_EQ
                                                                                                      158
 Looks up string literals or string-typed variable references on the
 two sides of the binary operation
                                                                                                      160
                                                                                                      161
 @param op the binary operation
                                                                                                      162
                                                                                                      163
private def ES_COMPARING_STRINGS_WITH_EQ_0(op : BinaryOperation) : Void = {
  (left, right) := getBinaryParts(op)
                                                                                                      165
  assert left instanceOf StringLiteral
                                                                                                      166
  assert right instanceOf StringLiteral
                                                                                                      167
} alt {
                                                                                                      168
  (left, right) := getBinaryParts(op)
                                                                                                      169
  assert left instanceOf VariableReference
                                                                                                      170
 var := left.variableDeclaration
                                                                                                      171
 assert def getVariablesWithStringType(var)
                                                                                                      172
 assert right instanceOf StringLiteral
                                                                                                      173
} alt {
  (left, right) := getBinaryParts(op)
                                                                                                      175
  assert right instanceOf VariableReference
 var := right.variableDeclaration
                                                                                                      177
 assert def getVariablesWithStringType(var)
                                                                                                      178
  assert left instanceOf StringLiteral
                                                                                                      179
} alt {
                                                                                                      180
  (left, right) := getBinaryParts(op)
                                                                                                      181
 assert left instanceOf VariableReference
                                                                                                      182
 v1 := left.variableDeclaration
                                                                                                      183
 assert def getVariablesWithStringType(v1)
                                                                                                      184
 assert right instanceOf VariableReference
                                                                                                      185
 v2 := right.variableDeclaration
                                                                                                      186
 assert def getVariablesWithStringType(v2)
                                                                                                      187
                                                                                                      189
// HELPER FUNCTIONS
                                                                                                      190
                                                                                                      191
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 Returns the left and right hand side expressions of a binary operation
                                                                                                      194
 @param op the binary operation
                                                                                                      195
 @return the left and right hand side expressions
                                                                                                      196
                                                                                                      197
private def getBinaryParts(op : BinaryOperation) : (Expression, Expression) = {
 left := op.leftExpression
                                                                                                      199
```

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right := op.rightExpression
                                                                                                        200
  return (left, right)
                                                                                                        201
                                                                                                        202
                                                                                                        203
/**
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 Enumerates the variable declarations with string type
                                                                                                        205
                                                                                                        206
 @param var the variable declaration
                                                                                                        207
                                                                                                        208
private def getVariablesWithStringType(var : VariableDeclaration) : Void = {
                                                                                                        209
 assert var.type instanceOf StringType
                                                                                                        210
                                                                                                        211
                                                                                                        212
/**
                                                                                                        213
 Returns the equals method of a class
                                                                                                        214
                                                                                                        215
  @param class the class
                                                                                                        216
 @return the equals method
                                                                                                        217
                                                                                                        218
private def getEqualsMethod(class : ClassConcept) : InstanceMethodDeclaration = {
                                                                                                        219
 method := class.member
                                                                                                        220
  assert method instanceOf InstanceMethodDeclaration
                                                                                                        221
  // check method name and {\bf return} type
                                                                                                        223
  name := method.name
                                                                                                        224
  assert method.returnType instanceOf BooleanType
                                                                                                        225
  assert eval(name.equals("equals"))
                                                                                                        226
  \ensuremath{//} assert that the method has only one parameter
                                                                                                        228
  assert count getParameters(method) == 1
                                                                                                        229
                                                                                                        230
 \ensuremath{//} and check that the parameter's type is the same as the class
                                                                                                        231
 parameter := getParameters(method)
                                                                                                        232
 parameterType := parameter.type
                                                                                                        233
  assert parameterType instanceOf ClassifierType
                                                                                                        234
  assert eval(parameterType.classifier.name.equals(Object.class.getSimpleName())))
                                                                                                        235
                                                                                                        236
  return method
                                                                                                        237
                                                                                                        238
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/**
                                                                                                        240
 Returns the hashCode method of a class
                                                                                                        241
                                                                                                        242
 @param class the class
                                                                                                        243
 @return the hashCode method
                                                                                                        245
private def getHashCodeMethod(class : ClassConcept) : InstanceMethodDeclaration = {
                                                                                                        246
 method := class.member
                                                                                                        247
  assert method instanceOf InstanceMethodDeclaration
                                                                                                        248
                                                                                                        249
 // check method name and return type
                                                                                                        250
 name := method.name
  assert method.returnType instanceOf IntegerType
                                                                                                        252
  assert eval(name.equals("hashCode"))
                                                                                                        253
                                                                                                        254
  // assert that the method has only one parameter
                                                                                                        255
  assert count getParameters(method) == 1
                                                                                                        257
  return method
                                                                                                        258
                                                                                                        259
                                                                                                        260
                                                                                                        261
 Enumerates variables which are referenced
                                                                                                        262
                                                                                                        263
  @param variable the variable
                                                                                                        264
                                                                                                        265
private def referencedVariables(variable : VariableDeclaration) : Void = {
                                                                                                        266
 assert reference instanceOf VariableReference
                                                                                                        267
```

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assert variable == reference.variableDeclaration
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// returns the super class of given class
                                                                                                      271
                                                                                                      272
 Returns the superclass of a class
                                                                                                      273
                                                                                                      274
 Oparam c the subclass
                                                                                                      275
 @return the superclass
                                                                                                      276
                                                                                                      277
private def getSuperClass(c : ClassConcept) : ClassConcept = {
                                                                                                      278
 s := c.superclass.classifier
                                                                                                      279
 assert s instanceOf ClassConcept
                                                                                                      280
 return s
                                                                                                      281
                                                                                                      282
                                                                                                      283
/**
                                                                                                      284
 Returns the no-arg constructor of a class.
                                                                                                      285
                                                                                                      286
 @param class the class
                                                                                                      287
 @return the no-arg constructor
                                                                                                      289
private def noArgConstructor(class : ClassConcept) : ConstructorDeclaration = {
                                                                                                      290
 constructor := class.member
                                                                                                      291
 assert constructor instanceOf ConstructorDeclaration
                                                                                                      292
 count := count getParameters(constructor)
                                                                                                      293
 assert count == 0
                                                                                                      294
 return constructor
                                                                                                      296
                                                                                                      297
                                                                                                      298
 Enumerates the classes which implement the Comparable interface
                                                                                                      299
                                                                                                      300
 Oparam class the class
                                                                                                      301
                                                                                                      302
private def comparables(class : ClassConcept) : << ... >> = {
                                                                                                      303
 interface := class.implementedInterface
                                                                                                      304
 assert eval(interface.classifier.name.equals(Comparable.class.getSimpleName()))
                                                                                                      305
                                                                                                      306
                                                                                                      307
/**
                                                                                                      308
 Enumerates the classes which implement the Serializable interface
                                                                                                      309
                                                                                                      310
 Oparam class the class
                                                                                                      311
                                                                                                      312
private def serializables(class : ClassConcept) : << ... >> = {
                                                                                                      313
 interface := class.implementedInterface
                                                                                                      314
 assert eval(interface.classifier.name.equals(Serializable.class.getSimpleName()))
                                                                                                      315
                                                                                                      316
                                                                                                      317
                                                                                                      318
 Returns the parameter(s) of a method
                                                                                                      319
                                                                                                      320
 @param method the method
                                                                                                      321
 @return the parameter(s)
                                                                                                      322
                                                                                                      323
private def getParameters(method : BaseMethodDeclaration) : ParameterDeclaration = {
 return method.parameter
                                                                                                      325
                                                                                                      326
```