

# PROJET AVL

I. Introduction

II. Structure du projet

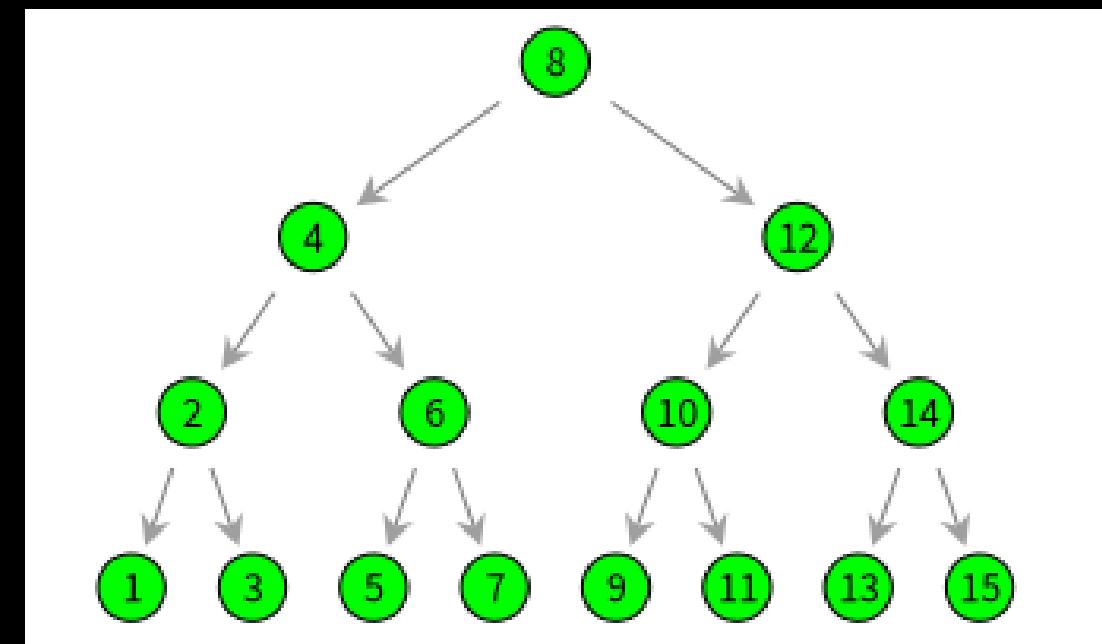
III. Code coverage &  
Mutation testing

IV. Conclusion

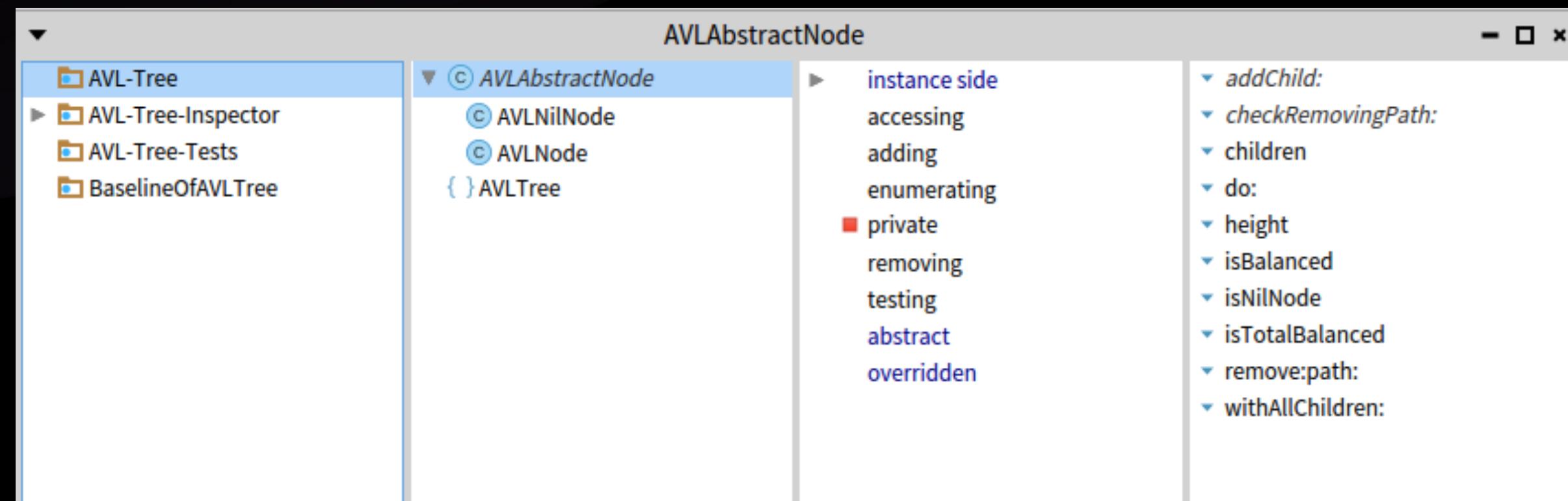
# I. INTRODUCTION

## AVL C'est quoi ?

- Arbre binaire de recherche auto-équilibré possédant une racine et de sorte que chaque nœud possède au maximum 2 éléments fils.
- Les hauteurs des deux sous-arbres d'un même nœud diffèrent au plus de un



## II. STRUCTURE DU PROJET



- AVL-Tree : Le package principal pour l'implémentation de l'arbre AVL
- AVL-Tree-Inspector : contient des outils d'inspection spécifiques pour l'arbre AVL.
- AVL-Tree-Tests : contient les tests unitaires pour l'implémentation de l'arbre AVL.
- AVL-Tree : un package de configuration ou de gestion des dépendances.

## II. STRUCTURE DU PROJET

### Implémentation du code

Classe abstraite

```
Object subclass: #AVLAbstractNode  
instanceVariableNames: ''  
classVariableNames: ''  
package: 'AVL-Tree'
```

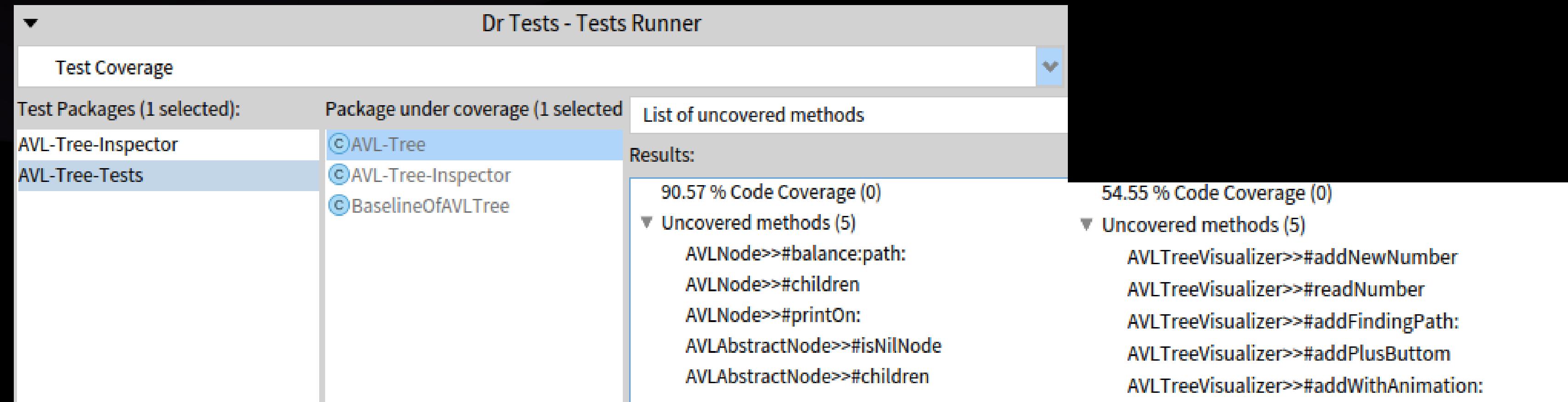
Classe représentant un noeud vide

```
AVLAbstractNode subclass: #AVLNilNode  
instanceVariableNames: ''  
classVariableNames: ''  
package: 'AVL-Tree'
```

Classe représentant un noeud non vide

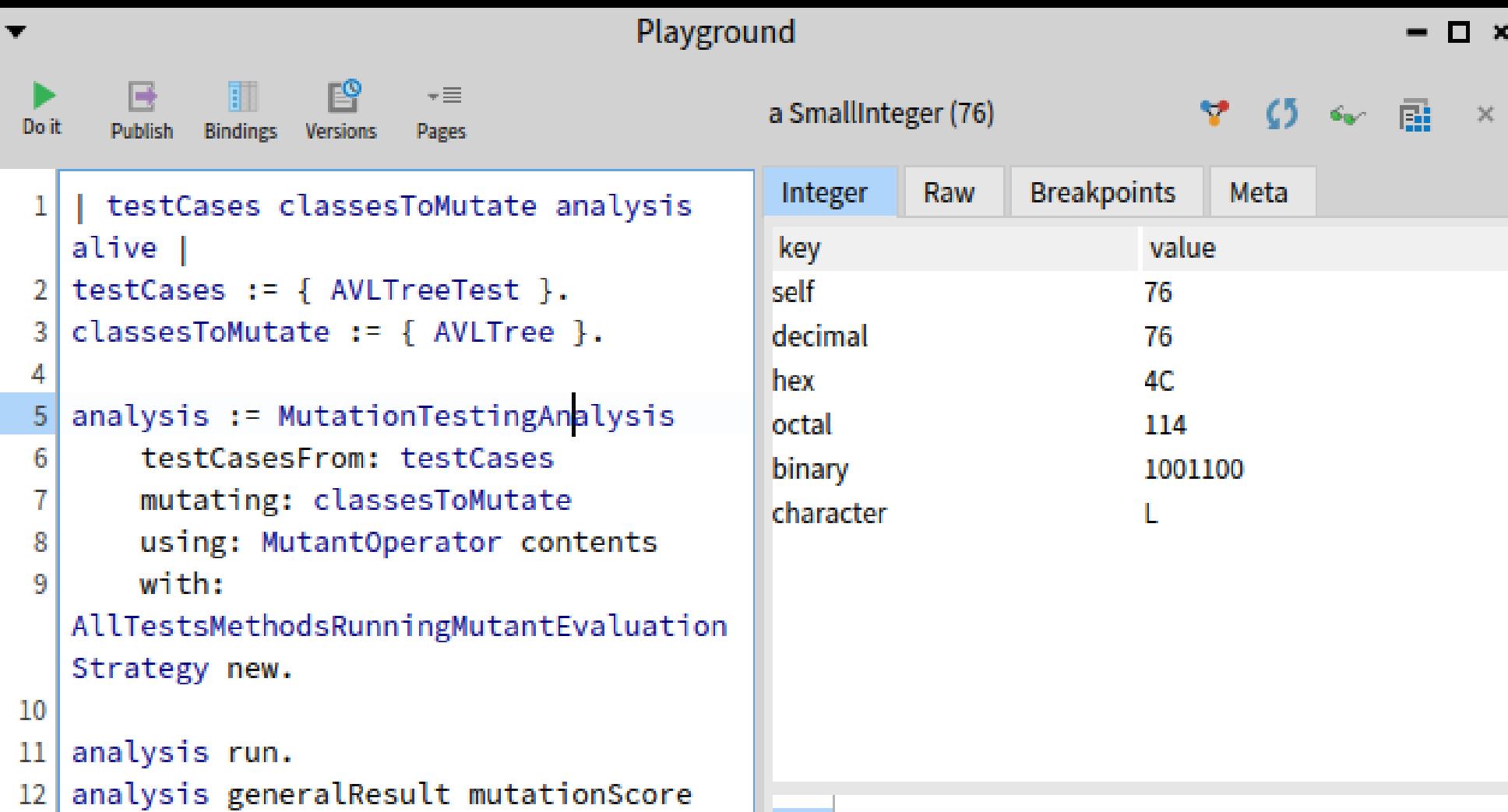
```
AVLAbstractNode subclass: #AVLNode  
instanceVariableNames: 'left contents right'  
classVariableNames: ''  
package: 'AVL-Tree'
```

## III.A. CODE COVERAGE



- Plus de 90% de couverture de test pour la classe principale
- 5 Méthodes non couvertes
- Ne mesure pas la pertinence et la précision des Tests
- Pas un indicateur de performance des tests

## III.B. MUTATION TESTING



The screenshot shows a 'Playground' window with a toolbar at the top featuring 'Do it', 'Publish', 'Bindings', 'Versions', and 'Pages' buttons. The main area has a title 'a SmallInteger (76)' above a table. The table has four tabs: 'Integer' (selected), 'Raw', 'Breakpoints', and 'Meta'. The 'Integer' tab displays the value 76 in various formats: self (76), decimal (76), hex (4C), octal (114), binary (1001100), and character (L). The code editor on the left contains the following code:

```
1 | testCases classesToMutate analysis
  alive |
2 testCases := { AVLTreeTest }.
3 classesToMutate := { AVLTree }.
4
5 analysis := MutationTestingAnalysis
  testCasesFrom: testCases
  mutating: classesToMutate
  using: MutantOperator contents
  with:
    AllTestsMethodsRunningMutantEvaluation
    Strategy new.
10
11 analysis run.
12 analysis generalResult mutationScore
```

- 76% de Couverture de Mutation
- 24% de Mutations non Déetectées

## III.B. MUTATION TESTING

+ Variable	+ Value
self	17 mutants, 13 killed, 4 alive, 0 terminated. Mutation Score: 76%.
{ } particularResults	an OrderedCollection [17 items] (Remove ^ in AVLTree>>#add: Remove ^ in AVLTree>>#height Remove [...])
Σ elapsedTime	0:00:00:00.243

+ + Value
1 Remove ^ in AVLTree>>#add:
2 Remove ^ in AVLTree>>#includes:
3 Remove ^ in AVLTree>>#remove:ifAbsent:
4 Remove ^ in AVLTree>>#inspectorCanvas

- 4 mutants toujours en vie
- Amélioration du score de mutation possible

# III.B. MUTATION TESTING

## Suppression des mutants

Mutant 1 (add)

```
add: newObject  
  
    root := root addChild: newObject.  
    ^ newObject
```

Mutant 2 (includes)

```
includes: anObject  
  
anObject ifNil: [ ^ nil ].  
^ (self search: anObject) notNil
```

Mutant 3 (remove)

```
| toRemove path |  
path := OrderedCollection new.  
toRemove := root remove: oldObject path: path.  
toRemove ifNil: [ ^ anExceptionBlock value ].  
  
toRemove == root ifTrue: [  
    root := root successor: path.  
    root ifNil: [ root := AVLNilNode new ].  
root checkRemovingPath: path.  
  
^ toRemove contents
```

Mutant 4 (inspectorCanvas)

```
inspectorCanvas  
  
<inspectorPresentationOrder: 90 title: 'AVL'>  
^ AVLTreeVisualizer new  
    tree: self;  
    asPresenter
```

## III.B. MUTATION TESTING

### Modifications apportées

Variable	Value
self	13 mutants, 13 killed, 0 alive, 0 terminated. Mutation Score: 100%.

- Tout les mutants ont été éliminés
- Amélioration du Mutation score

## IV. CONCLUSION

- Petit projet avec très peu de classe
- Pas de Design Pattern évident
- Méthodes assez courtes
- Coverage de test améliorable
- Très peu de documentation

# ARTEFACT

# Dr Tests - Tests Runner

Test Coverage

Test Packages (1 selected): Artefact-Core-Tests

Package under coverage (1 selected)

- AI-Algorithms-Graph
- AI-Algorithms-Graph-Components
- AI-Algorithms-Graph-Tests
- AST-Core
- AST-Core-Tests
- AST-Core-Traits
- Announcements-Core
- Announcements-Core-Tests
- Artefact-Core
- Artefact-Core-Tests
- Artefact-Examples
- Athens-Balloon
- Athens-Cairo

List of uncovered methods

Results:

- 60.00 % Code Coverage (0)
- Uncovered methods (2)
- Partially covered methods (0)

Playground

a Duration (0:00:18:58.769)

Do it Publish Bindings Versions Pages

```
1 testCases := {PDFBasicTest . PDFColorTest . PDFDataTypeTest
.PDFDemosTest . PDFFieldTest . PDFFontTest . PDFGeneratorTest
.PDFHorizontalLayoutTest . PDFParagraphTest . PDFStreamPrinterTest }|.
2 classesToMutate := 'Artefact-Core'asPackage definedClasses.
3
4 analysis := MutationTestingAnalysis
5   testCasesFrom: testCases
6   mutating: classesToMutate
7   using: MutantOperator contents
8   with: AllTestsMethodsRunningMutantEvaluationStrategy new.
9
10 analysis run.
11 testSelection := [analysis run.] timeToRun. "0:00:01:19.115"
```

Details Raw Breakpoints Meta

key	value
self	0:00:18:58.769
human readable	18 minutes 58 seconds 769 milliseconds
days	0
hours	0
minutes	18
seconds	58
nanoseconds	769000000

1 self

+L

Line: 1:26

## Playground

Do it Publish Bindings Versions Pages

```
1 analysis generalResult mutationScore
```

a SmallInteger (31)

Integer Raw Breakpoints Meta

key	value
self	31
decimal	31
hex	1F
octal	37
binary	11111
character	

Playground

an OrderedCollection [826 i...]

Do it Publish Bindings Versions Pages

Items Raw Breakpoints Meta

: In : Value

- 1 Remove ^ in PDFJpegElement class>>#fromMorph:
- 2 Replace #+ with #- in PDFBezierCurveElement>>#producePageElementCodeWith:styleSheet:
- 3 Replace do block with [:each |] in PDFBezierCurveElement>>#producePageElementCodeWith:styleSheet:
- 4 Remove ^ in PDFPage>>#defaultFormat
- 5 Remove ^ in PDFPage>>#margins
- 6 Remove ^ in PDFPage class>>#elements:
- 7 Remove ^ in PDFPage class>>#element:
- 8 Remove ^ in PDFDataXRef>>#acceptVisitor:
- 9 Remove ^ in PDFOpacityLuminosity>>#blendMode
- 10 Remove ^ in PDFDataStream>>#acceptVisitor:
- 11 Remove ^ in PDFOpacityColorDodge>>#blendMode
- 12 Remove ^ in PDFDataAssociativeArray>>#acceptVisitor:
- 13 Remove ^ in PDFFbookFormat>>#defaultSize
- 14 Remove ^ in PDFCodeSegment>>#isSecure
- 15 Remove ^ in PDFCodeSegment>>#printWith:
- 16 Remove ^ in PDFCodeSegment class>>#isAbstract
- 17 Replace a == b with (a == b) not in PDFCodeSegment class>>#isAbstract

1 self

#	Results
1	Remove ^ in PDFDotted>>#generateCodeWith:
2	Remove ^ in PDFDotted>>#space
3	Remove ^ in PDFDotted>>#length
4	Remove ^ in PDFA9Format>>#defaultSize
5	Remove ^ in PDFDataSymbol>>#isPrintable
6	Remove ^ in PDFDataSymbol>>#acceptVisitor:
7	Remove ^ in PDFDataSymbol>>#symbol
8	Remove ^ in PDFDataSymbol class>>#symbol:
9	Remove ^ in PDFDataDateAndTime>>#isPrintable
10	Remove ^ in PDFDataDateAndTime>>#time
11	Remove ^ in PDFDataDateAndTime>>#acceptVisitor:
12	Remove ^ in PDFDataDateAndTime>>#date
13	Remove ^ in PDFDataDateAndTime>>#formatDate:time:
14	Replace #< with #> in PDFDataDateAndTime>>#formatDate:time:
15	Replace #< with #> in PDFDataDateAndTime>>#formatDate:time:
16	Replace #< with #> in PDFDataDateAndTime>>#formatDate:time:
17	Replace #ifTrue: receiver with false in PDFDataDateAndTime>>#formatDate:time:
18	Replace #ifTrue: receiver with false in PDFDataDateAndTime>>#formatDate:time:

28 Remove ^ in PDFOnesecureElementCodeSegment<>#isSecure

29 Remove ^ in PDFSymbolFont>>#charWidths

30 Remove ^ in PDFSymbolFont>>#family

31 Remove ^ in PDFSymbolFont>>#fontName

32 Remove ^ in ArtefactOverSizedContent>>#content

33 Remove ^ in PDFLayout>>#createOriginalPositionDictionary

34 Replace do block with foreach loop in PDFLayout>>#createOriginalPositionDictionary

```
hour := aTime hours.  
str := hour asString.  
hour < 12 ifTrue: [ str := '0' , str ].  
timeStr := str.
```

```
minutes := aTime minutes.  
str := minutes asString.  
minutes < 10 ifTrue: [ str := '0' , str ].  
timeStr := timeStr , str.
```

```
seconds := aTime seconds.  
str := seconds asString.  
seconds < 10 ifTrue: [ str := '0' , str ].  
timeStr := timeStr , str.
```

```
^ (aDate yyyyymmdd copyWithRegex: '-' matchesReplacedWith:  
' ', timeStr
```

```
hour := aTime hours.  
str := hour asString.  
hour < 12 ifTrue: [ str := '0' , str ].  
timeStr := str.
```

```
minutes := aTime minutes.  
str := minutes asString.  
true ifTrue: [ str := '0' , str ].  
timeStr := timeStr , str.
```

```
seconds := aTime seconds.  
str := seconds asString.  
seconds < 10 ifTrue: [ str := '0' , str ].  
timeStr := timeStr , str.
```

```
^ (aDate yyyyymmdd copyWithRegex: '-' matchesReplacedWith:  
' ', timeStr
```

# DESIGN PATTERN

# Factory

PDFA0Format>>defaultSize

The screenshot shows a Java IDE interface with the following details:

- Project Tree:** On the left, under the package `artefact`, are the projects: `Artefact-Core`, `Artefact-Core-Tests`, `Artefact-Examples`, `Artefact-Tutorial`, and `BaselineOfArtefact`.
- Search Bar:** The search bar at the top contains the text `defaultSize`. Below it are buttons for `All Packages`, `Scoped View`, `Flat`, `Hier.`, `Inst. side` (which is selected), `Class side`, `Methods`, `Vars`, `Class refs.`, `Implementors`, and `Senders`.
- Search Results:** The results pane shows the class `PDFA0Format` highlighted in blue. Other classes listed include `PDFHelveticaFont`, `PDFSymbolFont`, `PDFTimesFont`, `PDFZapfdingbatsFont`, `PDFFormat`, `PDFA10Format`, `PDFA1Format`, `PDFA2Format`, `PDFA3Format`, `PDFA4Format`, `PDFA5Format`, `PDFA6Format`, `PDFA7Format`, and `PDFA8Format`.
- Annotations:** Annotations on the right side of the results pane include `instance side`, `accessing - defaults`, and `overrides`.
- Bottom Navigation:** The bottom navigation bar includes tabs for `Dependencies`, `PDFA0Format`, `Comment`, `defaultSize` (which is selected and highlighted in blue), and `Inst. side methc`.
- Result Preview:** The preview pane at the bottom shows the `defaultSize` method with the signature `^ 2384.03 point @ 3370.53 point`.

# DoubleDispatch

PDFFElementCodeSegment>>printWith:

The screenshot shows a Java documentation search interface. On the left, there's a sidebar with project navigation. The main area displays the class hierarchy for `PDFFElementCodeSegment`. The `printWith:` method is selected, and its implementation is shown in the bottom pane. The interface includes various search filters and toolbars at the top.

Artefact-Core

Artefact-Core-Tests

Artefact-Examples

Artefact-Tutorial

BaselineOfArtefact

Artefa

Filter...

PDFFElementCodeSegment

ArtefactOverSizedContent

ArtefactUndefinedAttribute

ManifestArtefactCore

PDFAlignment

PDFAngleDirected

PDFByteCode

PDFCodeSegment

PDFCompositeCodeSegment

PDFElementCodeSegment

PDFUnsecureElementCodeSegment

PDFColor

PDFDataType

PDFByteArray

PDFDataAssociativeArray

PDFDataComment

PDFTextContent

instance side ▲□

accessing

overrides

code

code:

fontId

fontId:

format

format:

opacityId

opacityId:

printWith:

All Packages    Scoped View    Flat    Hier.    Inst. side    Class side    Methods    Vars    Class refs.    Implementors    Senders

Dependencies    PDFFElementCodeSegment    Comment    printWith:    Inst. side methods

```
printWith: aPDFWriter
    aPDFWriter printElementCodeSegment: self
```

PDFDataComment>>acceptVisitor:

The diagram shows a UML class hierarchy. At the top level, there is a class named 'Artefact-Core'. Below it, under the package 'Artefact-Core', is a class 'PDFDataComment'. This class has several subclasses listed below it: 'PDFCompositeCodeSegment', 'PDFElementCodeSegment', 'PDFUnsecureElementCodeSegment', 'PDFColor', 'PDFDataType', 'PDFdataArray', 'PDFDataAssociativeArray', and 'PDFDataComment' (which is highlighted with a blue selection bar). Further down the hierarchy are 'PDFDataCouple', 'PDFDataDateAndTime', 'PDFDataObject', 'PDFDataReference', 'PDFDataStartXref', 'PDFDataStream', and 'PDFDataStreamRefSize'. To the right of the class list, there is a tree view labeled 'instance side' with nodes: 'accessing', 'printing', 'testing', 'visiting', and 'overrides'. On the far right, there is a vertical list of methods: 'acceptVisitor:', 'comment', 'comment:', 'isPrintable', and 'printOn:'. At the bottom of the interface, there are several tabs: 'Dependencies', 'PDFDataComment', 'Comment', 'acceptVisitor:' (which is selected and highlighted in blue), and 'Inst. side methc'. The text area at the bottom contains the code for the 'acceptVisitor:' method.

Artefact-Core

PDFCompositeCodeSegment

PDFElementCodeSegment

PDFUnsecureElementCodeSegment

PDFColor

PDFDataType

PDFdataArray

PDFDataAssociativeArray

PDFDataComment

PDFDataCouple

PDFDataDateAndTime

PDFDataObject

PDFDataReference

PDFDataStartXref

PDFDataStream

PDFDataStreamRefSize

PDFDataComment

instance side

accessing

printing

testing

visiting

overrides

acceptVisitor:

comment

comment:

isPrintable

printOn:

All Packages    Scoped View    Flat    Hier.    Inst. side    Class side    Methods    Vars    Class refs.    Implementors    Senders

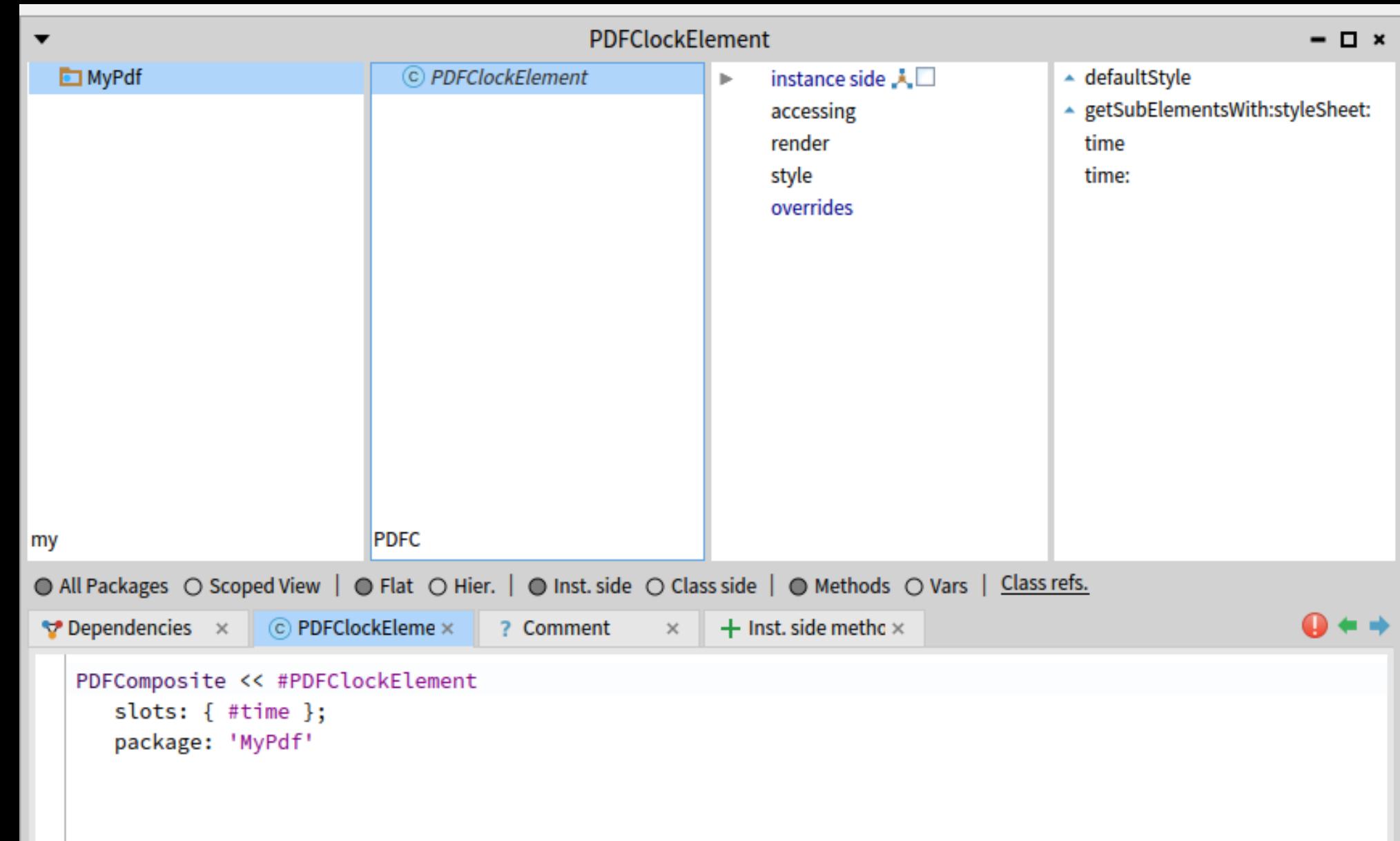
Dependencies    PDFDataComment    Comment    acceptVisitor:    Inst. side methc

acceptVisitor: aVisitor

  aVisitor visitPDFDataComment: self

FACILEMENT UTILISABLE ?

# Visitor



PDFClockElement>>getSubElementsWith:styleSheet:

MyPdf

PDFClockElement

instance side A □

accessing  
render  
style  
overrides

defaultStyle  
getSubElementsWith:styleSheet:  
time  
time:

my PDFC

All Packages    Scoped View    Flat    Hier.    Inst. side    Class side    Methods    Vars    Class refs.    Implementors    Senders

Dependencies    PDFClockEleme    Comment    getSubElement    Inst. side methc

```
getSubElementsWith: aGenerator styleSheet: aStyleSheet
| hourAngle minuteAngle |
hourAngle := Float pi / 2 - (time hour12 * 2 * Float pi / 12).
minuteAngle := Float pi / 2 - (time minute * 2 * Float pi / 60).

^ { (PDFCircleElement from: self from to: self to).
  (PDFCircleElement center: self center radius: self dimension x * 0.05),
  (PDFArrowElement from: self center angle: hourAngle length: dimension x * 0.25),
  (PDFArrowElement from: self center angle: minuteAngle length: dimension x * 0.45) }
```

```
colorTest: aStream
    "generate a sample document with colors"

    | pdfdoc aPage |
pdfdoc := PDFDocument new.

aPage := PDFPage new.
aPage add: (PDFCellElement new
    font: (PDFTimesFont new fontSize: 32pt);
    from: 10mm@10mm;
    dimension: 100 mm @ 20 mm;
    text: 'Hello World!';
    textColor: (PDFColor r: 255 g: 0 b: 0);
    fillColor: (PDFColor r: 0 g: 255 b: 0)
).
aPage add: (PDFRectElement new
    from: 10 mm @ 50 mm;
    dimension: 50 mm @ 50 mm;
    thickness: 5pt;
    drawColor: (PDFColor r: 0 g: 0 b: 255);
    fillColor: (PDFColor r: 0 g: 255 b: 0)
).

pdfdoc add: aPage.

pdfdoc exportTo: aStream
```