3.– 6. September 2012
in Nürnberg

Herbstcampus

Wissenstransfer
par excellence

Treppenschach(t)

Bessere Testfälle mit ScalaCheck

Andreas Flierl

imbus AG

@asflierl

http://blog.flierl.eu

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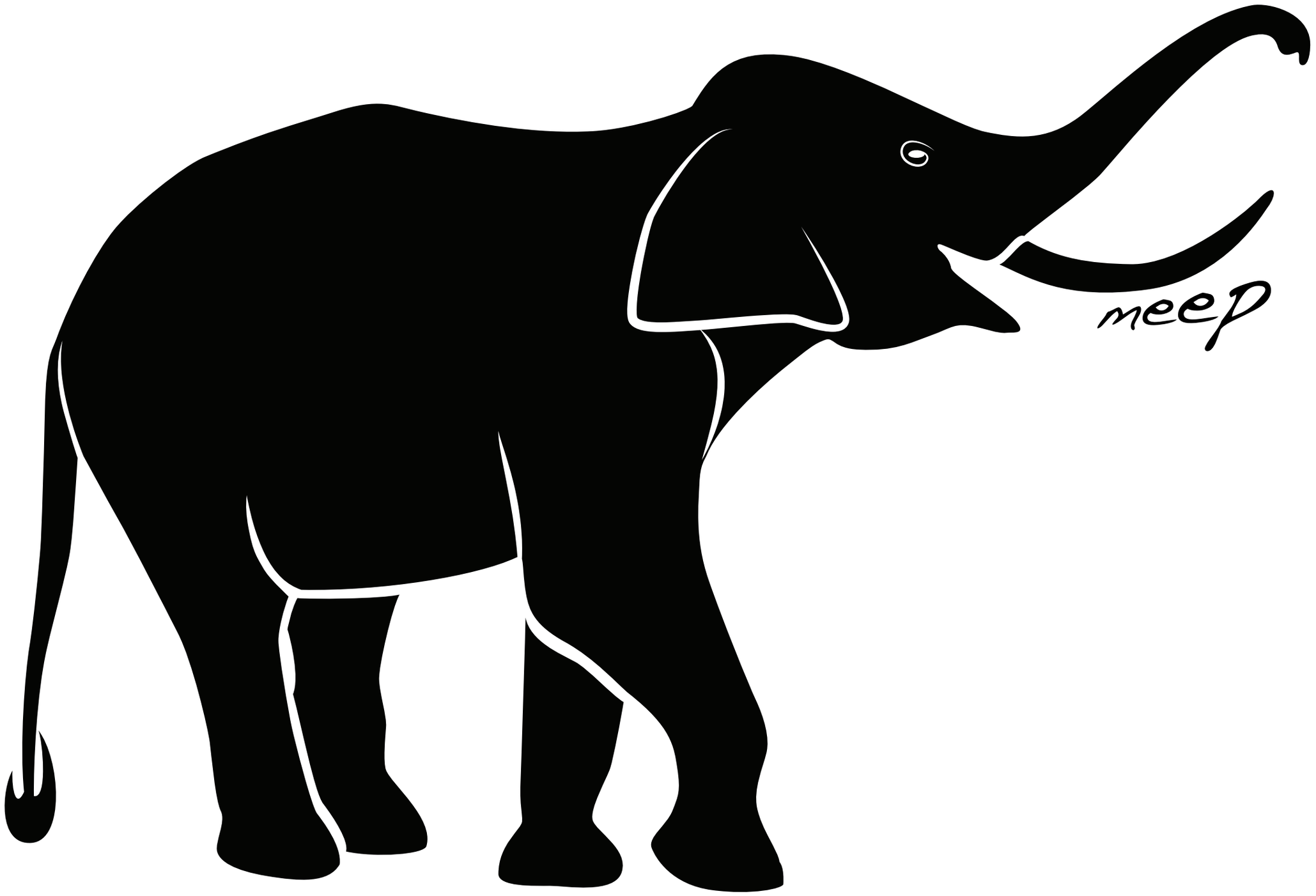

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```
"An elephant" should {
  "be identifiable" in {
    Elephant(42).id must be equalTo 42
  }
}
```

```
case class Elephant(id: Int)
```


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```
"An elephant" should {
  "be identifiable" in {
    Elephant(42, "Mona").id must be equalTo 42
  }

  "have a name" in {
    Elephant(42, "Mona").name must be equalTo "Mona"
  }
}
```

```
case class Elephant(id: Int, name: String)
```


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```
"An elephant" should {
  "be identifiable" in {
    Elephant(42, "Mona").id must be equalTo 42
  }

  "be identified only by its ID" in {
    Elephant(42, "Mona") must be equalTo Elephant(42, "Functo")
  }

  "have a name" in {
    Elephant(42, "Mona").name must be equalTo "Mona"
  }
}
```


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```scala
final case class Elephant(id: Int, name: String) {
  override def equals(other: Any): Boolean =
    other match {
      case Elephant(i, _) => id == i
      case _ => false
    }
}
```


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```
"An elephant" should {
  val id = ID(42)

  "be identifiable" in {
    Elephant(id, "Mona").id must be equalTo id
  }

  "be identified only by its ID" in {
    Elephant(id, "Mona") must be equalTo Elephant(id, "Functo")
  }

  "have a name" in {
    Elephant(id, "Mona").name must be equalTo "Mona"
  }
}

"An ID" should {
  "always be positive" in {
    ID(-42).code must be equalTo 42
  }
}
```


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```scala
final case class Elephant(id: ID, name: String) {
  override def equals(other: Any): Boolean =
    other match {
      case Elephant(i, _) => id == i
      case _ => false
    }
}

final class ID private (val code: Int)
object ID {
  def apply(code: Int): ID = new ID(math abs code)
}
```


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```
"An elephant" should {
  //...

  "have an abbreviated name" in {
    "name"                || "abbreviated"  |
    //--------------------||----------------|
    ""                    !! "<unnamed>"     |
    "Mona"                !! "Mona"          |
    "0123456789"          !! "0123456789"    |
    "0123456789A"         !! "012345678…"    |
    "Eyjafjallajökull"    !! "Eyjafjall…"    |> {

      (name, abbrev) =>
        Elephant(id, name).abbreviatedName must be equalTo abbrev
      }
    }

    //...
}

//...
```


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```scala
final case class Elephant(id: ID, name: String) {
  override def equals(other: Any): Boolean =
    other match {
      case Elephant(i, _) => id == i
      case _ => false
    }

  val abbreviatedName =
    if (name.isEmpty) "<unnamed>"
    else if (name.length <= 10) name
    else name.substring(0, 9) + "…"
}

final class ID private (val code: Int)
object ID {
  def apply(code: Int): ID = new ID(math abs code)
}
```


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```
"An elephant" should {
  //...

  val memory = List(Squee(now), Squee(now - 1.year))

  "remember the squees" in {
    Elephant(id, "Mona", memory).memory must be equalTo memory
  }

  "have a popularity rating" in {
    Elephant(id, "Mona", memory).popularity must be equalTo 1d
  }

  //...
}

//...
```


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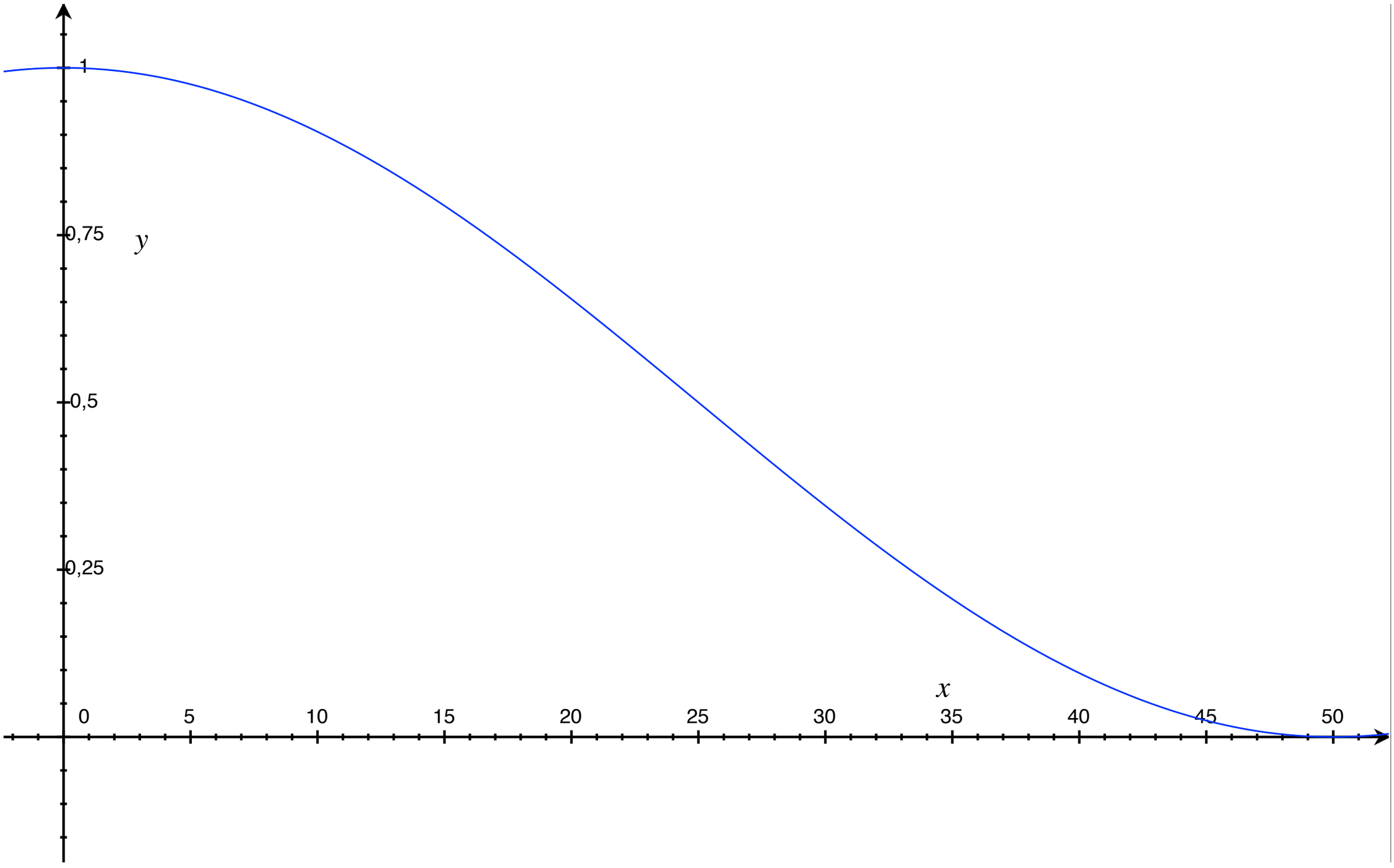

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```scala
final case class Elephant(id: ID, name: String, memory: Seq[Squee]) {
  override def equals(other: Any): Boolean = other match {
    case Elephant(i, _, _) => id == i
    case _ => false
  }

  val abbreviatedName =
    if (name.isEmpty) "<unnamed>"
    else if (name.length <= 10) name
    else name.substring(0, 9) + "…"

  def popularity = memory map age filter recent map weight reduce (_ + _)

  def age(squee: Squee) = weeksBetween(squee moment, now)
  def recent(span: Weeks) = span isLessThan weeks(50)
  def weight(span: Weeks) = (cos(span.getWeeks * Pi / 50d) + 1d) / 2d
}

final class ID private (val code: Int)
object ID {
  def apply(code: Int): ID = new ID(math abs code)
}

case class Squee(moment: DateTime)
```


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```
8  final case class Elephant(id: ID, name: String, memory: Seq[Squee]) {
9    override def equals(other: Any): Boolean = other match {
10     case Elephant(i, _, _) => id == i
11     case _ => false
12   }
13
14   val abbreviatedName =
15     if (name.isEmpty) "<unnamed>"
16     else if (name.length <= 10) name
17     else name.substring(0, 9) + "…"
18
19   def popularity = memory map age filter recent map weight reduce (_ + _)
20
21   def age(squee: Squee) = weeksBetween(squee moment, now)
22   def recent(span: Weeks) = span isLessThan weeks(50)
23   def weight(span: Weeks) = (cos(span.getWeeks * Pi / 50d) + 1d) / 2d
24 }
25
26 final class ID private (val code: Int)
27 object ID {
28   def apply(code: Int): ID = new ID(math abs code)
29 }
30
31 case class Squee(moment: DateTime)
```


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```
"An elephant" should {
  //...

  "not equal something else" in {
    Elephant(id, "Mona", Nil) == "fluffy cloud" must beFalse
  }

  //...
}

//...
```


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eu/flierl/treppenschacht/**Elephant.scala** 100 %

Elephant	100 %
ID	100 %
ID	100 %
Squee	100 %

CC BY SA

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```
final case class Elephant(id: ID, name: String, memory: Seq[Squee]) {
  override def equals(other: Any): Boolean = other match {
    case Elephant(i, _, _) => id == i
    case _ => false
  }

  val abbreviatedName =
    if (name.isEmpty) "<unnamed>"
    else if (name.length <= 10) name
    else name.substring(0, 9) + "…"

  def popularity = memory map age filter recent map weight reduce (_ + _)

  def age(squee: Squee) = weeksBetween(squee moment, now)
  def recent(span: Weeks) = span isLessThan weeks(50)
  def weight(span: Weeks) = (cos(span.getWeeks * Pi / 50d) + 1d) / 2d
}

final class ID private (val code: Int)
object ID {
  def apply(code: Int): ID = new ID(math abs code)
}

case class Squee(moment: DateTime)
```

hashCode

unicode

equals,
hashCode,
toString

empty list

future dates

Int.MinValue

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Alter Hut #1

Tests zeigen die
Anwesenheit von Fehlern,
nicht deren **Ab**wesenheit.

(Negativbeweis)

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Alter Hut #2

Testabdeckung (code coverage) ist **kein** Maß für die Güte der Testfälle.

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… oder anders

100% Abdeckung
→ keine Aussage

25% Abdeckung
→ Tests unzureichend

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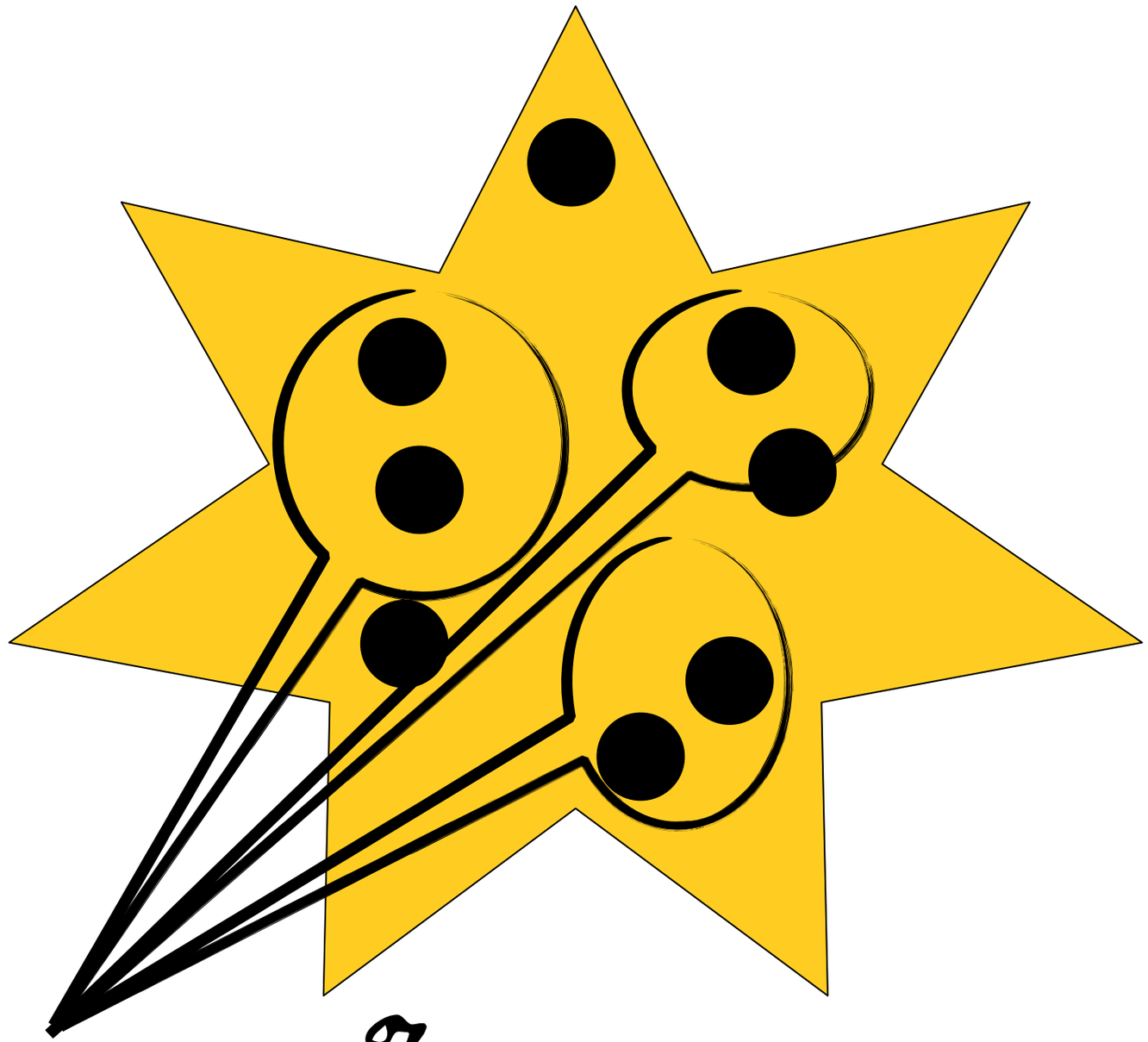

Coverage 25%

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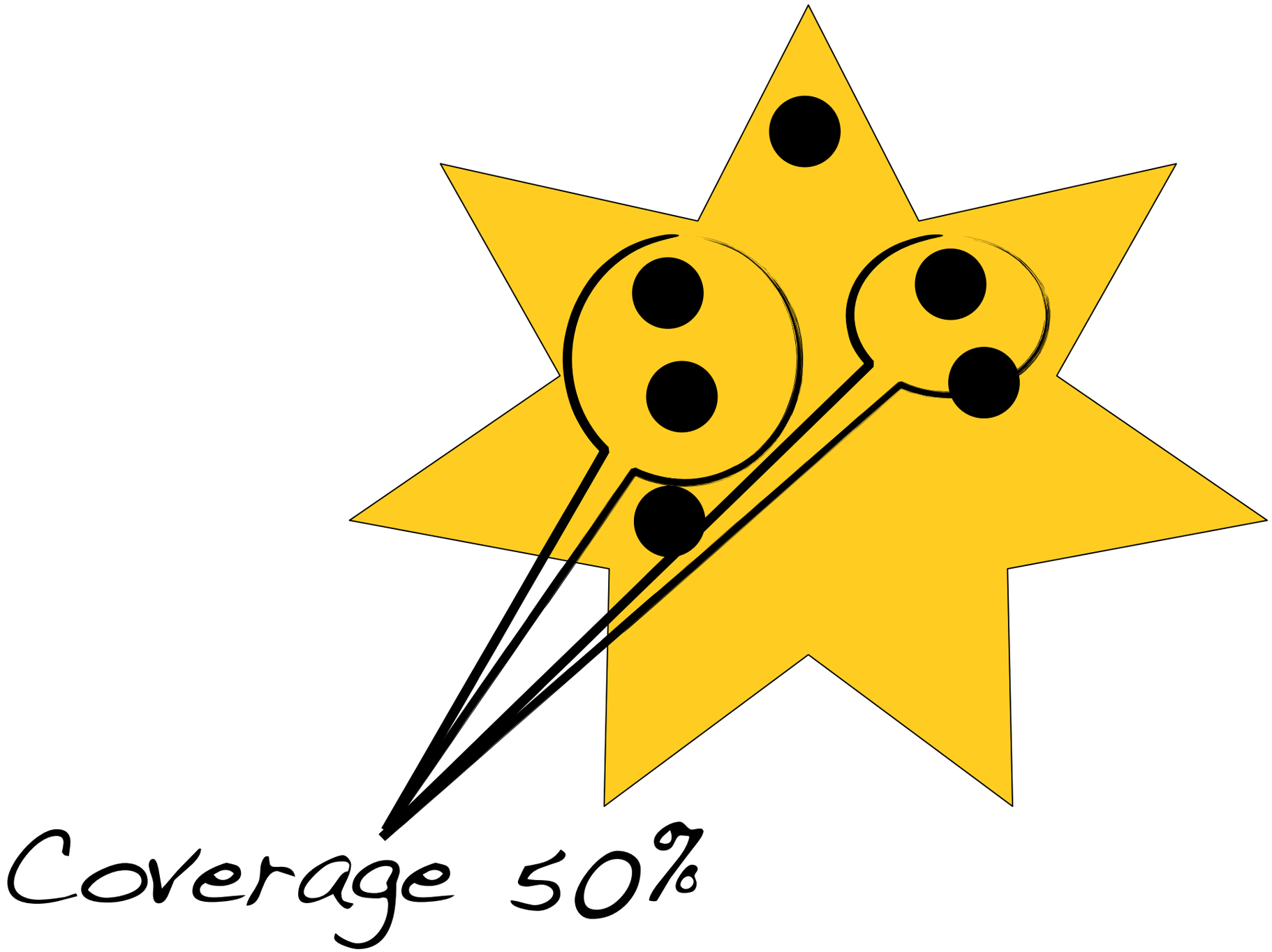

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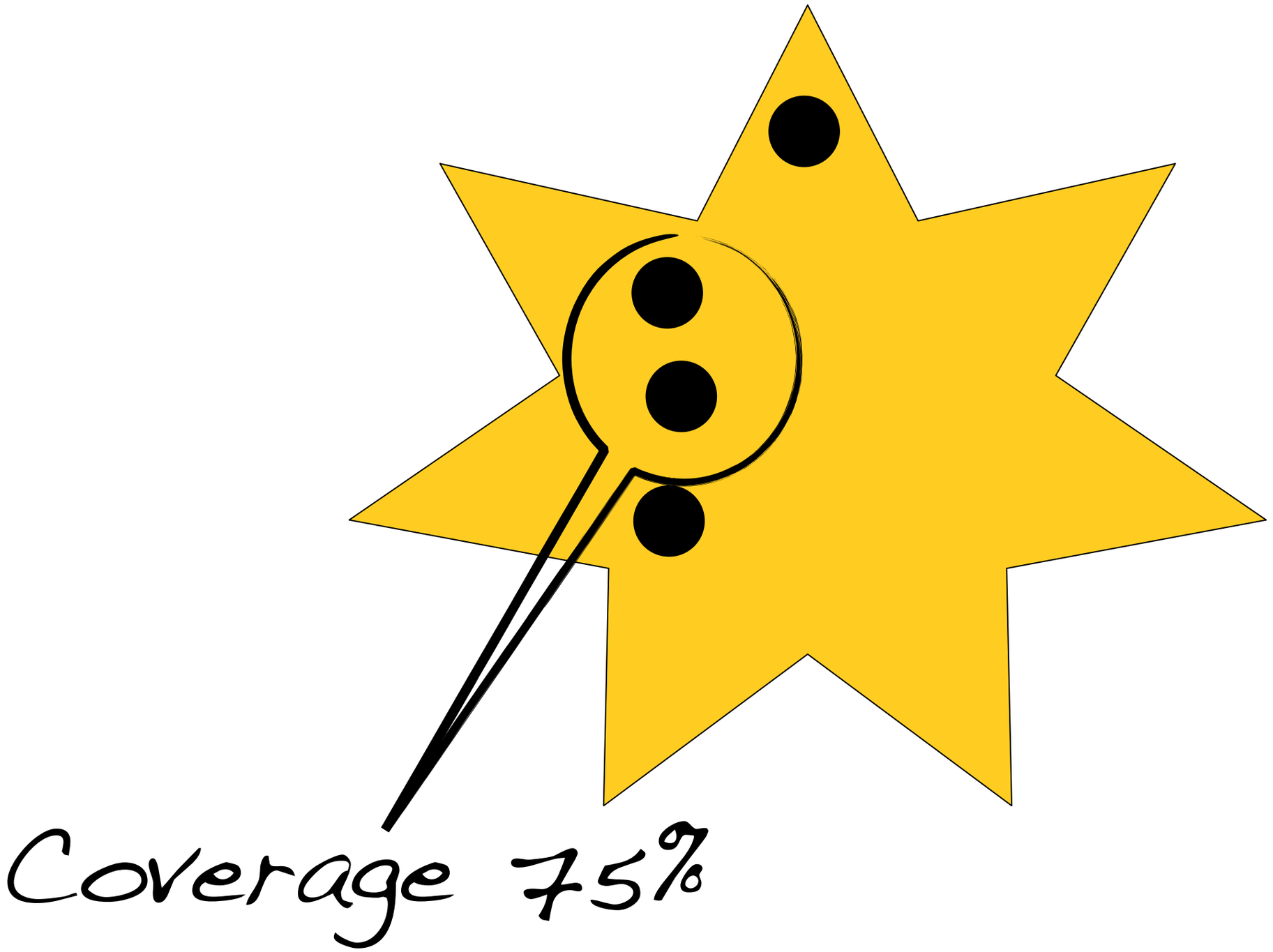

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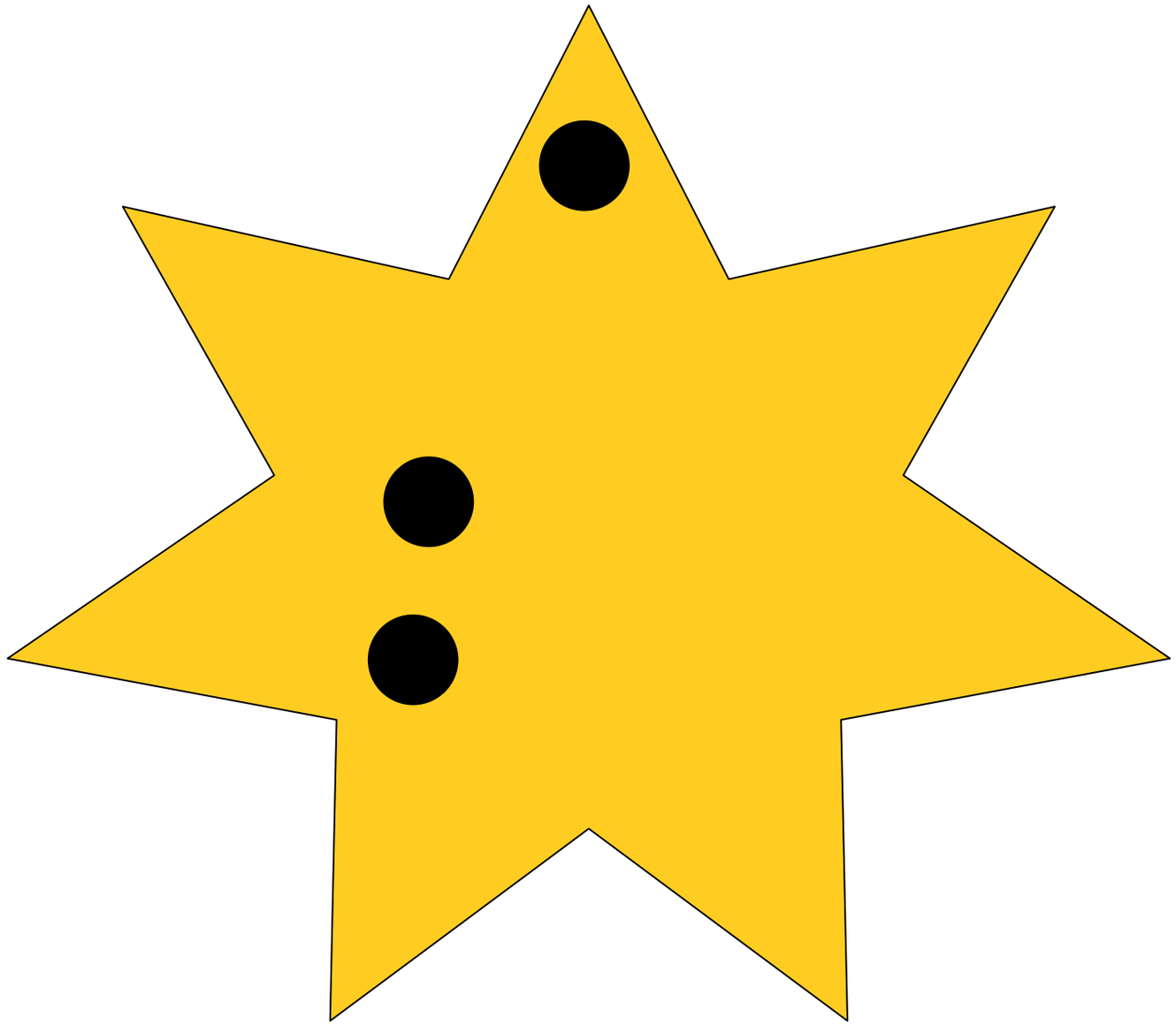

Coverage 100%

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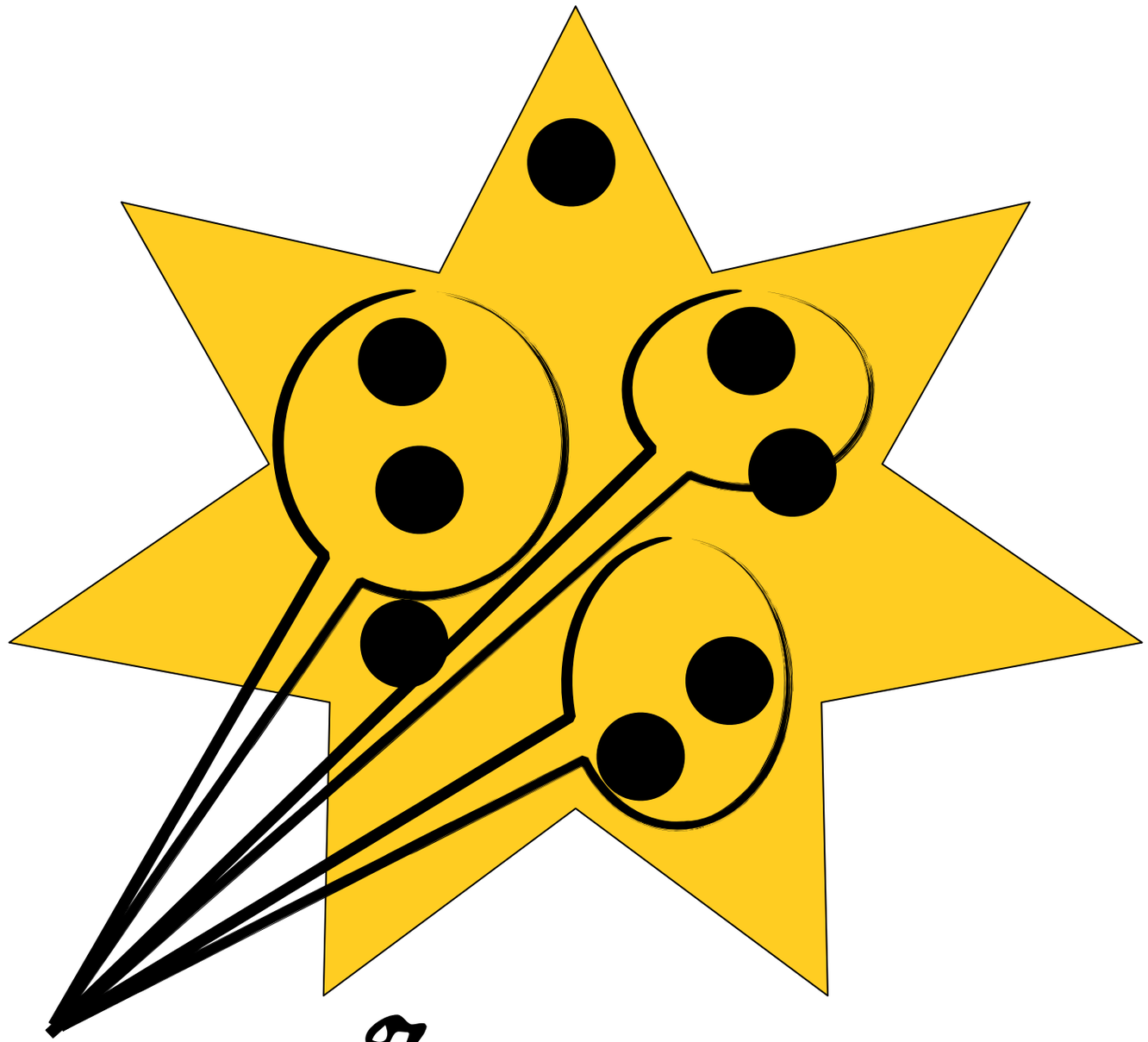

Coverage 25%

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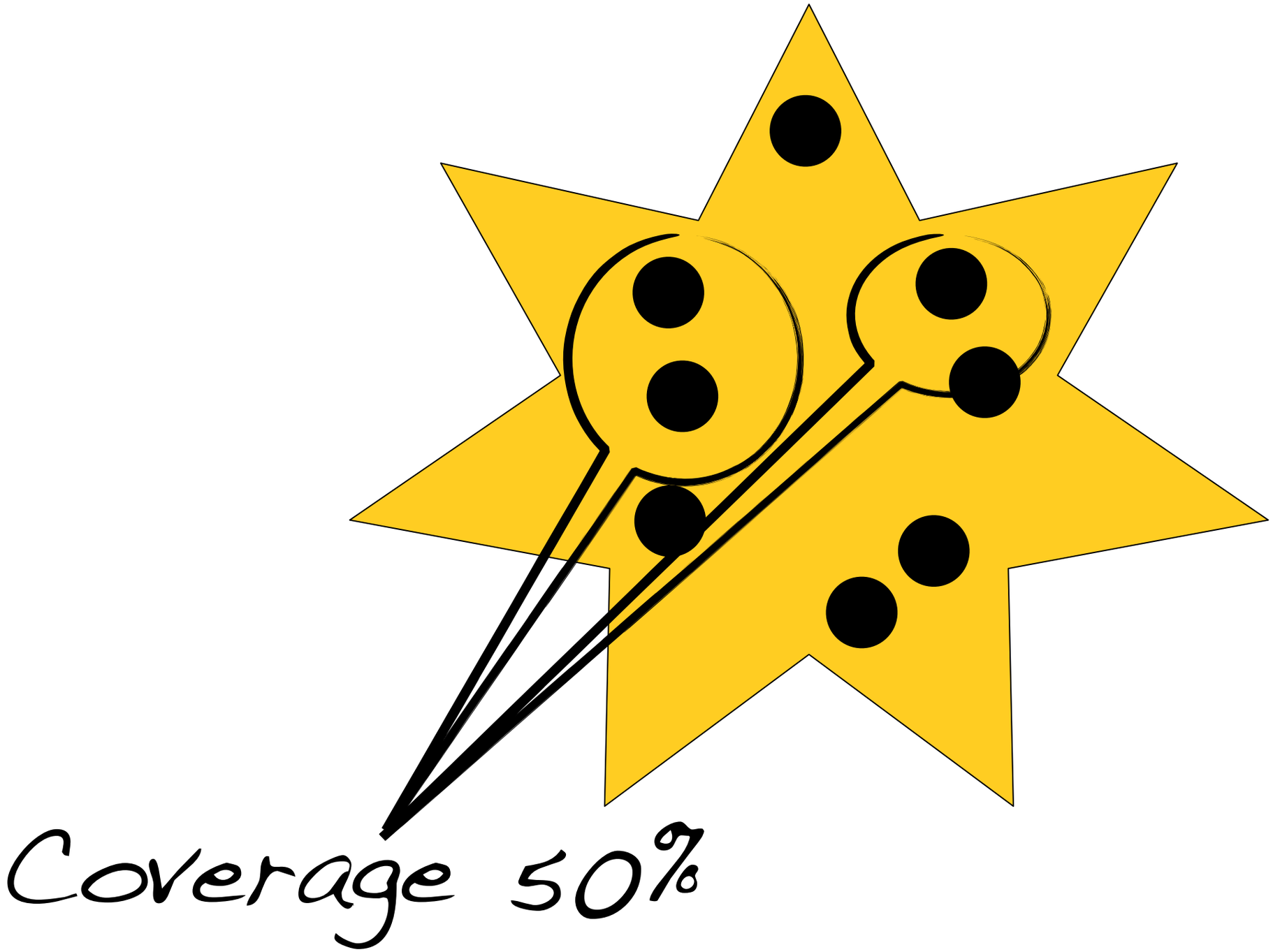

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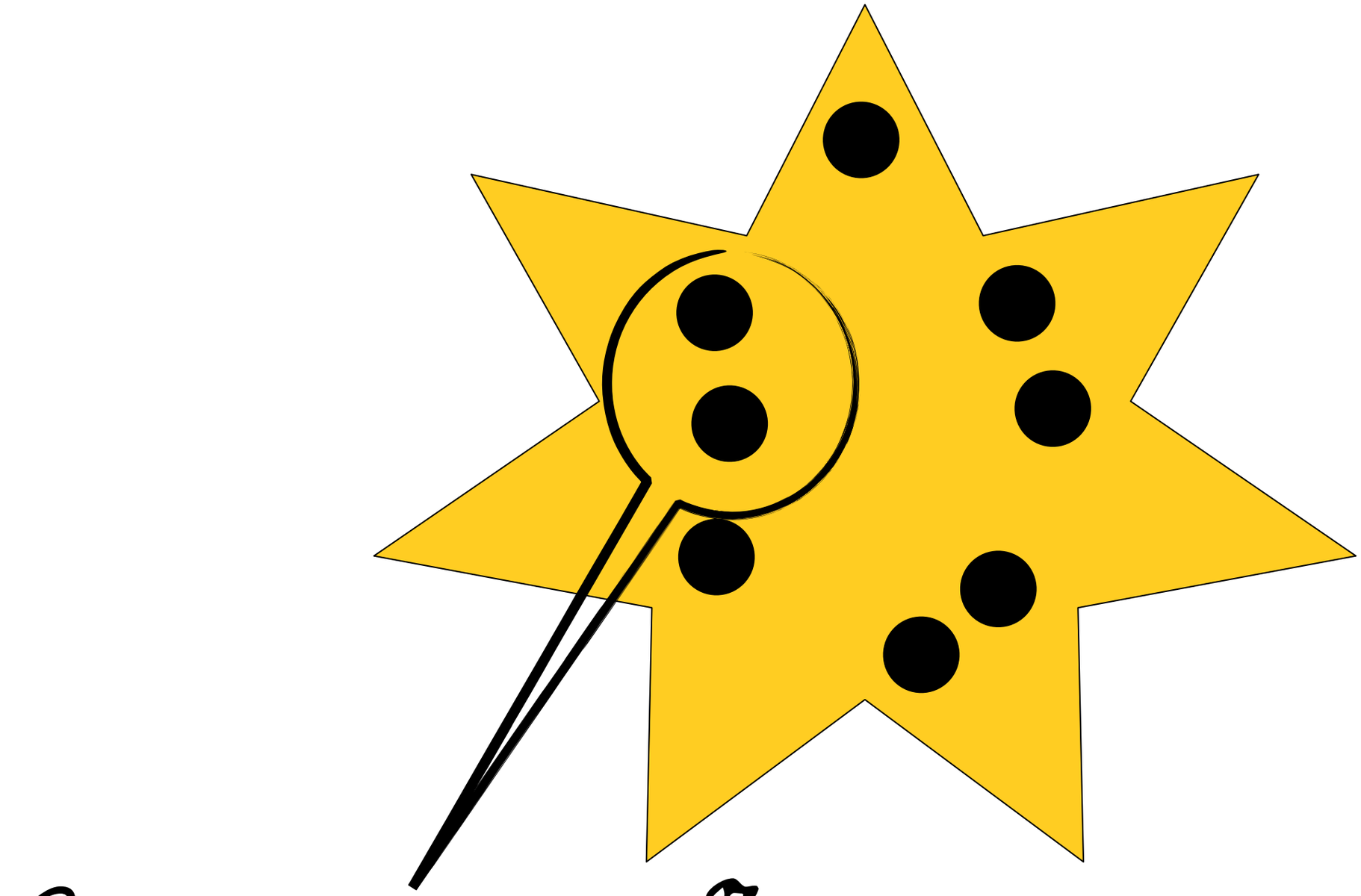

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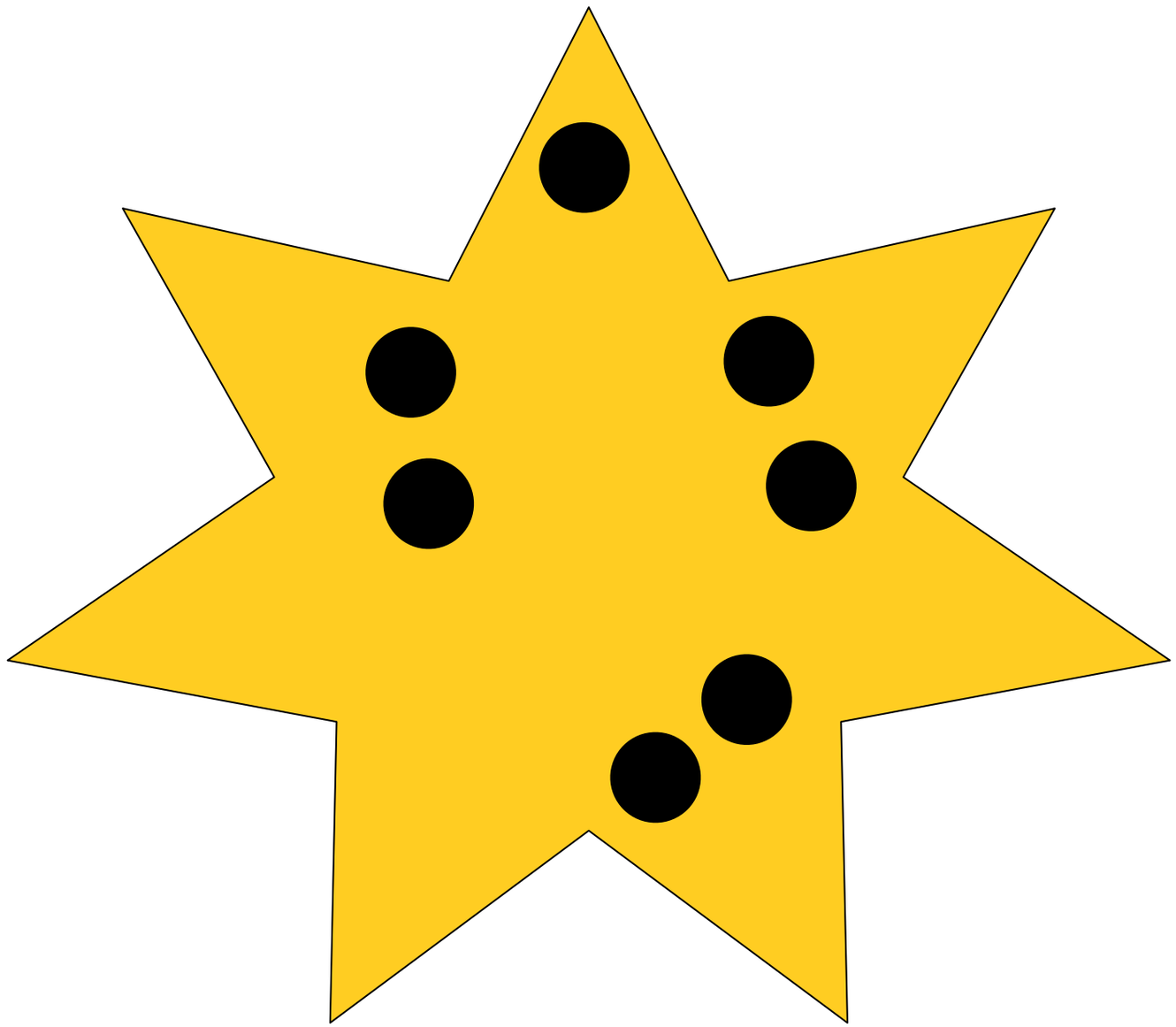

Coverage 100%

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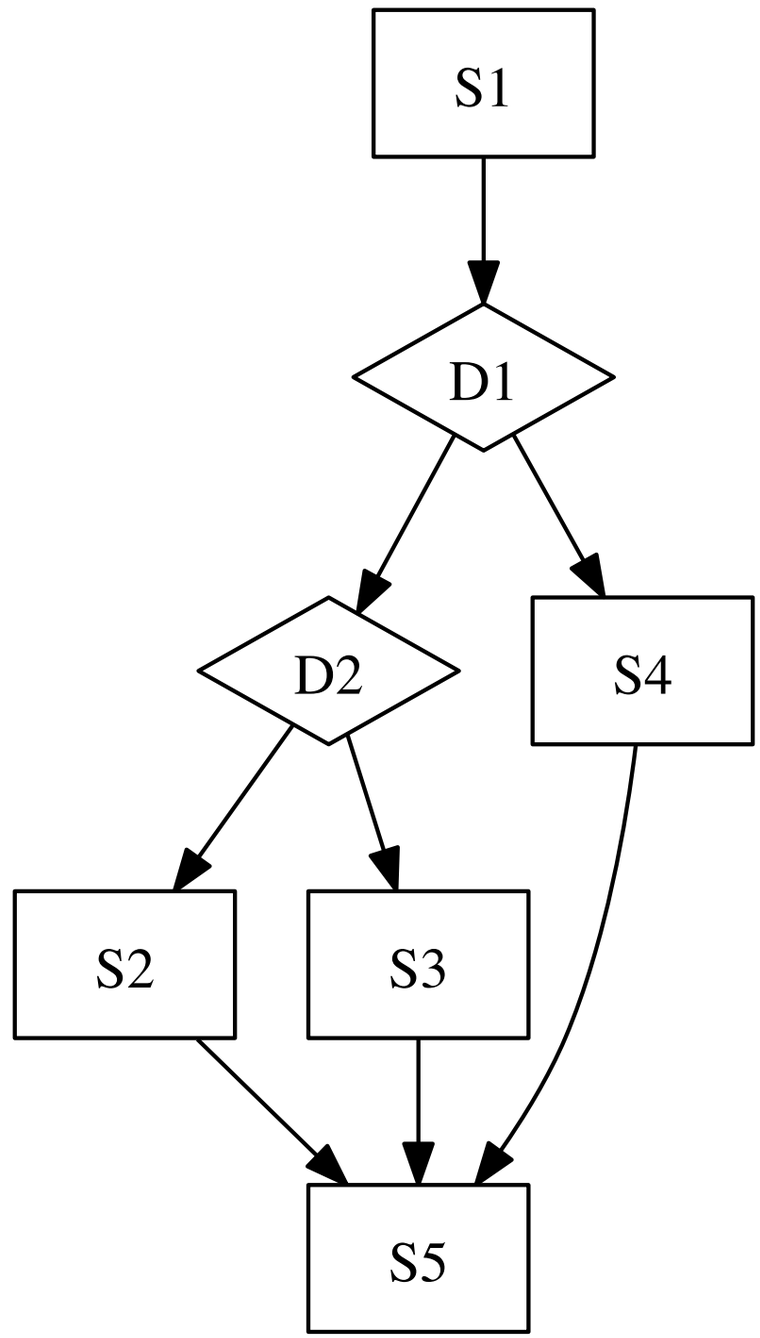
Testabdeckung

```
def f(a: Int, b: Int, c: Int): Int = {
  val x = a + b                    // S1
  val y =
    if (x < c)                     // D1
      if (x % 2 == 0)              // D2
        x                          // S2
      else
        x + 1                      // S3
    else c                         // S4
  x + y                            // S5
}
```



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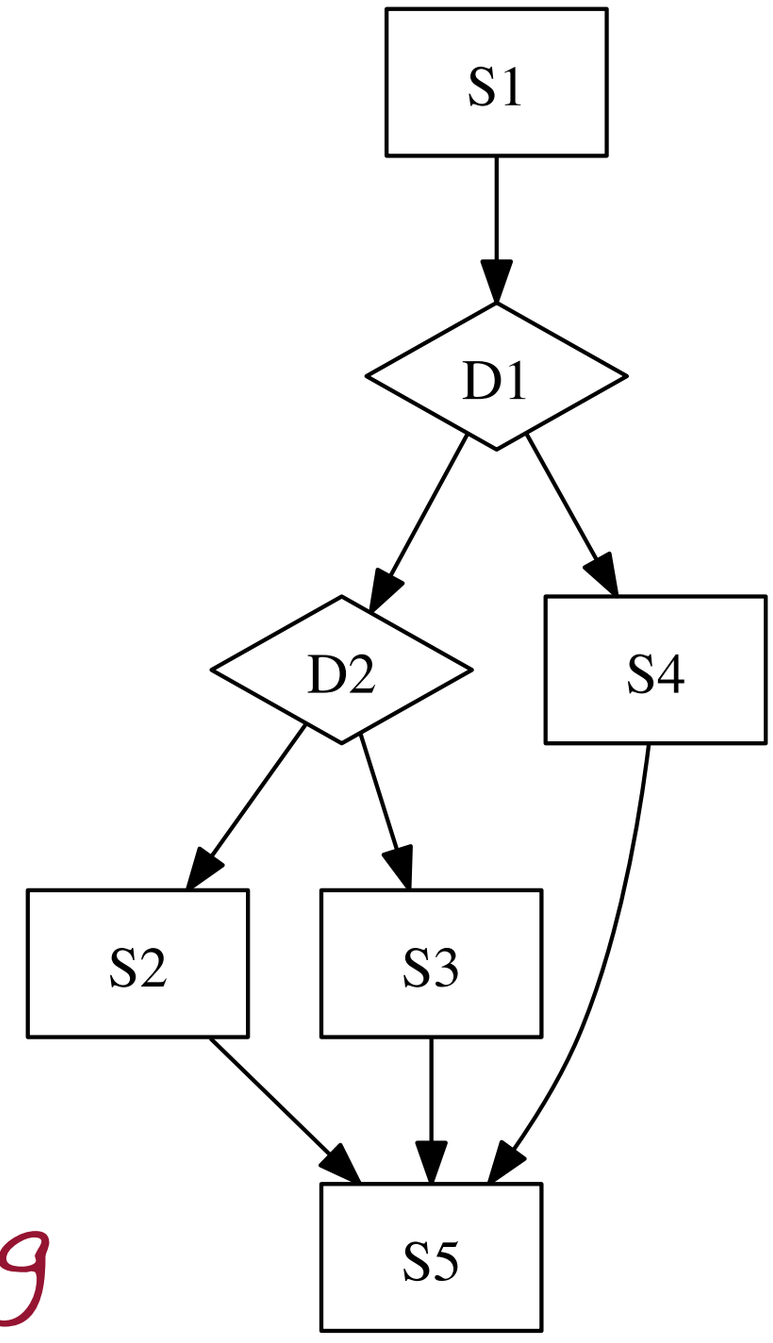
Testabdeckung

C0: Anweisungen

C1: Zweige

C2(a-c): Pfade

C3(a-c): Bedingungen



Achtung!

uneinheitliche Benennung

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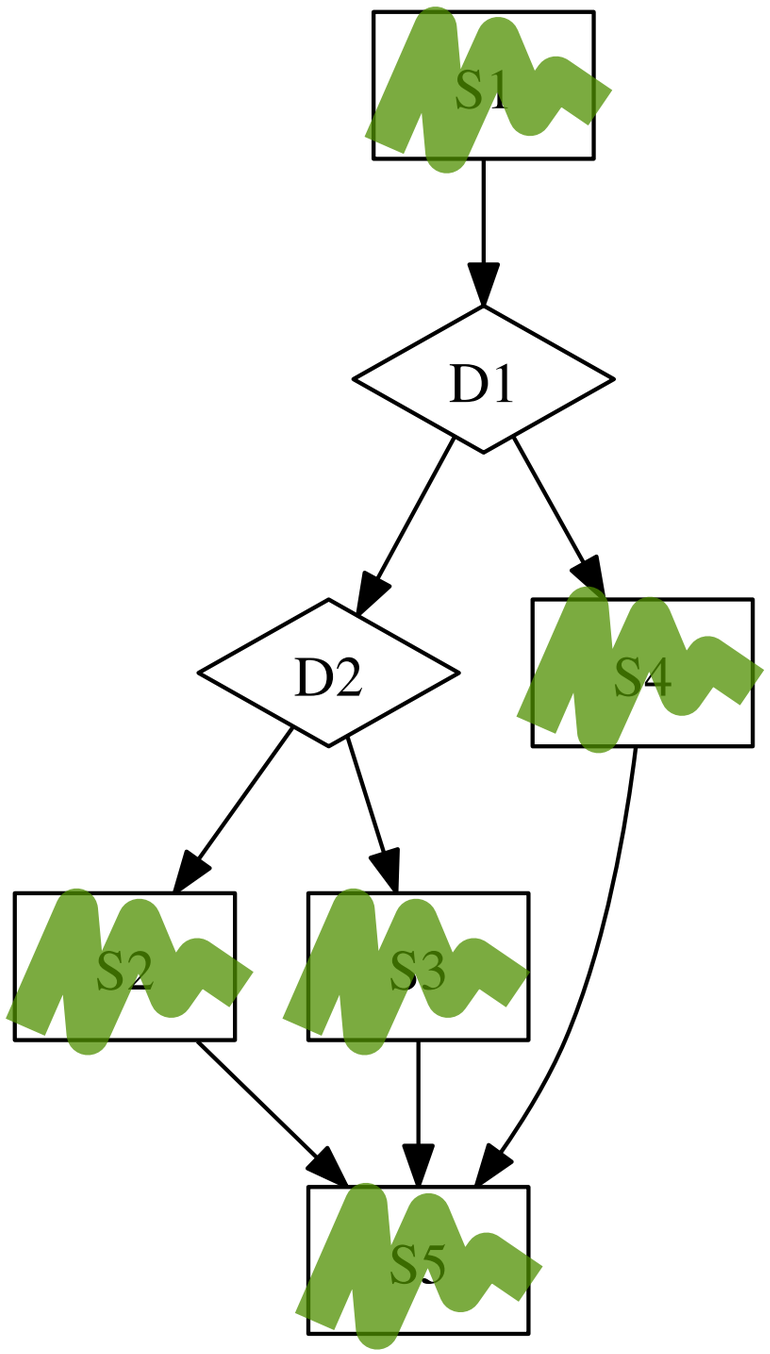
Testabdeckung

C0: Anweisungen

C1: Zweige

C2(a-c): Pfade

C3(a-c): Bedingungen



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Testabdeckung

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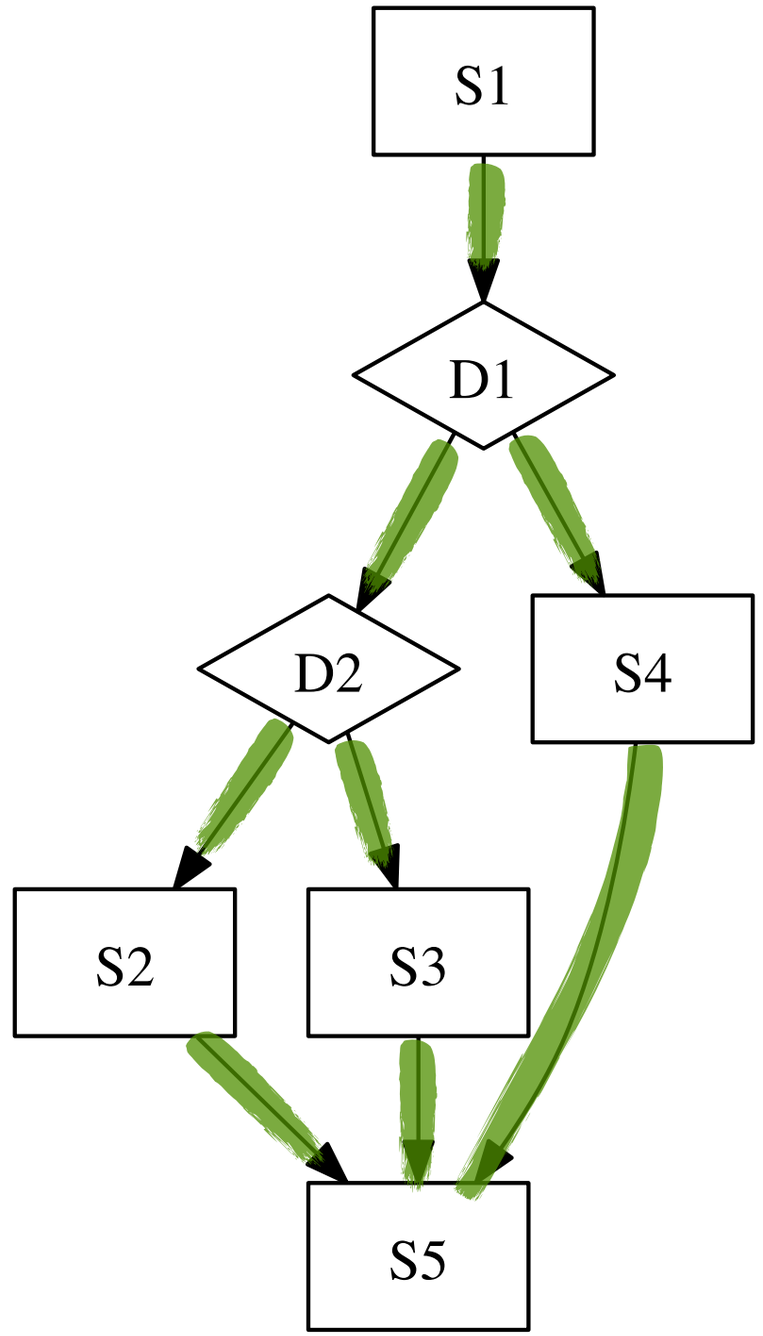

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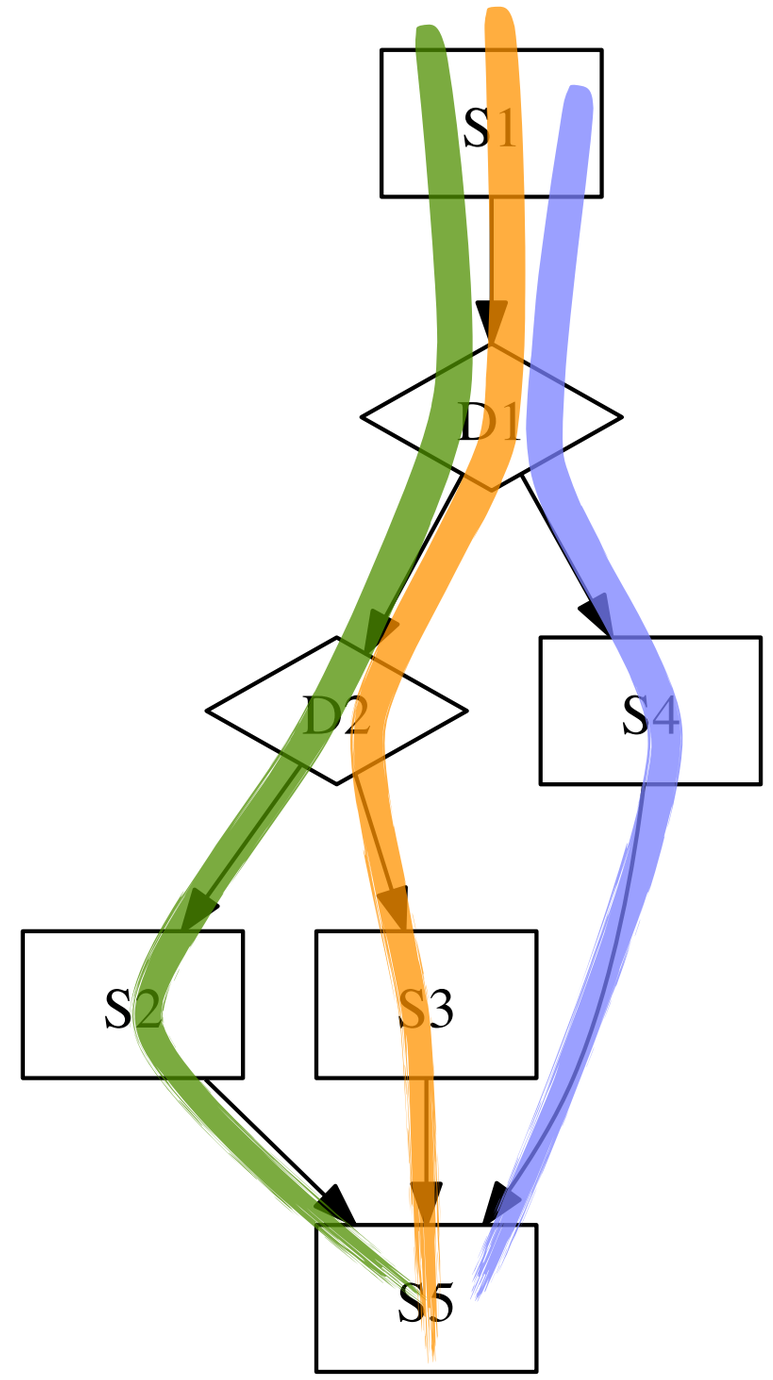

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Testabdeckung

C0: Anweisungen

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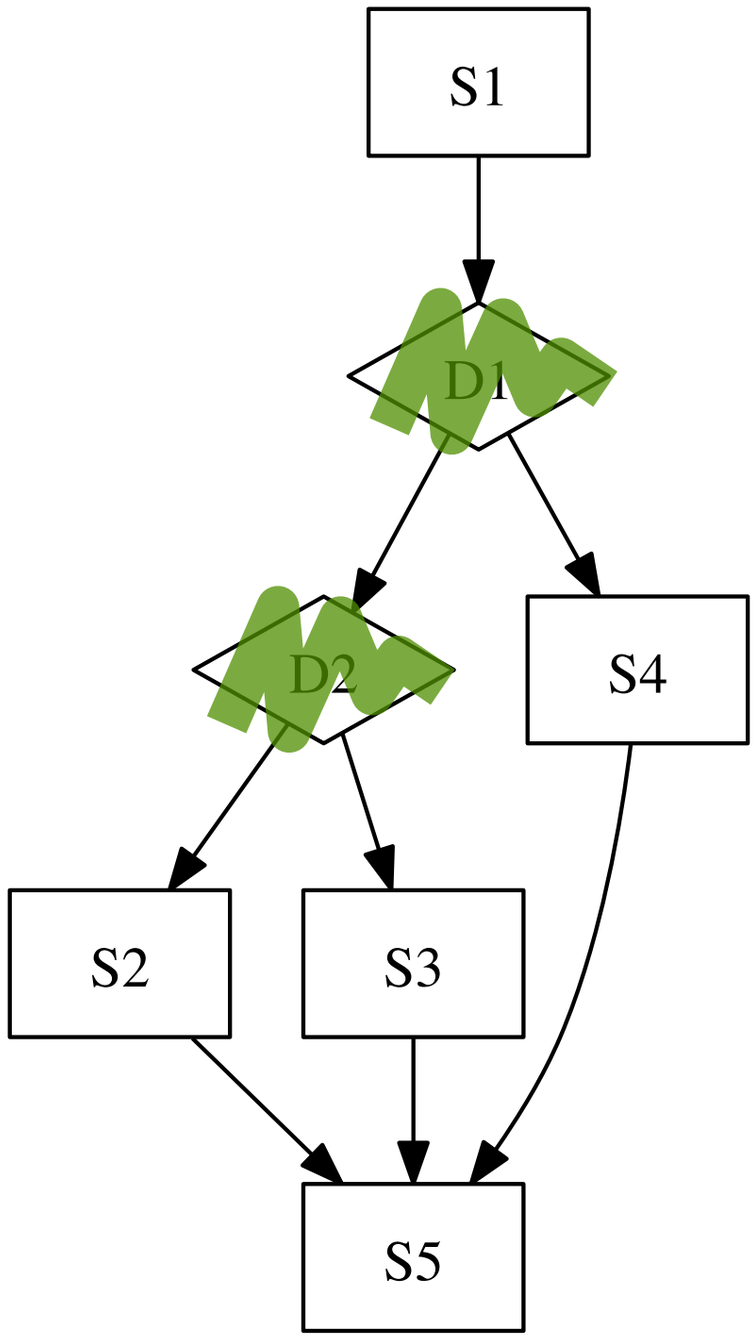

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Testabdeckung

C0: Anweisungen
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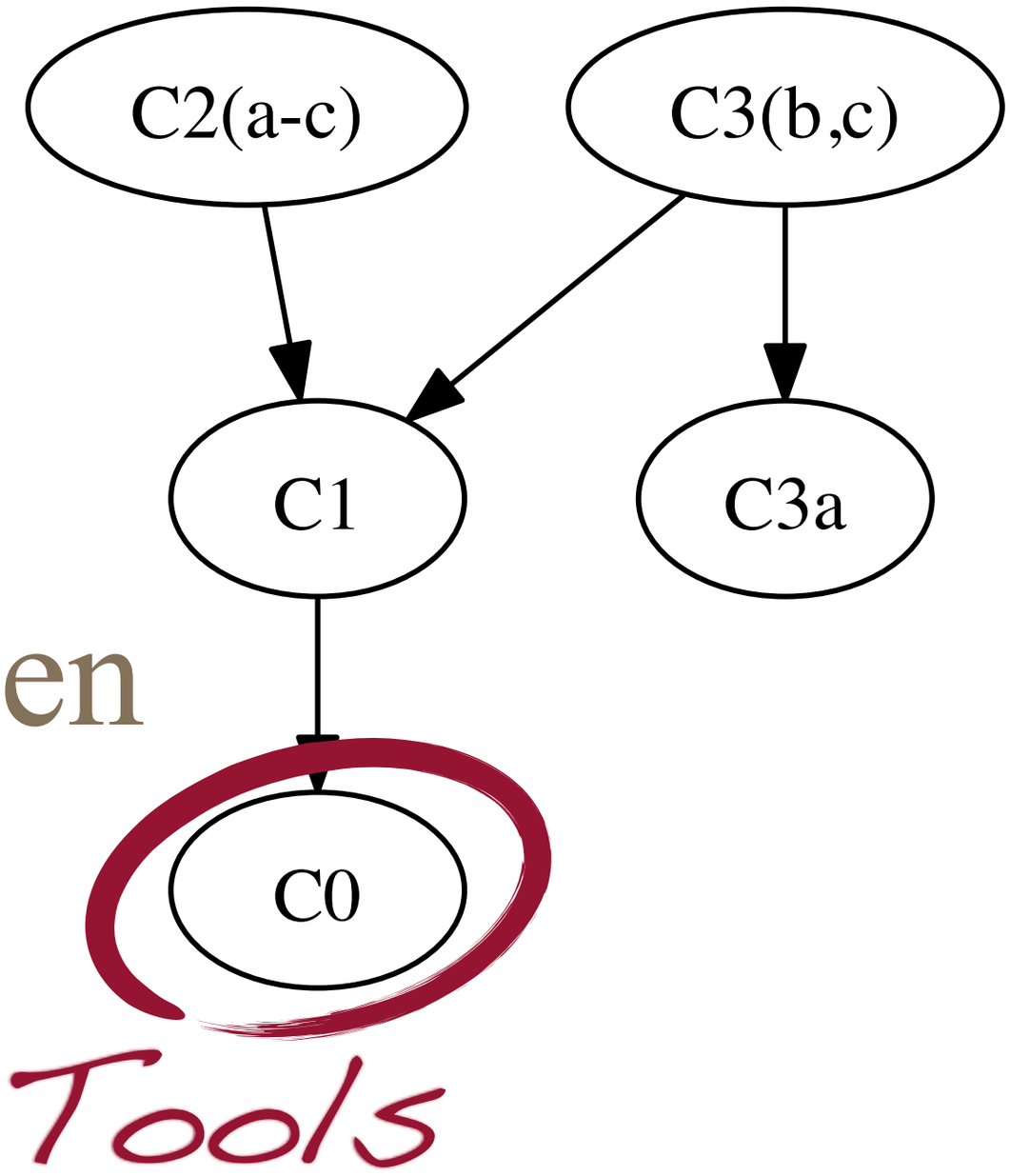

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Akzeptanzkriterien?

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Alter Hut #3

Vollständiger Test ist (außer bei trivialen Testobjekten) **nicht** möglich.

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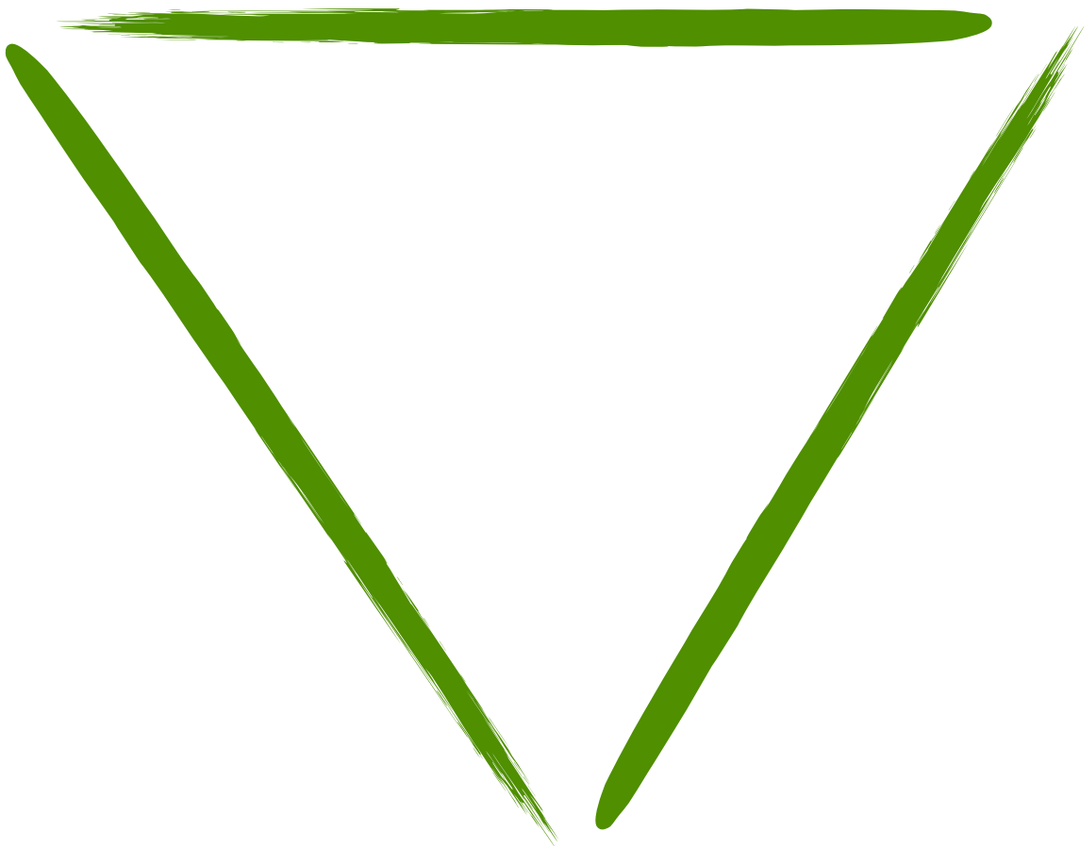
Und jetzt?

mehr Tests bessere Tests



Wartbarkeit

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Noch mehr Tests?

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```scala
final case class Elephant(id: ID, name: String, memory: Seq[Squee]) {
  override def equals(other: Any): Boolean = other match {
    case Elephant(i, _, _) => id == i
    case _ => false
  }

  val abbreviatedName =
    if (name.isEmpty) "<unnamed>"
    else if (name.length <= 10) name
    else name.substring(0, 9) + "…"

  def popularity = memory map age filter recent map weight reduce (_ + _)

  def age(squee: Squee) = weeksBetween(squee moment, now)
  def recent(span: Weeks) = span isLessThan weeks(50)
  def weight(span: Weeks) = (cos(span.getWeeks * Pi / 50d) + 1d) / 2d
}

final class ID private (val code: Int)
object ID {
  def apply(code: Int): ID = new ID(math abs code)
}

case class Squee(moment: DateTime)
```

VS

```scala
class FooSpec extends Specification with DataTables {
  "An elephant" should {
    val id = ID(42)

    "be identifiable" in {
      Elephant(id, "Mona", Nil).id must be equalTo id
    }

    "be identified only by its ID" in {
      Elephant(id, "Mona", Nil) must be equalTo Elephant(id, "Functo", Nil)
    }

    "not equal something else" in {
      Elephant(id, "Mona", Nil) == "fluffy cloud" must beFalse
    }

    "have a name" in {
      Elephant(id, "Mona", Nil).name must be equalTo "Mona"
    }

    "have an abbreviated name" in {
      "name"             || "abbreviated" |
      //-----------------||--------------|
      ""                 !! "<unnamed>"   |
      "Mona"             !! "Mona"        |
      "0123456789"       !! "0123456789"  |
      "0123456789A"      !! "012345678…"  |
      "Eyjafjallajökull" !! "Eyjafjall…"  |> {

      (name, expectedAbbreviation) =>
        Elephant(id, name, Nil).abbreviatedName must be equalTo expectedAbbreviation
      }
    }

    val memory = List(now, now - 25.weeks, now - 1.year) map Squee

    "remember the squees" in {
      Elephant(id, "Mona", memory).memory must be equalTo memory
    }

    "have a popularity rating" in {
      Elephant(id, "Mona", memory).popularity must be equalTo 1.5d
    }
  }

  "An ID" should {
    "always be positive" in {
      ID(-42).code must be equalTo 42
    }
  }
}
```


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$$\text{loc(tests)} \overset{?}{>} 2\,\text{loc(impl)}$$

$\longrightarrow$ code smell

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→ mehr (sinnvolle) Tests

→ nicht mehr Code

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Bessere Testfälle?

Äquivalenzklassenzerlegung,

Grenzwertanalyse

usw.

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Alter Hut #4

Blindheit gegenüber
den **eigenen** Fehlern.

Pair Programming?

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automatisiert

Durchführung

Testfallauswahl

manuell

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(insert drum roll here)

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Zufällige Testfälle.

nein, wirklich!

... also zumindest fast

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Property-Based Testing

- nicht wirklich neu
- Properties
- “geführte” Auswahl zufälliger Testdaten

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ScalaCheck

- http://github.com/rickynils/scalacheck
- “A powerful tool for automatic unit testing.”
- klein & einfach

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ScalaCheck

- test case minimisation
- stateful testing

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ScalaCheck läuft...

- mit Specs2 !
- mit ScalaTest
- mit SBT
- oder alleine

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3.– 6. September 2012
in Nürnberg

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Vielen Dank

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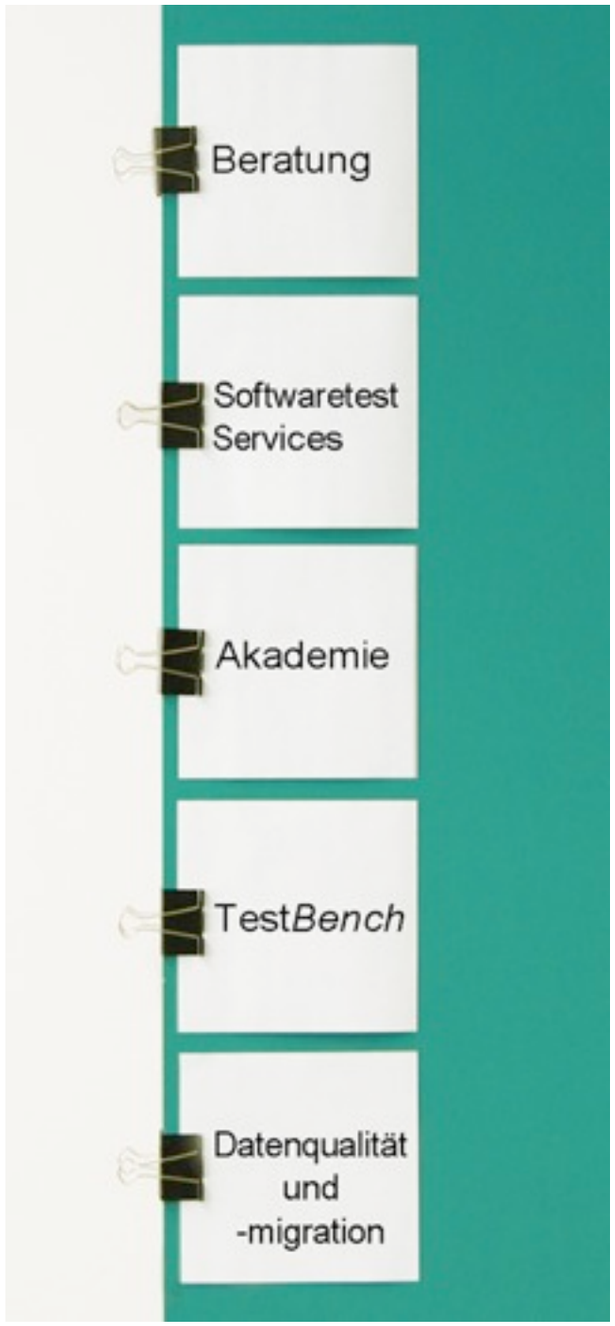

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