Figure 1:

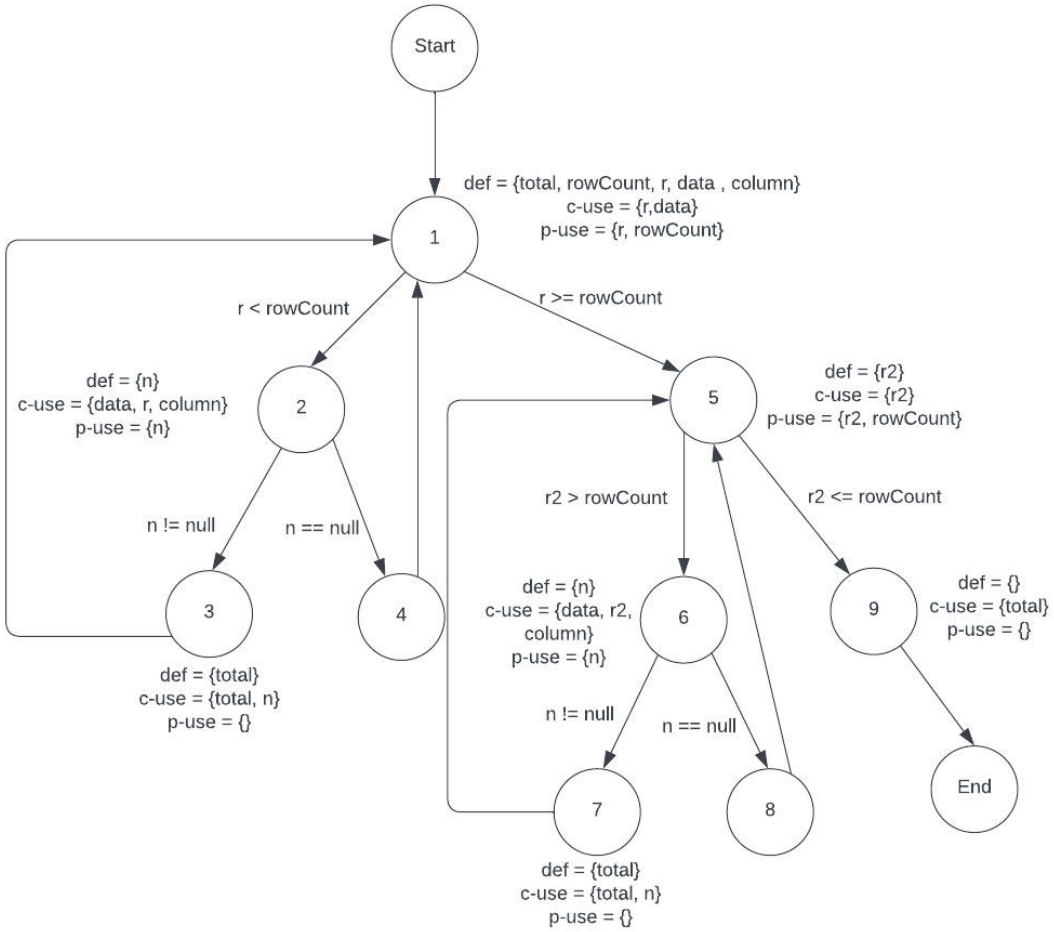

Start
def = {total, rowCount, r, data , column}
c-use = {r,data}
p-use = {r, rowCount}
1
r < rowCount
r >= rowCount
def = {n}
c-use = {data, r, column}
p-use = {n}
2
5
def = {r2}
c-use = {r2}
p-use = {r2, rowCount}
n != null
n == null
r2 > rowCount
r2 <= rowCount
3
4
def = {n}
c-use = {data, r2, column}
p-use = {n}
6
9
def = {}
c-use = {total}
p-use = {}
def = {total}
c-use = {total, n}
p-use = {}
n != null
n == null
End
7
8
def = {total}
c-use = {total, n}
p-use = {}

Figure 2:

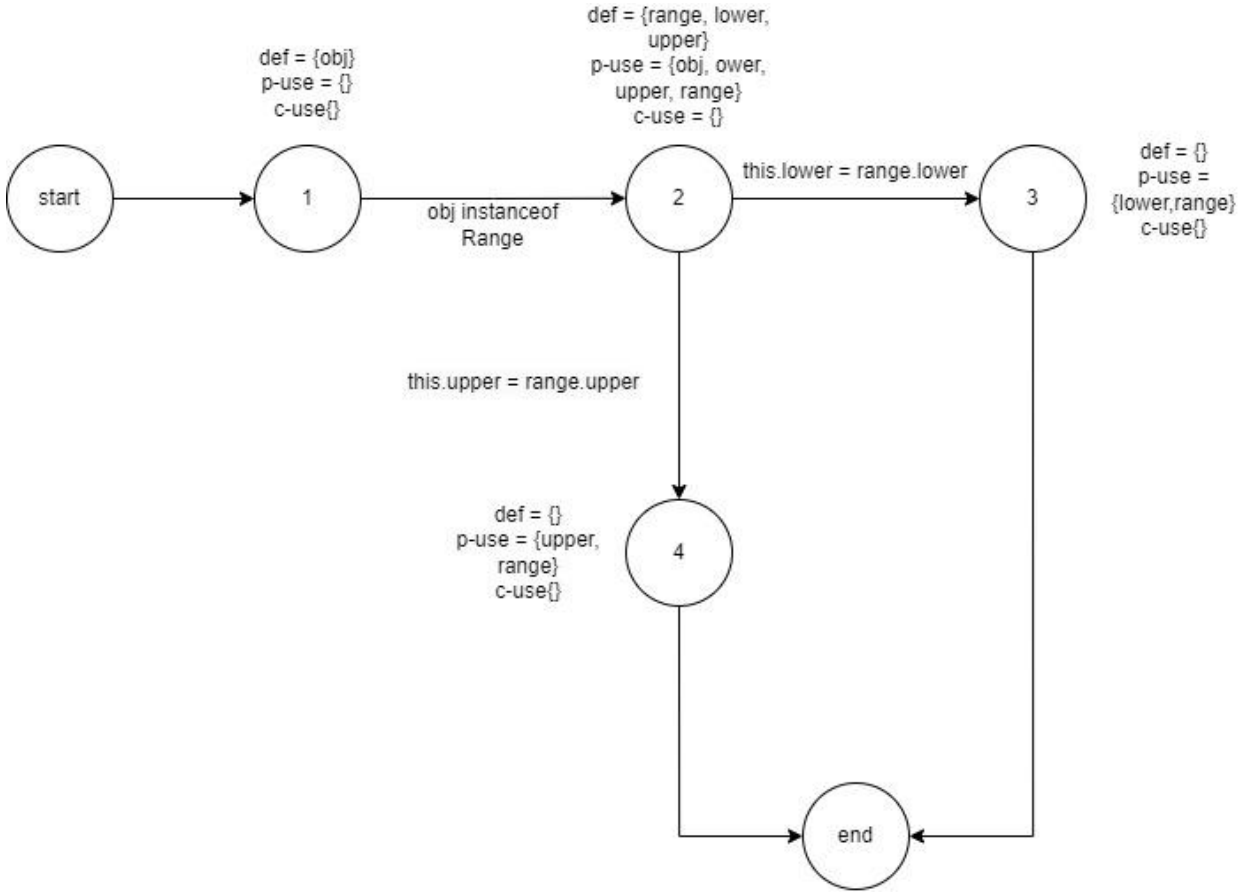
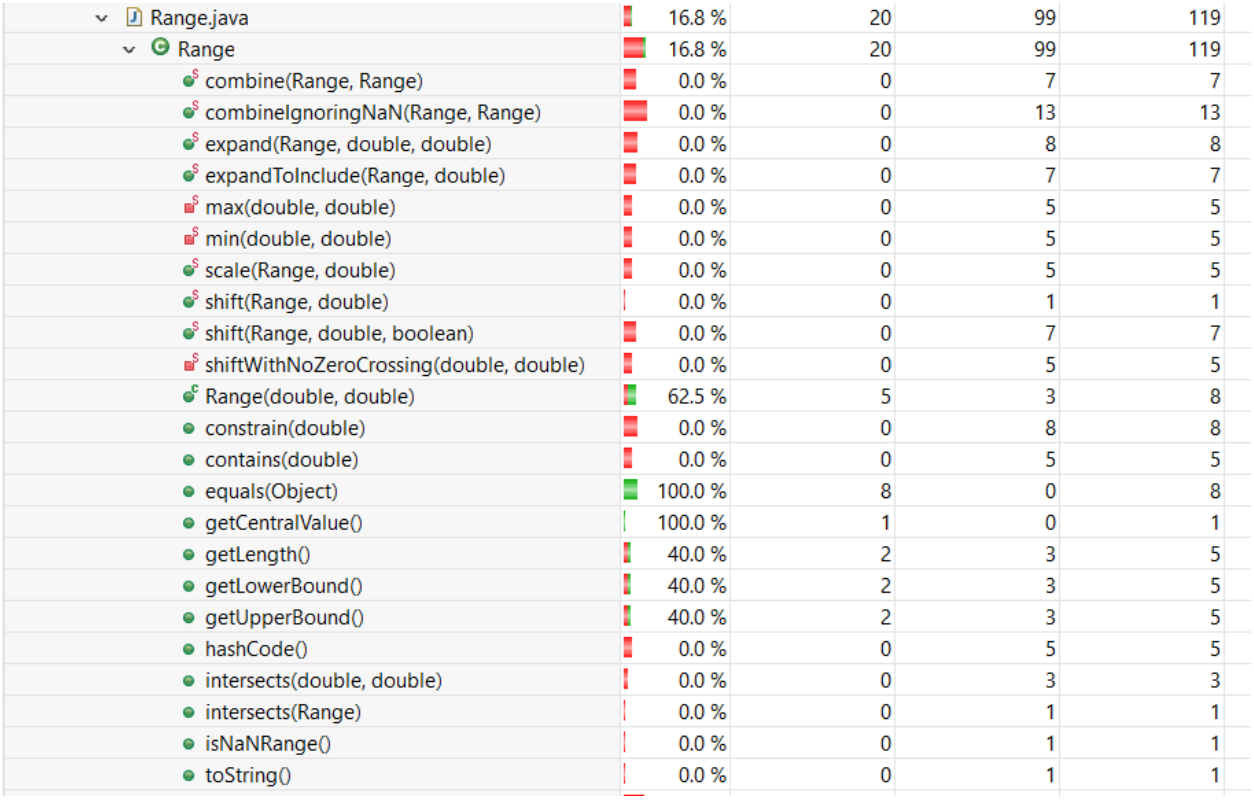

def = {obj}
p-use = {}
c-use{}
def = {range, lower, upper}
p-use = {obj, ower, upper, range}
c-use = {}
start
1
obj instanceof Range
2
this.lower = range.lower
3
def = {}
p-use = {lower,range}
c-use{}
this.upper = range.upper
def = {}
p-use = {upper, range}
c-use{}
4
end

Figure 3:
Old Range Coverage:
Branch coverage:

Range	12.2 %	10	72	82
combine(Range, Range)	0.0 %	0	4	4
combineIgnoringNaN(Range, Range)	0.0 %	0	14	14
expand(Range, double, double)	0.0 %	0	2	2
expandToInclude(Range, double)	0.0 %	0	6	6
max(double, double)	0.0 %	0	4	4
min(double, double)	0.0 %	0	4	4
scale(Range, double)	0.0 %	0	2	2
shift(Range, double)		0	0	0
shift(Range, double, boolean)	0.0 %	0	2	2
shiftWithNoZeroCrossing(double, double)	0.0 %	0	4	4
Range(double, double)	50.0 %	1	1	2
constrain(double)	0.0 %	0	6	6
contains(double)	0.0 %	0	8	8
equals(Object)	100.0 %	6	0	6
getCentralValue()		0	0	0
getLength()	50.0 %	1	1	2
getLowerBound()	50.0 %	1	1	2
getUpperBound()	50.0 %	1	1	2
hashCode()		0	0	0
intersects(double, double)	0.0 %	0	8	8
intersects(Range)		0	0	0
isNaNRange()	0.0 %	0	4	4
toString()		0	0	0

Line Coverage:



Range.java	16.8 %	20	99	119
Range	16.8 %	20	99	119
combine(Range, Range)	0.0 %	0	7	7
combineIgnoringNaN(Range, Range)	0.0 %	0	13	13
expand(Range, double, double)	0.0 %	0	8	8
expandToInclude(Range, double)	0.0 %	0	7	7
max(double, double)	0.0 %	0	5	5
min(double, double)	0.0 %	0	5	5
scale(Range, double)	0.0 %	0	5	5
shift(Range, double)	0.0 %	0	1	1
shift(Range, double, boolean)	0.0 %	0	7	7
shiftWithNoZeroCrossing(double, double)	0.0 %	0	5	5
Range(double, double)	62.5 %	5	3	8
constrain(double)	0.0 %	0	8	8
contains(double)	0.0 %	0	5	5
equals(Object)	100.0 %	8	0	8
getCentralValue()	100.0 %	1	0	1
getLength()	40.0 %	2	3	5
getLowerBound()	40.0 %	2	3	5
getUpperBound()	40.0 %	2	3	5
hashCode()	0.0 %	0	5	5
intersects(double, double)	0.0 %	0	3	3
intersects(Range)	0.0 %	0	1	1
isNaNRange()	0.0 %	0	1	1
toString()	0.0 %	0	1	1

Method coverage:

Range.java	26.1 %	6	17	23
Range	26.1 %	6	17	23
combine(Range, Range)	0.0 %	0	1	1
combineIgnoringNaN(Range, Range)	0.0 %	0	1	1
expand(Range, double, double)	0.0 %	0	1	1
expandToInclude(Range, double)	0.0 %	0	1	1
max(double, double)	0.0 %	0	1	1
min(double, double)	0.0 %	0	1	1
scale(Range, double)	0.0 %	0	1	1
shift(Range, double)	0.0 %	0	1	1
shift(Range, double, boolean)	0.0 %	0	1	1
shiftWithNoZeroCrossing(double, double)	0.0 %	0	1	1
Range(double, double)	100.0 %	1	0	1
constrain(double)	0.0 %	0	1	1
contains(double)	0.0 %	0	1	1
equals(Object)	100.0 %	1	0	1
getCentralValue()	100.0 %	1	0	1
getLength()	100.0 %	1	0	1
getLowerBound()	100.0 %	1	0	1
getUpperBound()	100.0 %	1	0	1
hashCode()	0.0 %	0	1	1
intersects(double, double)	0.0 %	0	1	1
intersects(Range)	0.0 %	0	1	1
isNaNRange()	0.0 %	0	1	1
toString()	0.0 %	0	1	1

New Range coverage:
Branch Coverage:

Element	Coverage	Covered Branches	Missed Branches	Total Branches
JFreeChart_Lab3	0.3 %	183	53,607	53,790
junit-4.11.jar	10.6 %	111	941	1,052
src	0.3 %	72	21,408	21,480
org.jfree.data	12.2 %	71	509	580
RangeTest.java		0	0	0
Range.java	86.6 %	71	11	82
Range	86.6 %	71	11	82
shift(Range, double)		0	0	0
getCentralValue()		0	0	0
hashCode()		0	0	0
intersects(Range)		0	0	0
toString()		0	0	0
combine(Range, Range)	100.0 %	4	0	4
expandToInclude(Range, double)	100.0 %	6	0	6
max(double, double)	100.0 %	4	0	4
min(double, double)	100.0 %	4	0	4
scale(Range, double)	100.0 %	2	0	2
shift(Range, double, boolean)	100.0 %	2	0	2
shiftWithNoZeroCrossing(double,	100.0 %	4	0	4
Range(double, double)	100.0 %	2	0	2
equals(Object)	100.0 %	6	0	6
isNaNRange()	100.0 %	4	0	4
combineIgnoringNaN(Range, Rar	85.7 %	12	2	14
constrain(double)	83.3 %	5	1	6
contains(double)	75.0 %	6	2	8
intersects(double, double)	75.0 %	6	2	8
expand(Range, double, double)	50.0 %	1	1	2
getLength()	50.0 %	1	1	2
getLowerBound()	50.0 %	1	1	2
getUpperBound()	50.0 %	1	1	2

Statement coverage:

RangeTest (Mar. 3, 2023 4:44:43 p.m.)

Element	Coverage	Covered Lines	Missed Lines	Total Lines
JFreeChart_Lab3	0.6 %	844	142,978	143,822
junit-4.11.jar	13.9 %	474	2,947	3,421
src	0.6 %	370	57,417	57,787
org.jfree.data	21.7 %	368	1,331	1,699
RangeTest.java	98.5 %	258	4	262
Range.java	92.4 %	110	9	119
Range	92.4 %	110	9	119
combine(Range, Range)	100.0 %	7	0	7
combineIgnoringNaN(Range, Rar	100.0 %	13	0	13
expand(Range, double, double)	100.0 %	8	0	8
expandToInclude(Range, double)	100.0 %	7	0	7
max(double, double)	100.0 %	5	0	5
min(double, double)	100.0 %	5	0	5
scale(Range, double)	100.0 %	5	0	5
shift(Range, double)	100.0 %	1	0	1
shift(Range, double, boolean)	100.0 %	7	0	7
shiftWithNoZeroCrossing(double,	100.0 %	5	0	5
Range(double, double)	100.0 %	8	0	8
constrain(double)	100.0 %	8	0	8
contains(double)	100.0 %	5	0	5
equals(Object)	100.0 %	8	0	8
getCentralValue()	100.0 %	1	0	1
hashCode()	100.0 %	5	0	5
intersects(double, double)	100.0 %	3	0	3
intersects(Range)	100.0 %	1	0	1
isNaNRange()	100.0 %	1	0	1
toString()	100.0 %	1	0	1
getLength()	40.0 %	2	3	5
getLowerBound()	40.0 %	2	3	5
getUpperBound()	40.0 %	2	3	5

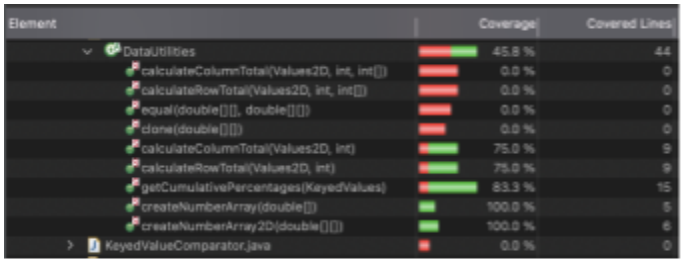
Method Coverage:

RangeTest (Mar. 3, 2023 4:44:43 p.m.)

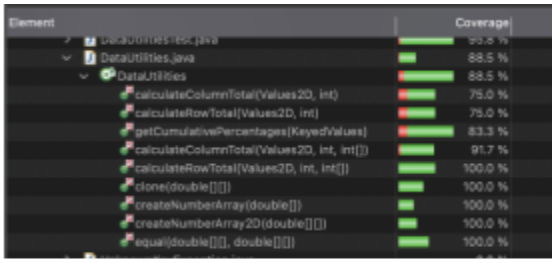
Element	Coverage	Covered Methods	Missed Methods	Total Methods
JFreeChart_Lab3	1.3 %	302	23,273	23,575
junit-4.11.jar	16.6 %	196	987	1,183
src	1.2 %	106	8,449	8,555
org.jfree.data	31.5 %	105	228	333
Range.java	100.0 %	23	0	23
Range	100.0 %	23	0	23
combine(Range, Range)	100.0 %	1	0	1
combineIgnoringNaN(Range, Rar	100.0 %	1	0	1
expand(Range, double, double)	100.0 %	1	0	1
expandToInclude(Range, double)	100.0 %	1	0	1
max(double, double)	100.0 %	1	0	1
min(double, double)	100.0 %	1	0	1
scale(Range, double)	100.0 %	1	0	1
shift(Range, double)	100.0 %	1	0	1
shift(Range, double, boolean)	100.0 %	1	0	1
shiftWithNoZeroCrossing(double,	100.0 %	1	0	1
Range(double, double)	100.0 %	1	0	1
constrain(double)	100.0 %	1	0	1
contains(double)	100.0 %	1	0	1
equals(Object)	100.0 %	1	0	1
getCentralValue()	100.0 %	1	0	1
getLength()	100.0 %	1	0	1
getLowerBound()	100.0 %	1	0	1
getUpperBound()	100.0 %	1	0	1
hashCode()	100.0 %	1	0	1
intersects(double, double)	100.0 %	1	0	1
intersects(Range)	100.0 %	1	0	1
isNaNRange()	100.0 %	1	0	1
toString()	100.0 %	1	0	1

DataUtilities Coverage comparisons

Line coverage



Old DataUtilities Test Suite



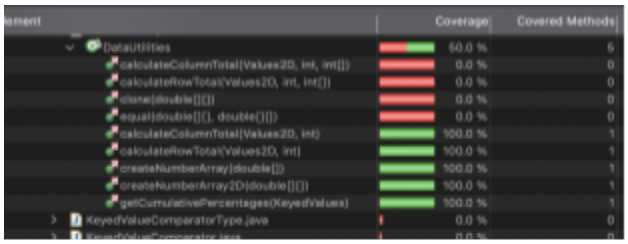
New DataUtilities Test Suite

Branch coverage

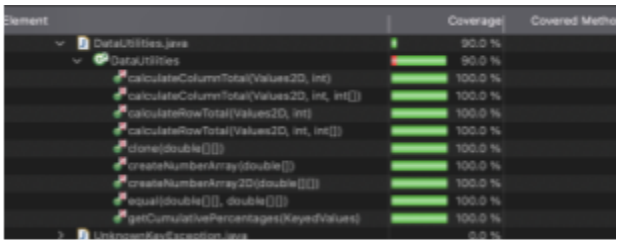
Old DataUtilities Test Suite

New DataUtilities Test Suite

Method coverage



Old DataUtilities Test Suite



New DataUtilities Test Suite