SOEN 384
Software Management, Measurement and Quality Control
Department of Computer Science and Software Engineering (CSSE)

Fall 2023

Mini Project 4

Team:

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Question 1

1.1

The release date for each tag are as follow:

r5.8.2: November 28th, 2021
r5.9.2: January 10th, 2023
r5.10.0: July 23rd, 2023

Question 2

2.1

The number of private classes and public class for each tag are as follows:

r5.10.0: 15 private classes, 359 public classes
r5.9.2: 15 private classes, 347 public classes
r5.8.2: 14 private classes, 322 public classes

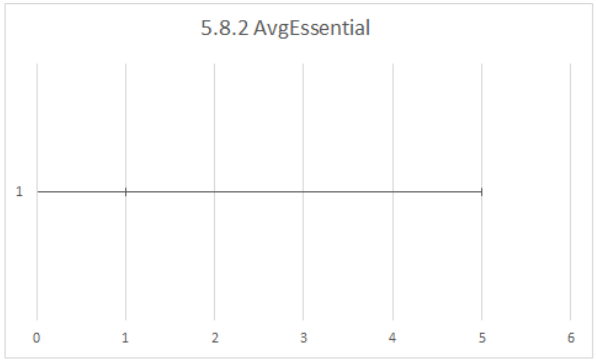
2.2

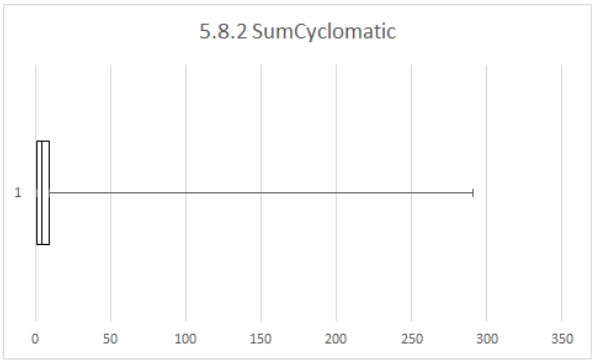
A) The quality characteristics are as follows:
- **SumCyclomatic**: coupling
- **AvgEssential**: cohesion
- **MaxInheritanceTree**: inheritance
- **PercentLackOfCohesion**: cohesion
- **CountClassDerived**: inheritance
- **CountClassCoupled**: coupling
- **CountDeclMethod**: code complexity
- **CountLineCode**: cohesion

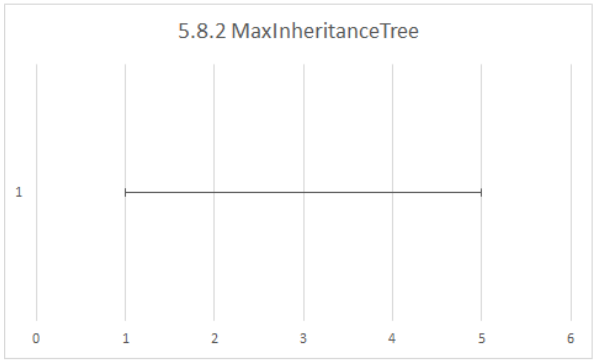
B)

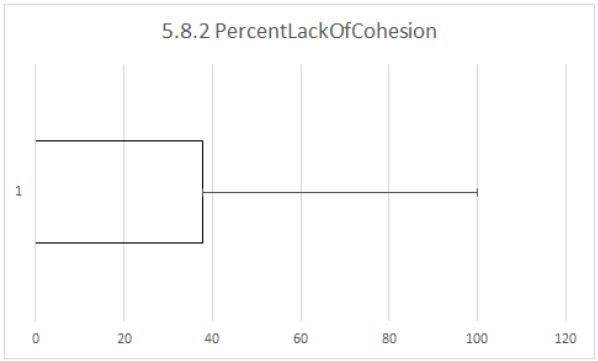
i) Consider the follows box plots,

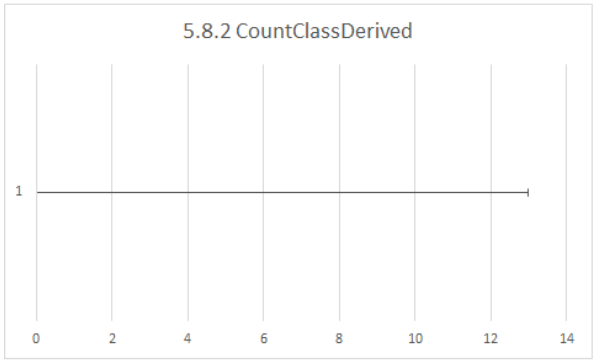
r5.8.2 Box Plots

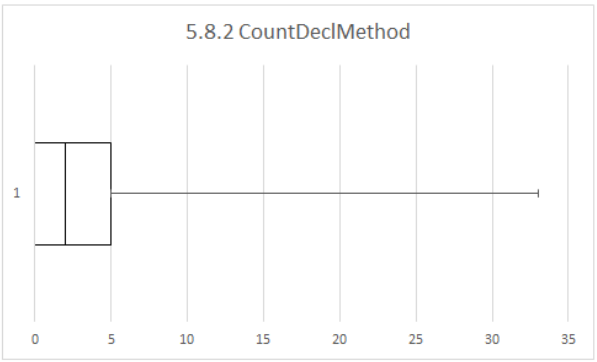


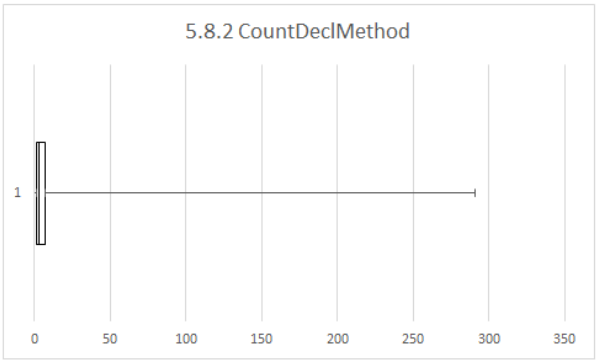


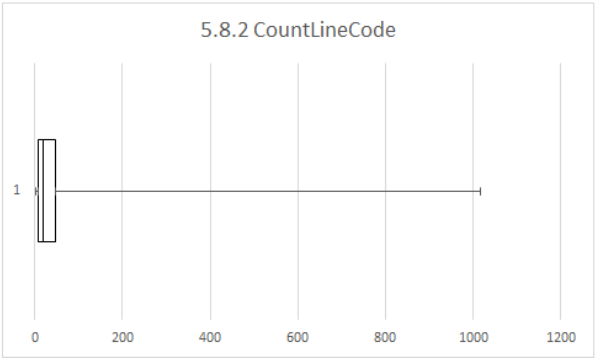




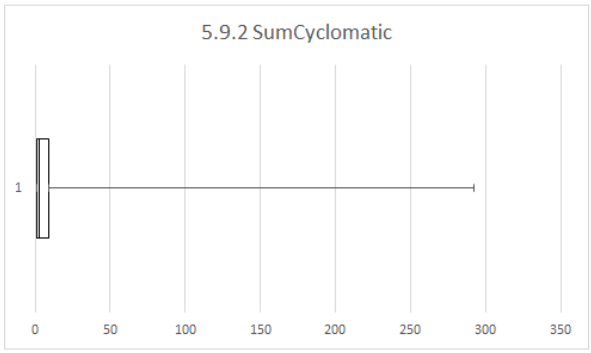


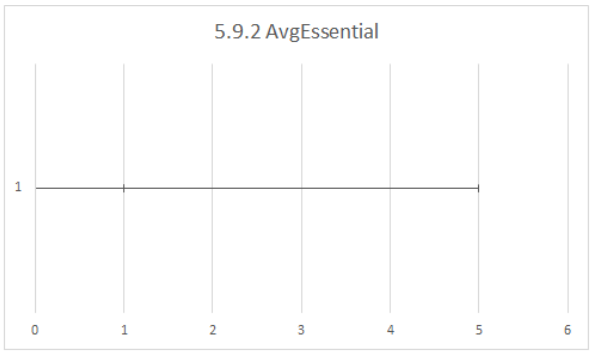


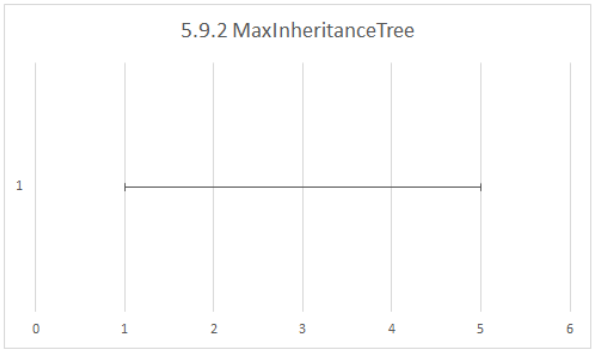


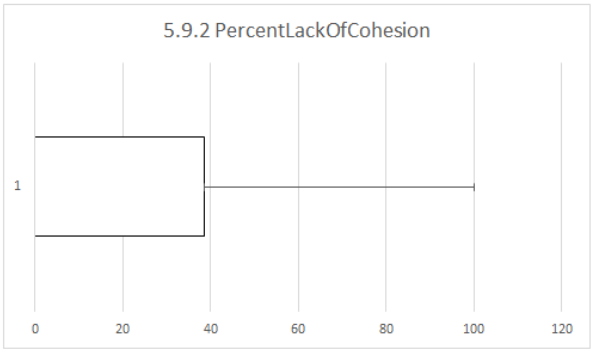


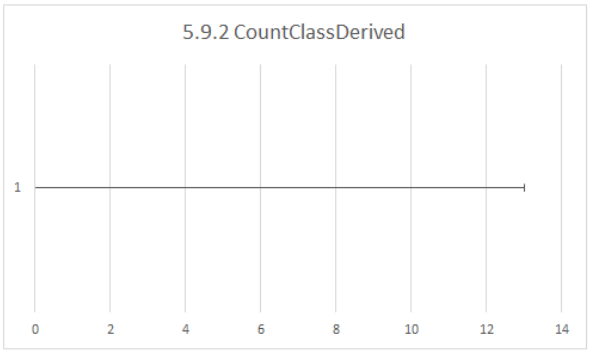
r5.9.2 Box Plots

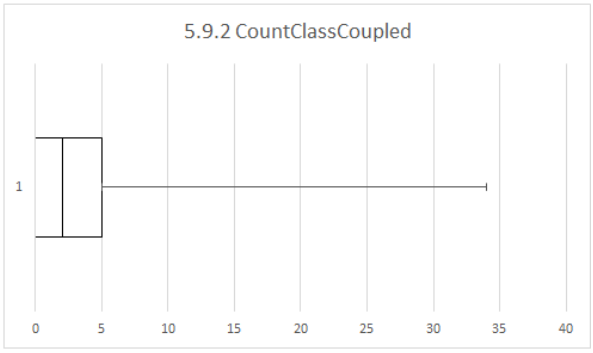


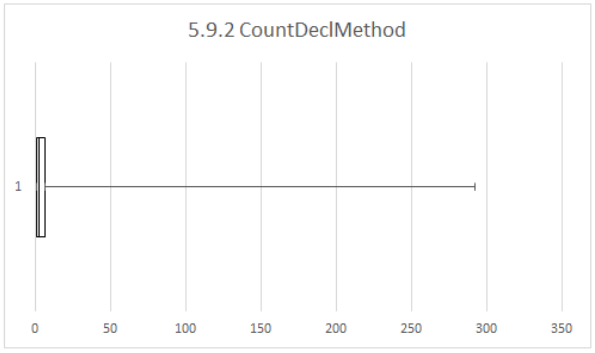


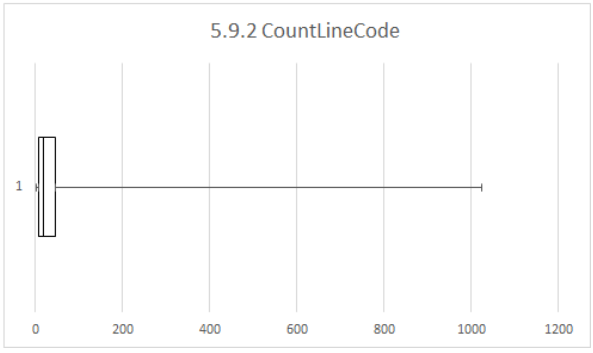




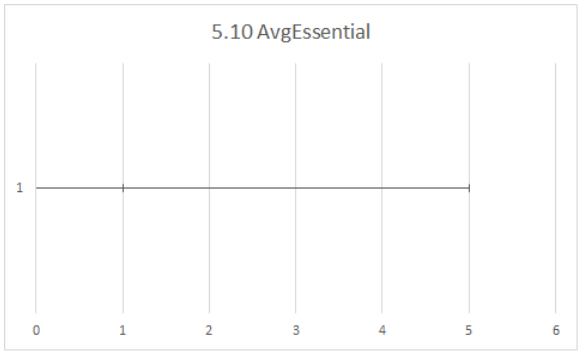


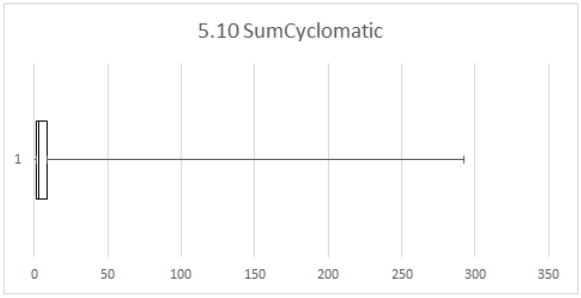


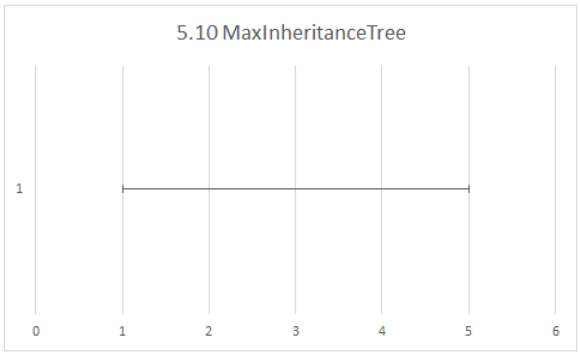


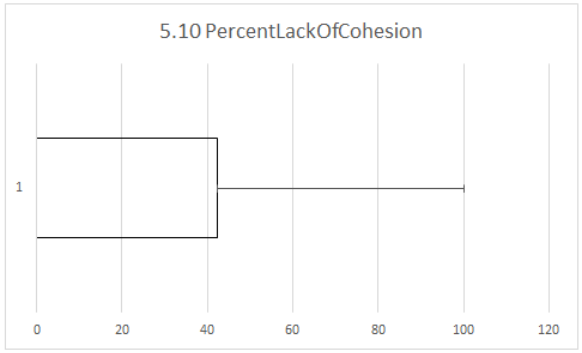


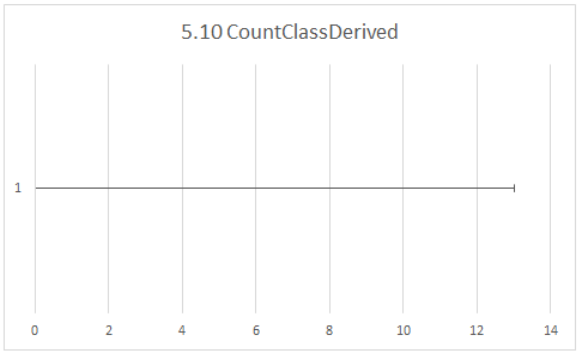
r5.10.0 Box Plots

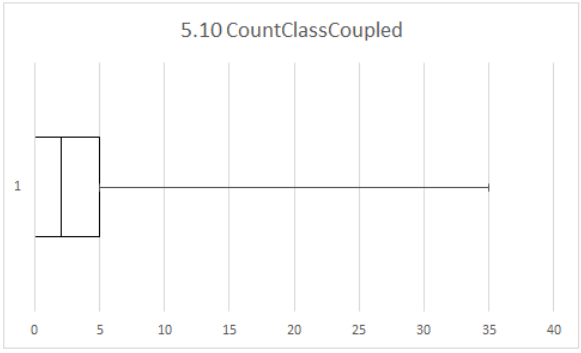


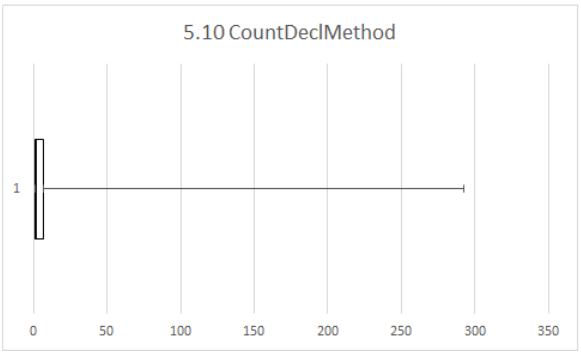












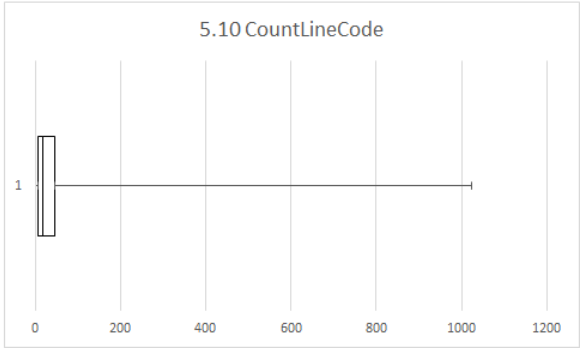


Table of Medians

	Avg Essential	Sum Cyclomatic	Max Inheritance Tree	Percent Lack OfCohesion	Count Class Derived	Count Class Coupled	Count Decl Method	Count Line Code
5.8.2	1	4	1	0	0	2	3	20
5.9.2	1	3	1	0	0	2	3	19.5
5.10	1	3	1	0	0	2	2	19

Table of Ranges Where 50% of Values Reside

	Avg Essential	Sum Cyclomatic	Max Inheritance Tree	Percent Lack OfCohesion	Count Class Derived	Count Class Coupled	Count Decl Method	Count Line Code
5.8.2	{1,1}	{1,9}	{1,1}	{0,37.75}	{0,0}	{0,5}	{1,7}	{9,47.75}
5.9.2	{1,1}	{1,9}	{1,1}	{0,38.5}	{0,0}	{0,5}	{1.7}	{8,47}
5.10	{1,1}	{1,9}	{1,1}	{0,42.25}	{0,0}	{0,5}	{1,7}	{8,47.25

Table of Minimum Values

	Avg Essential	Sum Cyclomatic	Max Inheritance Tree	Percent Lack OfCohesion	Count Class Derived	Count Class Coupled	Count Decl Method	Count Line Code
5.8.2	0	0	1	0	0	0	0	2
5.9.2	0	0	1	0	0	0	0	2
5.10	0	0	1	0	0	0	0	2

Table of Maximum Values

	Avg Essential	Sum Cyclomatic	Max Inheritance Tree	Percent Lack OfCohesion	Count Class Derived	Count Class Coupled	Count Decl Method	Count Line Code
5.8.2	5	291	5	100	13	33	291	1015
5.9.2	5	292	5	100	13	34	292	1024
5.10	5	292	5	100	13	35	292	1024

ii) Overall, the quality characteristics of the code is increasing across tags.

iii)

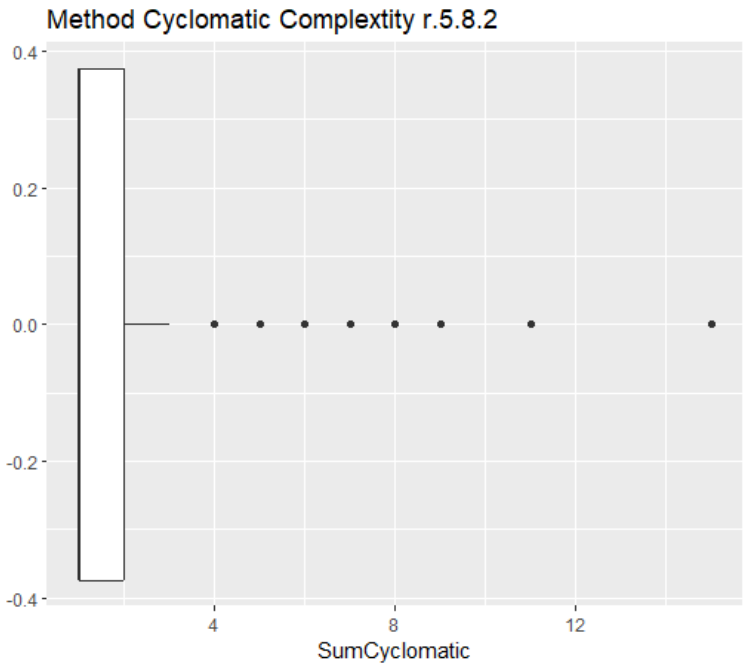
1. **AvgEssential:**
    - All three tags have a median of 1, suggesting a consistent average essential complexity.
2. **SumCyclomatic:**

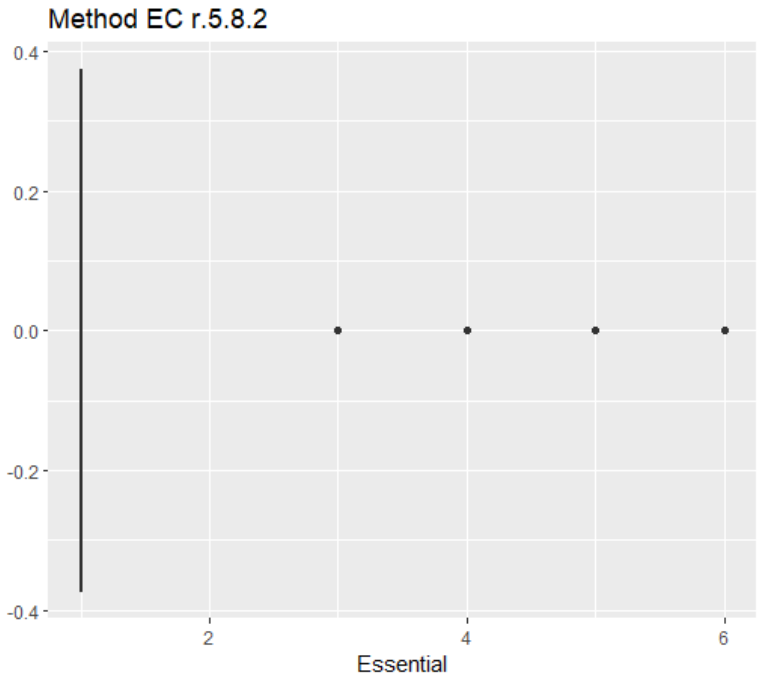
    - There is a decrease in the median from 5.8.2 to 5.9.2, indicating a potential improvement in the overall cyclomatic complexity. However, the median remains consistent between 5.9.2 and 5.10.
3. **MaxInheritanceTree:**
    - The median is consistently 1 across all tags, suggesting a consistent maximum depth of the inheritance tree.
4. **PercentLackOfCohesion:**
    - The median is consistently 0 across all tags, indicating a lack of cohesion.
5. **CountClassDerived:**
    - The median is consistently 0, indicating no classes derived from a particular class. This could be intentional in the design.
6. **CountClassCoupled:**
    - The median remains consistent at 2, suggesting a consistent level of class coupling.
7. **CountDeclMethod:**
    - There is a decrease in the median from 5.9.2 to 5.10, indicating a potential reduction in the number of declared methods. The median remains consistent between 5.8.2 and 5.9.2.
8. **CountLineCode:**
    - There is a decrease in the median from 5.8.2 to 5.9.2 and 5.9.2 to 5.10, indicating a potential reduction in the number of lines of code.

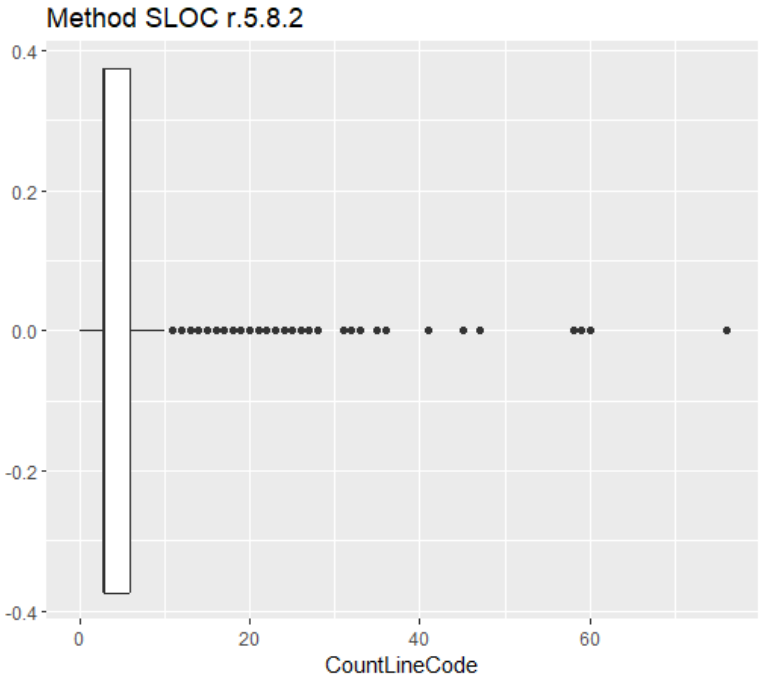
Overall, the trends in these metrics suggest potential positive changes in code quality.

Question 2.3

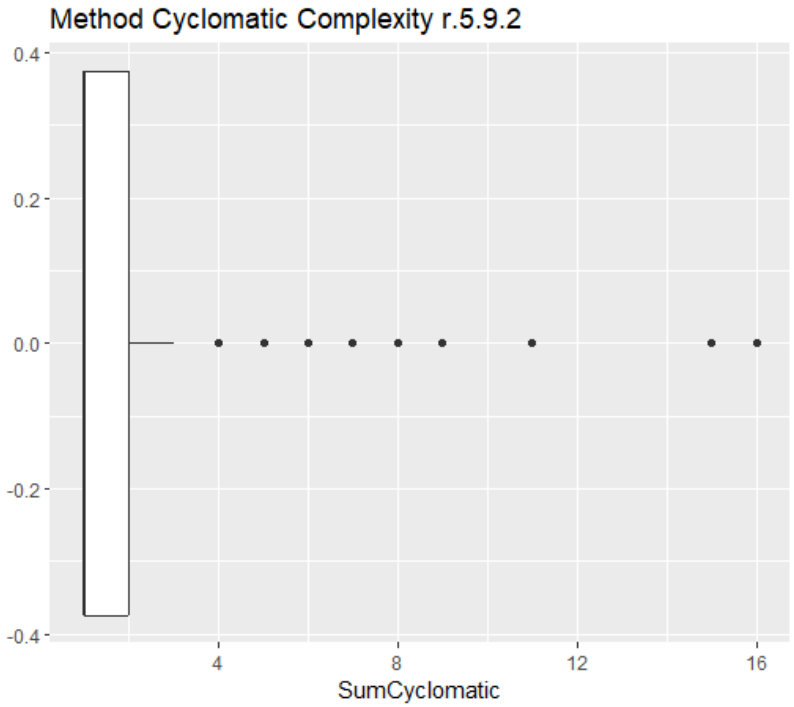
Consider the following r.5.8.2 method graphs,

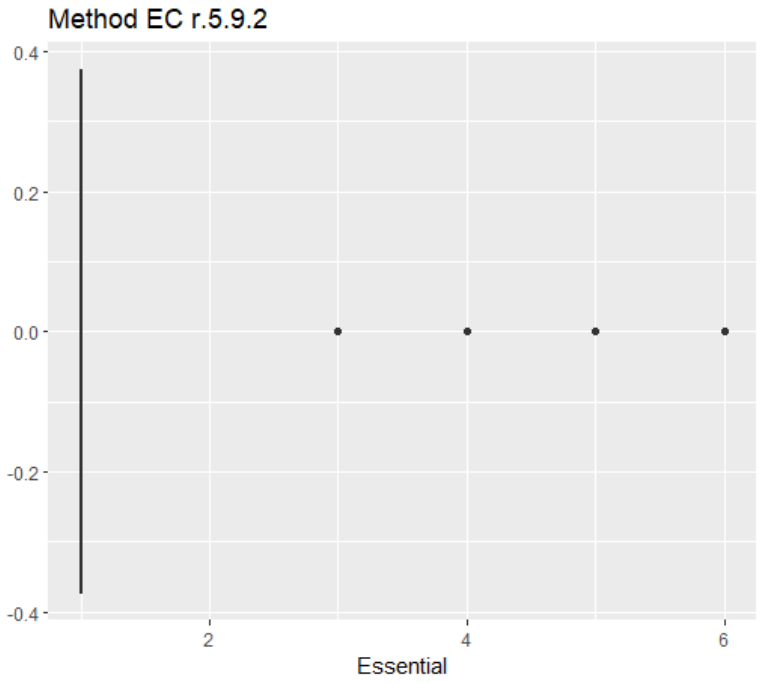


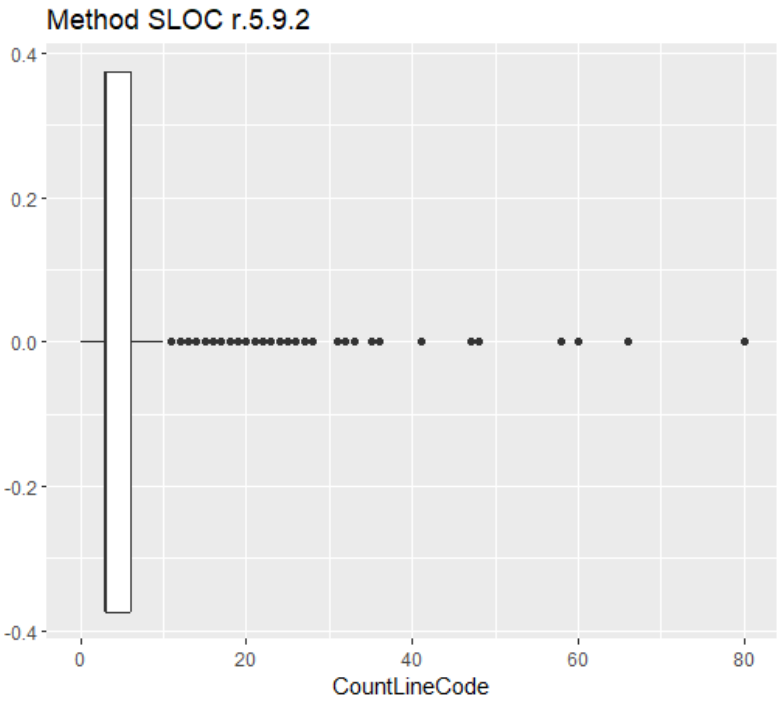

Method EC r.5.8.2
0.4
0.2
0.0
-0.2
-0.4
2
4
6
Essential


Method SLOC r.5.8.2
0.4
0.2
0.0
-0.2
-0.4
0
20
40
60
CountLineCode

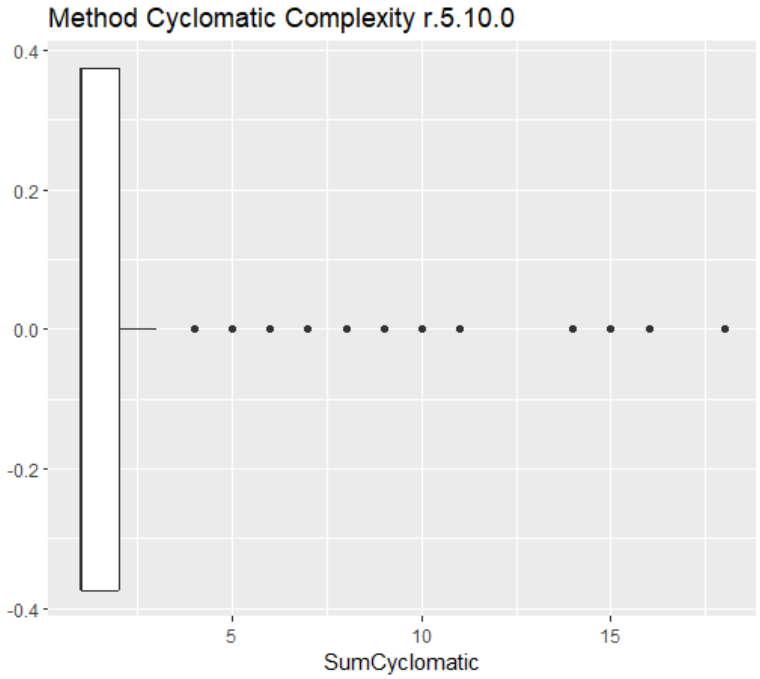
Further, consider the following r.5.9.2 method graphs

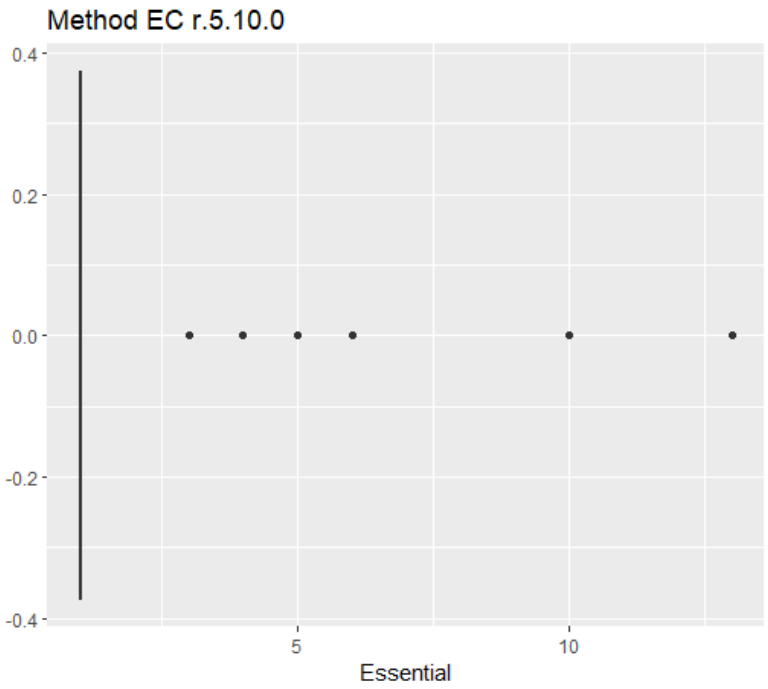


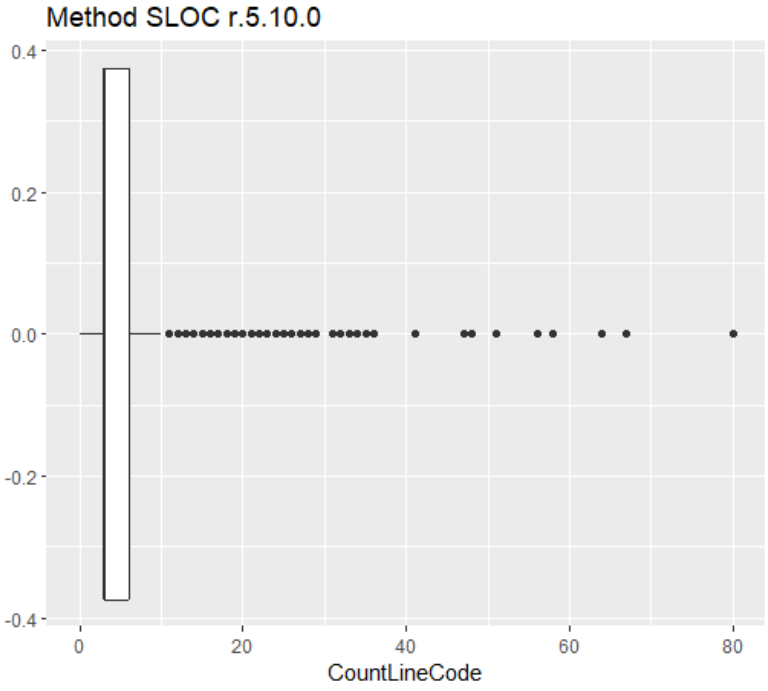




Once more, consider the following r.5.10.0 method graphs




Method EC r.5.10.0
0.4
0.2
0.0
-0.2
-0.4
5
10
Essential


Method SLOC r.5.10.0
0.4
0.2
0.0
-0.2
-0.4
0
20
40
60
80
CountLineCode

Question 2.3

A)

Number of methods r.5.8.2

- Private Methods: 721
- Public Methods: 1845
- Protected Methods: 158

Number of methods r.5.9.2

- Private Methods: 777
- Public Methods: 1964
- Protected Methods: 162

Number of methods r.5.10.0

- Private Methods: 804
- Public Methods: 2124
- Protected Methods: 177

B)

Consider the methods of r.5.10.0

- Consider the table below that ranks the SLOC and EC from highest to lowest:

EC	SLOC	Name	Kind
1	250	org.junit.jupiter.params.provider.CsvArgumentsProviderTests.throwsExceptionIfValueAndTextBlockAreDeclared	Method
1	143	org.junit.platform.StackTracePruningTests.shouldNotPruneStackTraceWhenDisabled	Method
1	108	org.junit.jupiter.engine.TestInstanceLifecycleTests.instancePerClassWithNestedTestClass	Method
1	104	org.junit.jupiter.engine.TestInstanceLifecycleTests.instancePerMethodOnOuterTestClassWithInstancePerClassOnNestedTestClass	Method
1	104	org.junit.jupiter.engine.TestInstanceLifecycleTests.instancePerMethodWithNestedTestClass	Method

Consider the methods r.5.8.2

- Consider the table below that ranks the SLOC and EC from highest to lowest:

EC	SLOC	Name	Kind
1	76	org.junit.jupiter.params.ParameterizedTestExtensionTests.getExtensionContextReturningSingleMethod	Private Method
1	60	org.junit.platform.suite.commons.SuiteLauncherDiscoveryRequestBuilder.suite	Public Method
1	59	org.junit.jupiter.engine.extension.TempDirectory.CloseablePath.deleteAllFilesAndDirectories	Private Method
1	58	org.junit.jupiter.engine.TestInstanceLifecycleTests.instancePerClass	Private Method
1	47	org.junit.jupiter.engine.discovery.AbstractOrderingVisitor.orderChildrenTestDescriptors	Protected Method

Consider the methods r.5.9.2

- Consider the table below that ranks the SLOC and EC from highest to lowest:

EC	SLOC	Name	Kind
1	80	org.junit.jupiter.params.ParameterizedTestExtensionTests.getExtensionContextReturningSingleMethod	Private Method
1	66	org.junit.jupiter.engine.extension.TempDirectory.CloseablePath.deleteAllFilesAndDirectories	Private Method
1	60	org.junit.platform.suite.commons.SuiteLauncherDiscoveryRequestBuilder.suite	Public Method
1	58	org.junit.jupiter.engine.TestInstanceLifecycleTests.instancePerClass	Private Method
3	48	org.junit.platform.engine.support.discovery.EngineDiscoveryRequestResolution.resolve	Private Method

C) Generally, the same methods are found in each tag, and the metrics SLOC and EC have increased with time, for each tag.