

# Inf1-OP Exam Report 2018

Volker Seeker

October 9, 2018

## 1 Preamble

This document was composed to summarise information regarding the exam of the course Informatics 1 - Object Oriented Programming. Although a majority of students gets through well and pass rates have stayed on the same level as in the previous year, some students typically struggle to pass this course. The pass rate in 2017/18 for the entire course has been 84% which is about the same as in the year before with 83%. The aim of this document is to help in finding a way to increase the pass rate even more and provide support for struggling students. Particularly the amount of zero marks should be addressed which is due to the format of the exam and the applied marking approach.

### 1.1 Original teaching committee action point

The INF1-OP exam has a high failure rate with many zero marks which is in part due to the format two questions, with a requirement to compile the program successfully to get any marks at all. Because the structure is inherited from the last course co-ordinator the pattern of bad results is repeated. One option would be to compartmentalise the compile test, and the other would be to divide the exam into more questions. The committee discussed this, noting that the large cohort (over 340 students in 2017-18) makes the exam difficult to mark manually. It was decided that the co-ordinator should bring a report on the exam to the next TC in order to better assess the options.

## 2 Traditional Exam Process

It follows a short description of the traditional exam process to provide some background:

### 2.1 Exam Format

Each exam usually has two questions with multiple subquestions. Each question requires the students to implement solutions to a given problem in Java. To set the scene and introduce the task, each question starts with a description of the problem and related resources. A single questions is usually answered in a single Java class file while subquestions require the

implementation of distinct methods within that class. A set of existing classes for the students to work with is often provided. The entire exam is set for two hours.

## **2.2 Compilation and Test Hurdle**

In order to ensure a minimum level of programming skill and to allow for a smooth marking process, the students are required to submit code that compiles without error and passes basic JUnit test cases which are provided. If compilation fails or basic tests are not passed, the corresponding question receives zero marks.

## **2.3 Marking**

In a first instance students' submissions are marked automatically using an automarker script which runs and evaluates JUnit test cases on their code. Each of the executed tests corresponds to an amount of marks which will be subtracted if the test fails. Not everything can be tested with reasonable complexity using Unit tests. Hence, some additional static analysis and manual eyeballing of the code is applied.

# **3 Changes in 2017/18**

In order to reduce the failure rate, some changes have been introduced in 2017/18. The fail rate of students has dropped by 5% in the main sit. The zero spike is at 7% for the main sit if not considering the students who did not participate and at 0% for the resit. The average marks for the two main sits were 69% and 66% if not considering students who did not participate (see Section 7 for details).

## **3.1 Exam Format Changes**

There are still two questions. They follow a specific format which is introduced to the students in the mock exam. The first question requires the students to write a new class from scratch possibly extending an existing super class. The second questions requires the students to implement method stubs in a class skeleton possibly using existing utility functions. See the 2017/18 main exam for an example:

[http://www.inf.ed.ac.uk/teaching/exam\\_papers/2018/informatics1/inf1-  
oop-sitting\\_1.pdf](http://www.inf.ed.ac.uk/teaching/exam_papers/2018/informatics1/inf1-<br/>oop-sitting_1.pdf)

## **3.2 Marking Changes**

Whenever a submission did not compile or did not pass the basic unit tests it was scrutinised more thoroughly. An effort was made to “fix” the submitted code so it would pass the tests and compile. All “fixes” were documented and marks were redacted accordingly.

Fixing code usually meant that function bodies which caused errors were commented out so that the submission would compile, pass the tests and could be marked for the working methods.

With this approach some students could be “saved” from failing due to a single error in one function while most of the rest was working well. However, the amount of students who actually moved beyond 40% due to that was relatively low (10 students for the main sit). The others would fall somewhere between 0% and 40% and reduce the zero spike.

In the resit even more effort was made and also partial marks were given for commented out code or partially correct implementations. The amount of students moving beyond the fail mark was, however, not significantly higher.

## 4 Potential Changes for 2018/19

### 4.1 More Compilation Units

To reduce the impact of a zero marks due to compilation or test errors on the entire exam, more than two compilation units in more than two questions can be introduced. The downside of this approach is that problems might go towards artificial toy problems since the compilation units need to be kept small.

### 4.2 Improved Submission Process

The submission system could be improved to allow submitting single functions rather than entire classes. This is not currently possible with the available submission system. A potential solution could be using the CodeRunner web interface which provides such functionality. In addition, CodeRunner can compile and test the code before submitting it and potentially reject it right away.

<http://coderunner.org.nz/>

### 4.3 Additional Time

A student focus meeting before the beginning of the year was held, some students were interviewed after the exam and the student rep provided some additional feedback regarding the mock exam. One point that came up was that students were able to solve the lab exercises correctly as well as old exam questions. However, they would perform poorly under the pressure of the exam situation.

One possible solution could be to extend the time of the exam to three hours. This could reduce the pressure and give students more time to test their solutions and make them comply with compilation and basic unit tests.

A downside is the amount of students on the course (407 currently registered for 2018/19) and whether three hour exams can be held on a single day for such numbers.

## 4.4 Positive Marking

The current marking process uses a negative marking scheme where marks are subtracted if tests fail and presents the results to the students in that way. Since positive marking is encouraged, the marking scheme using the automarker and additional manual efforts can be changed to follow a positive approach where passed tests are rewarded with marks.

## 4.5 More Manual Marking

The compilation and basic unit test rules could be loosened by allowing submissions which violate those conditions. This would require a higher manual effort from the marking side. Marks could be given for partially correct code or commented out code.

A downside is again the amount of students. With the previous marking approach in 2017/18 it took about 70 hours to finish the marking for the main sit which included writing the Unit tests for the automarker. About 25 hours were needed for the resit which had roughly 50 submissions. More time was spent on manual marking for this sitting. Scaling that up to 400 students would result in 200 marking hours.

If additional markers can be employed to help out, this might be an option. However, coordinating multiple markers and making sure that marks are assigned consistently and fairly creates additional overhead.

Another downside is the fact that allowing solutions which don't compile and do not fulfill basic tests, significantly lowers what is expected of students for this exam who will then go forward into the second year where programming skills are required.

## 5 Future Changes

The problems some students have with the current exam is not necessarily only due to the nature of the exam but likely also due to the nature of how the course is taught. The curriculum for the second semester of UG1 is currently being revised which would include a redesign of the INF1-OP course and the way it is taught and assessed. This could potentially solve the current situation with the INF1-OP exam.

## 6 Conclusion

In the main exam 2017/18, the fail rate has been reduced by 5% as well as the spike at zero marks. This is potentially due to the changes of the exam and marking process introduced in 2017/18. Further changes are suggested in this document and could help to increase the pass rate even more. Considering that the course will be restructured following a curriculum review in 2019/20, a larger revision of the exam process can be applied at that point.

## 7 Supplement

This section shows statistics of the mock, main and resit exams from 2017/18. Additional data is available to put other statistics together such as the correlation of students failing the exam and students participating in the mock, practicing old exams, taking the exam for the second time or being outside students. This has, however, not been done yet.

# Inf1-OP Mock 2018

## Statistics

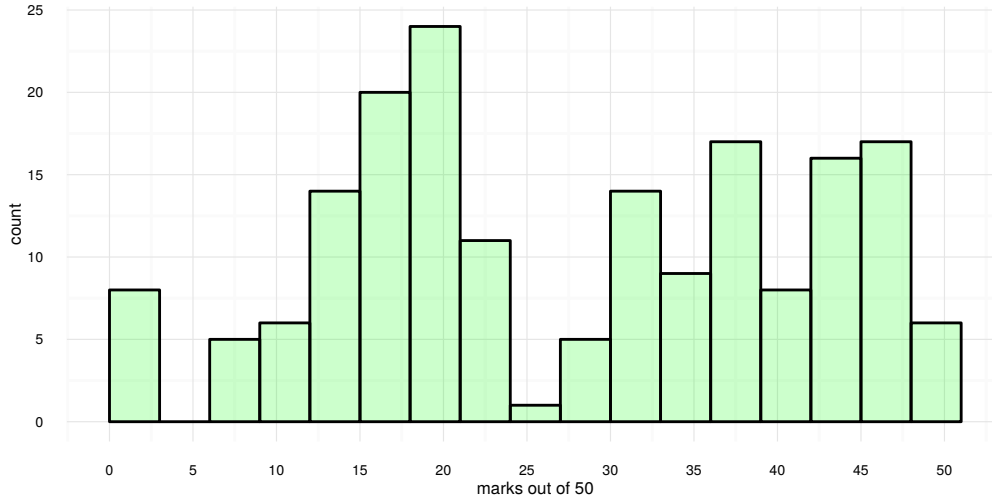
Participation 208/351 (59.26%)

Mean Marks 28.01 (56.01%)

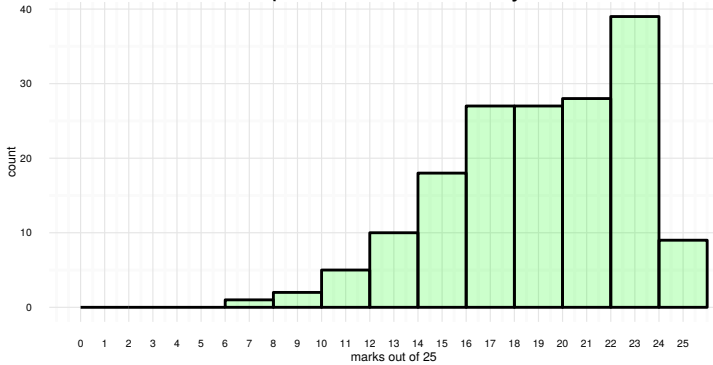
Fail Rate (accepted submissions) 32.69%

Fail Rate (total) 45.67%

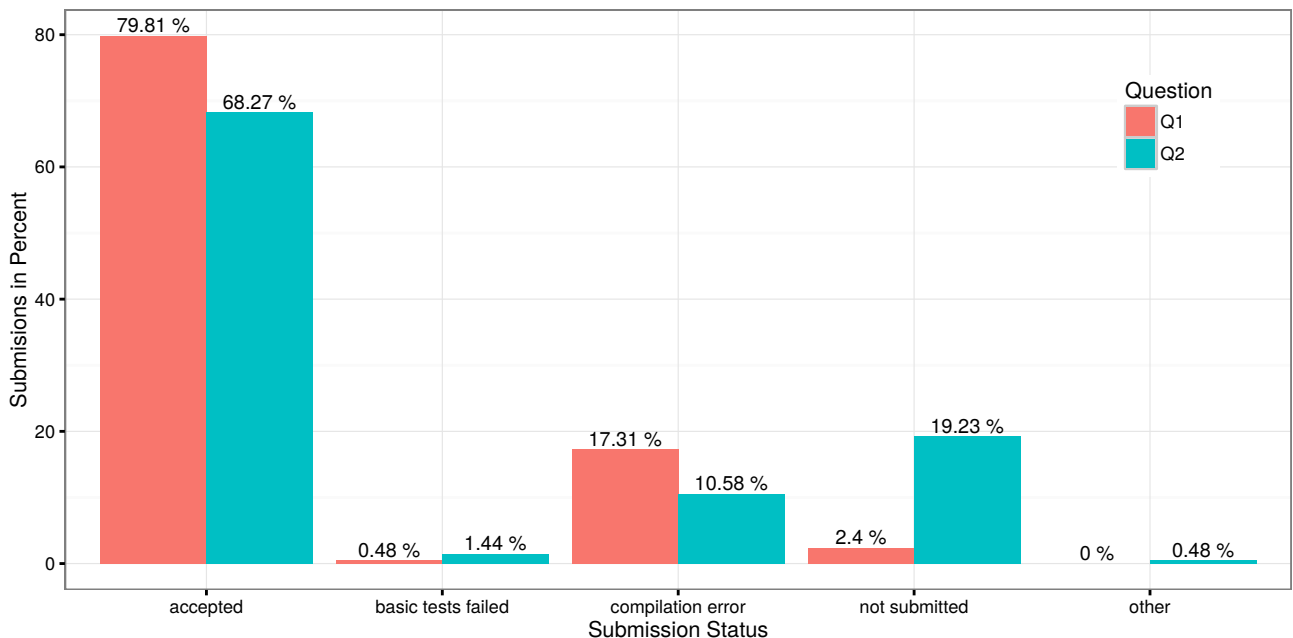
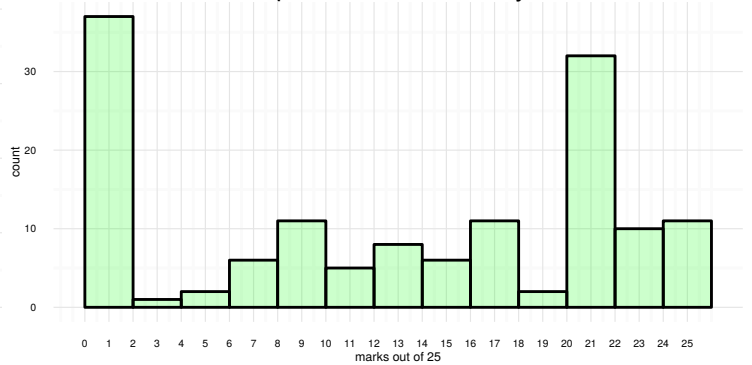
Distribution of Total Marks  
accepted submissions only



Distribution of Marks Question 1  
accepted submissions only



Distribution of Marks Question 2  
accepted submissions only



# Inf1-OP Main 2018

## Statistics PE1

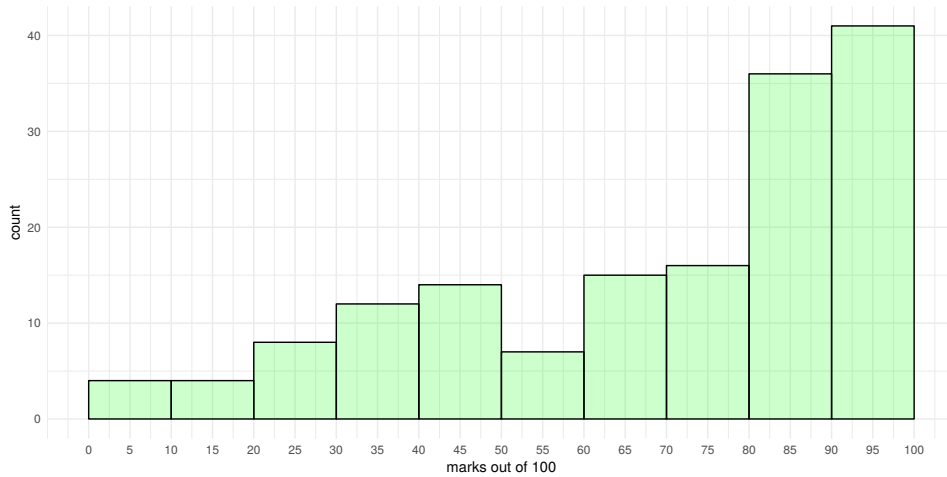
Participation 163

Mean Marks 69.57 %

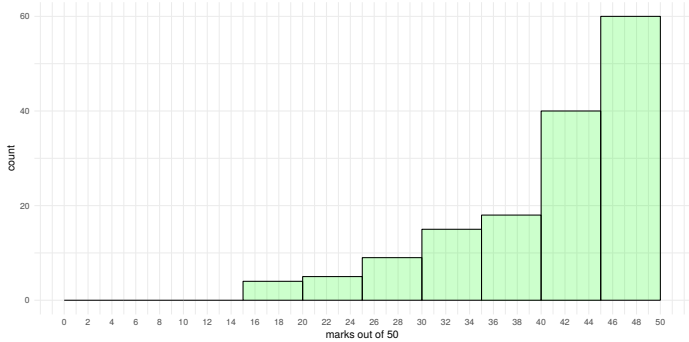
Fail Rate (accepted submissions) 15.95 %

Fail Rate (total) 19.63 %

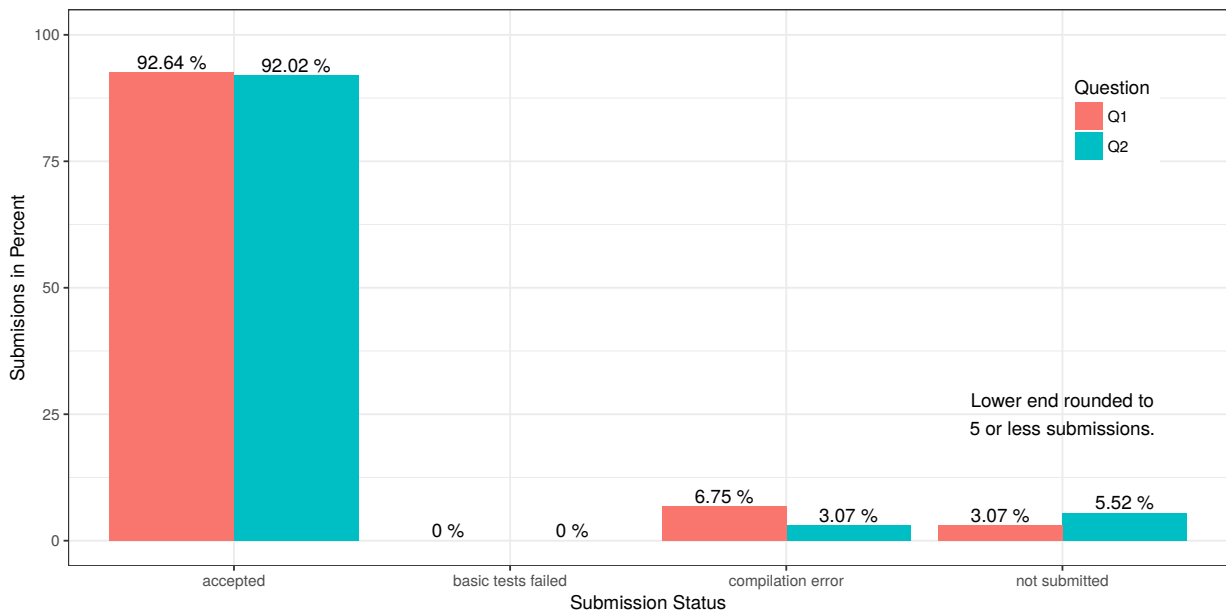
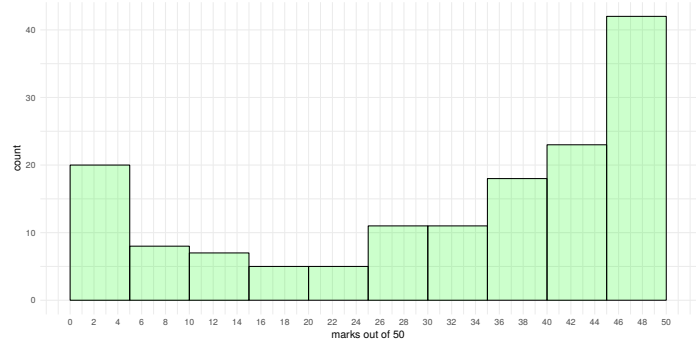
Distribution of Total Marks  
accepted submissions only



Distribution of Marks Question 1  
accepted submissions only



Distribution of Marks Question 2  
accepted submissions only



# Inf1-OP Main 2018

## Statistics PE1

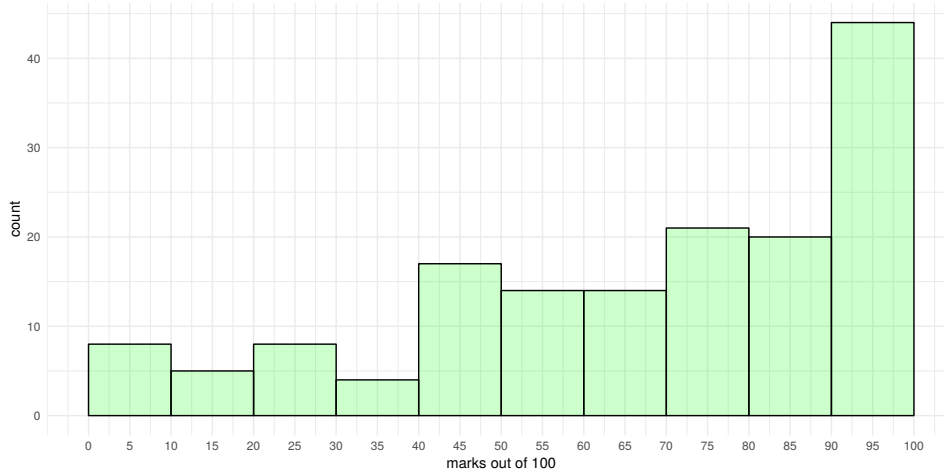
Participation 162

Mean Marks 66.73 %

Fail Rate (accepted submissions) 15.43 %

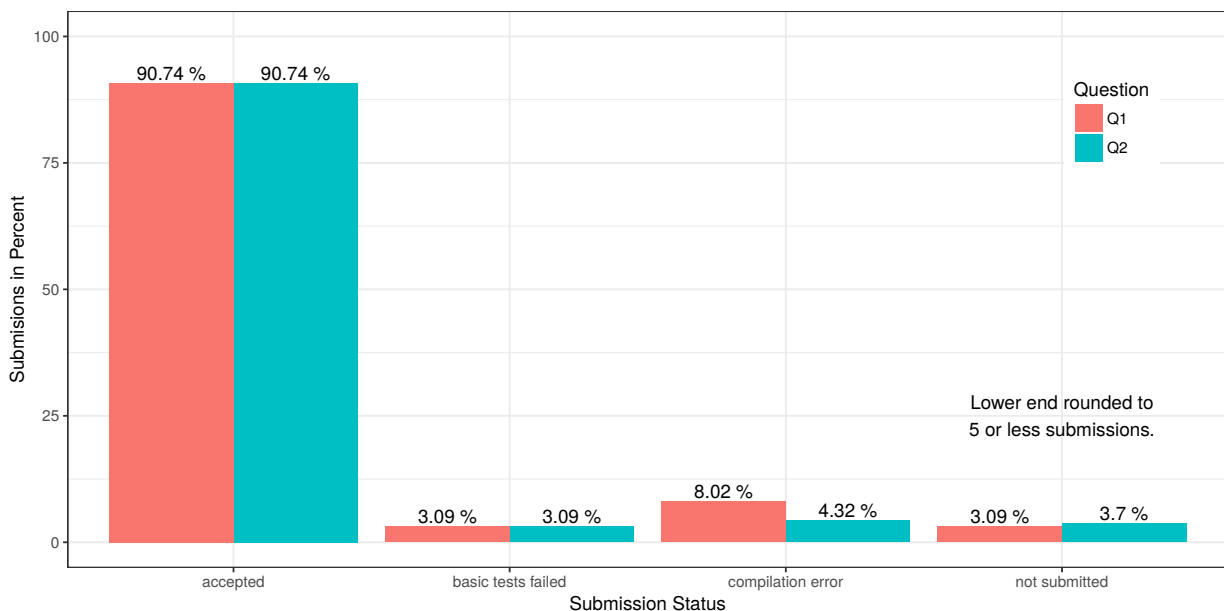
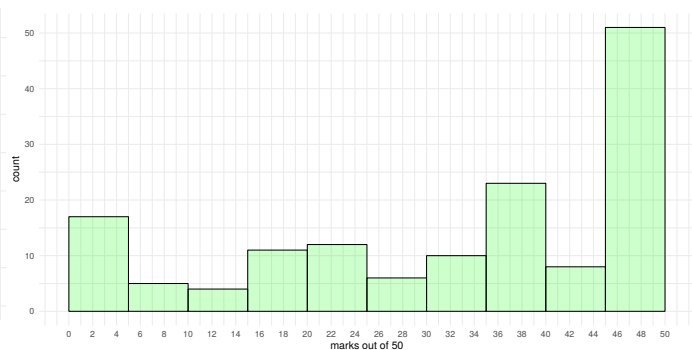
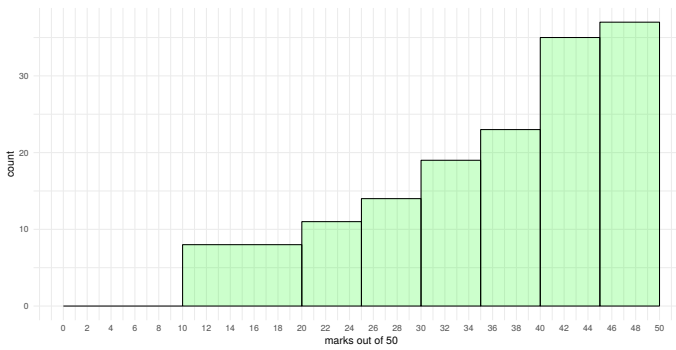
Fail Rate (total) 19.75 %

Distribution of Total Marks  
accepted submissions only



Distribution of Marks Question 1  
accepted submissions only

Distribution of Marks Question 2  
accepted submissions only





# Inf1-OP Resit 2018

## Statistics RPE

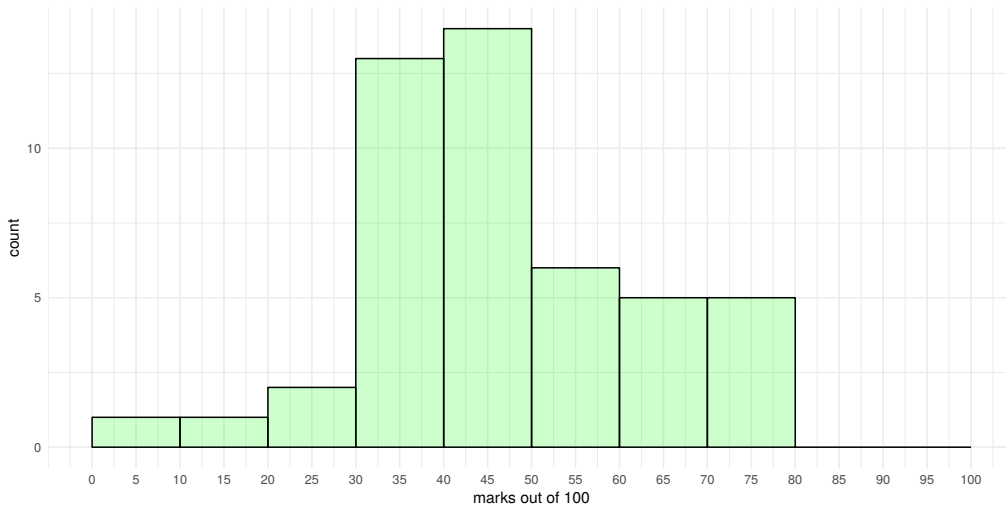
Participation 49

Mean Marks 46.36 %

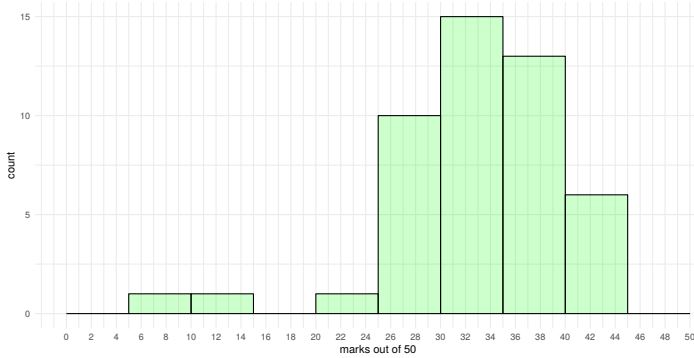
Fail Rate (accepted submissions) 34.69 %

Fail Rate (total) 38.78 %

Distribution of Total Marks  
accepted submissions only



Distribution of Marks Question 1  
accepted submissions only



Distribution of Marks Question 2  
accepted submissions only

