

Assignment 2

Total marks: 50.

Out: March 6

Due: March 18 by 17:00

Note: Your report for this assignment should be the result of your own individual work. Take care to avoid plagiarism (“copying”). You may discuss the problems with other students, but do not take written notes during these discussions, and do not share your written solutions.

Insertion sort is a simple array sorting algorithm that is often used. It performs well when the array is small or is almost sorted already. For a description of the algorithm, see for example http://en.wikipedia.org/wiki/Insertion_sort.

Develop an Event-B model of the insertion sort algorithm in Rodin, and prove that it is correct, i.e., eventually returns a sorted version of the input array. You can model the sorting problem as in the selection sort example of Section 15.7 of the textbook; you can assume that the input array contains no duplicates. Develop the model progressively in several refinements. Make sure you discharge all proof obligations.

After you have developed your model, show how one can generate the complete code for the algorithm by applying the merging rules of Chapter 15 to the model. Show all the intermediate steps, indicating the merging rule used, the events that the rule is applied to, and the resulting event where the action is a program.

When you are finished, export your completed model into an archive file `insertionSort.zip` and write your account of how the program is generated from the model into a file `insertionSort.pdf`, and then submit them as:

```
submit -l 3342 asg2 insertionSort.zip insertionSort.pdf
```

Bonus Question: Defensive Celebrity Algorithm (worth up to 5 bonus marks)

Develop an Event-B model in Rodin of a defensive version of the algorithm that solves *celebrity problem*, where there may be a celebrity (only one) or there may be no celebrity. Include a boolean output variable b that is set to true if and only if there is a celebrity, in addition to the output variable r that identifies the celebrity if there is one. Prove that the system eventually returns the correct results. You can use the model of the celebrity problem discussed in the labs as a starting point.

If you work on this bonus question, export your completed model into an archive file `defensiveCelebrity.zip` and then submit it as:

```
submit -l 3342 asg2 defensiveCelebrity.zip
```