

Programming Education - Automatic Scoring, Algorithm Education, Support for Self-education

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Abstract. The authors have been engaged in various forms for programming education and information education for many years. Following three activities related with programming education will be introduced in this paper: Automatic Scoring tools on Moodle in university lecture. Teaching material development for algorithm education in senior high school. Support for programming for practical use in research field.

1. Introduction

Programming education will be compulsory in elementary school from FY2020. For this reason, programming education has been in the spotlight recently. The authors have been engaged in various forms for programming education and information education for many years. Following three activities related with programming education will be introduced in this paper:

- Automatic scoring tools on Moodle in university lecture. (by Kuwana, Asamoto)
- Teaching material development for algorithm education in senior high school. (by Kuwana, Yamaguchi, Kagami)
- Support for programming for practical use in research field. (by Kuwana)

2. Activities Related with Programming Education

2.1 Automatic Scoring Tools on Moodle

A famous open source LMS (Learning Management System) "Moodle" has been in service for many years in Ochanomizu University [1]-[2]. Teachers use Moodle to distribute lecture notes to students, to accept reports from students, or for other purposes. Moodle is also used for information sharing by a group of teachers or staff of university, regardless of the lectures. A usage example of Moodle in programming lecture is introduced in this article.

"Exercises in Computer Programming 2 (FORTRAN)" is one of the courses in the liberal arts in Ochanomizu University for beginners of programming. Students can study basic way of thinking about programming through the lecture. For example: variable, branch, repeat, subroutine, etc. Linux

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commands are also lectured that's why no IDE (integrated development environment) is introduced in the lecture. Students compile and execute their program by commands.

Coding a lot of programs will improve programming skills. Students had to submit their all source code and execution result as their homework. But, students could not receive soon the review for their homework as more students and programs increase in the class. Student's learning efficiency decreases without feedback. Automatic scoring tools were used in FY 2017, for the purpose to return feedback in real time. Students were able to touch more programs and get used to programming.

One of activity of Moodle "Quiz" is used to make questions. Figure 1 shows an example of question about "repeat" which is important concept of programming. Students input answer in the boxes in this example (They sometimes select the answer from possible candidate in the other questions). When the answers are submit, right and wrong and feedbacks are shown soon as is shown in Fig. 2. Here, the figures were recreated in English. Japanese was used in actual classes.

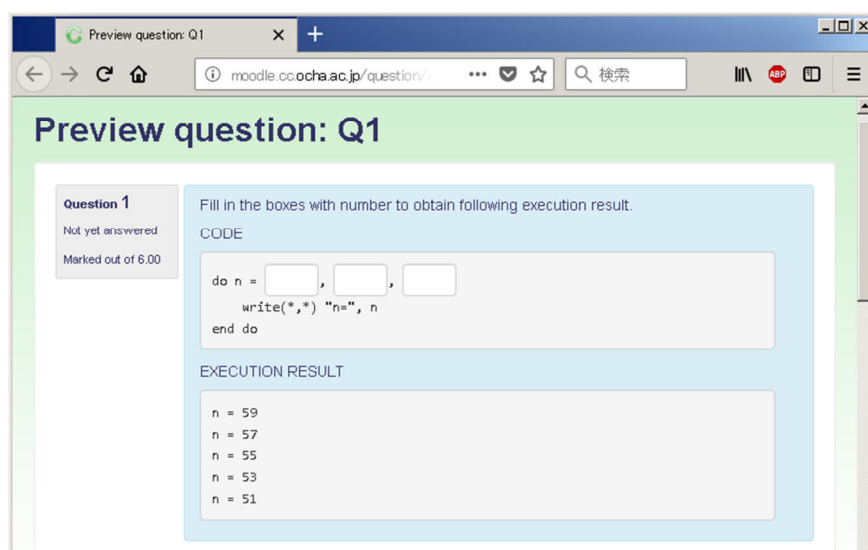


Fig. 1. Screen of question for students.

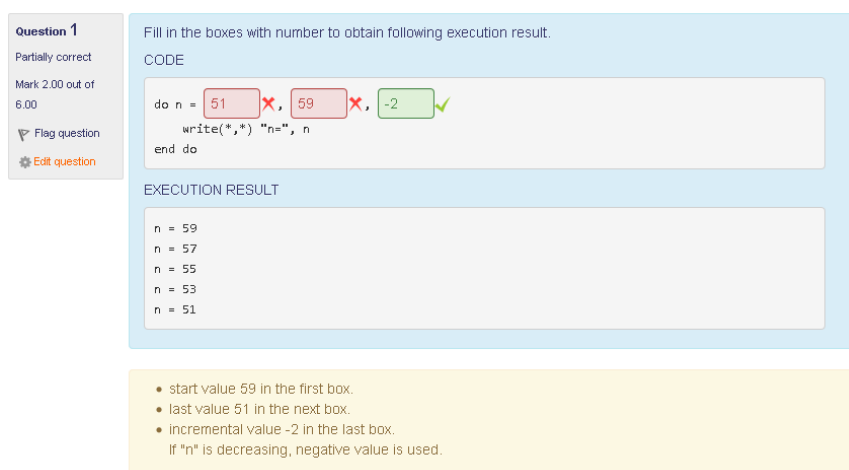


Fig. 2. Screen of answer and feedback for students.

Evaluation for this Automatic Scoring tools is future work. For reference, Table 1 shows the number of students in the class per year. There are students who attended only to the guidance and didn't take the class. And also there are students who stopped taking classes on the way. Column (C), percentage of students who did not obtained credits does not evaluate class content strictly. However,

it could be evaluated that although the number of students who attended was large compare to the previous year, the percentage of students who quit the class was as usual.

Table. 1. The number of students in the class per year.

FY	(A) who attended to the initial guidance	(B) who finally obtained credits	(C) Percentage of students who did not obtained credits
2012	7	6	14%
2013	32	26	18%
2014	26	21	19%
2015	No lecture	---	---
2016	22	17	19%
2017	54	46	15%

Of course, in order to master programming it is necessary to make program actually. However some beginner students take a dislike to programming when their code does not work with small mistakes. In order to learn concepts of programming, it would be effective to carry out such a filling test in large quantities.

2.2 Teaching Material Development for Algorithm Education

It is necessary to understand the algorithm in order to make a good program. The program will be "black box" without understanding the algorithm. Problems like bugs could not be deal without knowledge of algorithms. Teaching materials and teaching plans to master logical thinking skills through algorithmic education are developed in Ochanomizu University Senior High School [3].

"Sorting" was chosen as subject. It is because easy to imagine, familiar subject matter including mathematical elements. The teaching materials that worked with JavaScript on a web browser are developed as is shown in Fig.3. It works without special software. The only rule is "Click two animals, their place will change." Use that rule over and over again to sort the animals in ascending order of size.

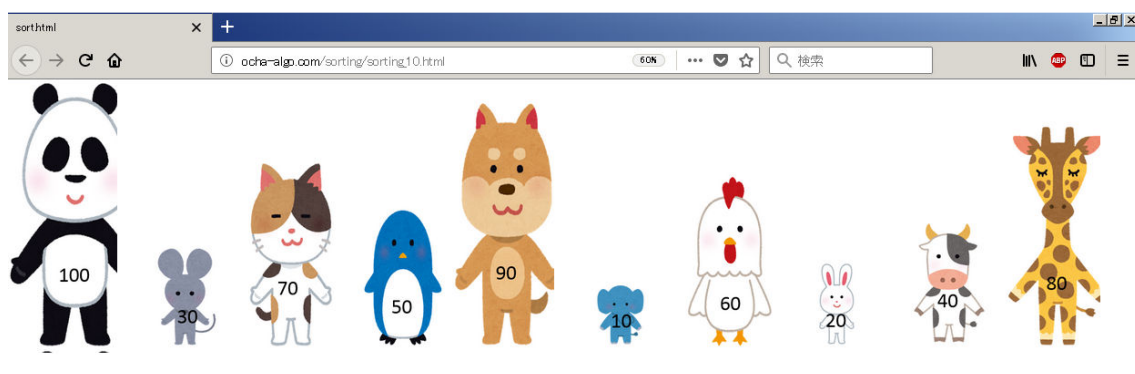


Fig. 3. A teaching material for sorting.

In the class using this teaching material and teaching plans, the following topics will be taught:

- Computers cannot operate intuitive operation like human.
- Multiple simple operations are combined to create complicated operations.
- There are many algorithms for sorting. Their efficiency is different. If the number of data is large, an efficient algorithm is necessary.

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2.3 Support for Self-Education of Programming for Practical Use.

Students in Gunma University who are studying programming for their own research are supported. The code they actually used in their research has been improved. Some examples of their demands are as follows:

- The way to write data to an external file.
- The way to input data automatically. The data are inputted manually until now.
- The way to draw the resulting number as a graph.

Their demands vary from student to student. Since it is necessary to respond individually, it takes time to solve the problem. Efficient support will be required.

3. Conclusion

Three activities related to programming education were introduced.

- A hole-filling problem may be effective to learn the concept of programming. Especially for beginners because receiving feedback in real time and solving many problems.
- Teaching materials and teaching plans for Algorithm education which is the basis of programming will be made public for everyone to use.
- Self-educators understand the concept of programming, but they sometimes do not know how to use them in practice. Support in practice is necessary.

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