### Object Oriented Programming -Effects of the Implemented Course Modifications



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2/27



### Outline

OOP course at the Faculty of Mathematics

JavaFX, current state and perspectives

- Incorporation of the JavaFX into OOP course
- JavaFX within OOP course positive and negative effects
- Results obtained from empirical data

Conclusion

3/27



# OOP course at the Faculty of Mathematics

- Required course
- Second semester of the second year of undergraduate studies.
- Student should be capable of using objects, classes and inheritance in order to solve problems.
- She/he should be capable of programming, testing and debugging in Java, from both command line and IDE.

OOP course at Faculty of Mathematics (2)

- Faculty of Mathematics has two study programs
  - O Mathematics, with stronger mathematical background.
  - Informatics, which is more practically oriented.
- Therefore, OOP courses differs for those two study programs:
  - For future mathematicians, this course is the last chance to get acquainted with important concepts, methodologies, technologies and trends in programming (RM04).
  - For future programmers, this course represents an entry point for deeper examination of programming concepts, methodologies, technologies and trends (P102).

OOP course at Faculty of Mathematics (3)

- In current curricula, OOP course comes in two 'flavors':
  - For future mathematicians (RM04), it has 2+2 classes and 5 ESPB.
  - For future programmers (P102), it has 3+2 classes and 5 ESPB.
- In both 'flavors', OOP course has following characteristics:
  - it is performed on Java programming language;
  - students are encouraged to learn to work with Eclipse IDE;
  - it is not focused on GUI programming, but on OO concepts.

OOP course at Faculty of Mathematics (4)

- In OOP course, applications with GUI are good examples for explaining and exploring objectoriented approach, from both technological and methodical viewpoint:
  - Students are able to create 'fancy' applications and that make them more interested in further learning.
  - Because of OO approach, they are able to create GUI applications with not-so-much efforts.
  - O Graphical controls are almost perfect example of using OO concepts and paradigms.
- In this course, in most cases, GUI is build with IDE tools – it is not focus on GUI programming, but on OO concepts.

7/27



### JavaFX, current state and perspectives

 JavaFX is a set of graphics and media packages that enables developers to design, create, test, debug, and deploy rich client applications that operate consistently across diverse platforms.



8/27



# JavaFX, current state and perspectives (2)

- JavaFX is built on Java technology.
- According to Oracle:
  - JavaFX platform enables developers to easily create and deploy Rich Internet Applications (RIA).
  - JavaFX platform provides a rich set of graphics and media API with high performance hardware-accelerated graphics and media engines that simplify the development of datadriven enterprise client applications.
- JavaFX in Oracle's world is similar to Flash in Adobe's world and to Silverlight in Microsoft's world.

9/27



# JavaFX, current state and perspectives (3)

- When Java FX was released, many authors predicted that it would be become a primary technology for programming diverse platforms, including tablets and smart phones.
- However, those predictions didn't come true:
  - JavaFX is now mainly used within Enterprise Java application domain, to replace the outdated Swing.
  - Oracle has no plans to officially support porting JavaFX to Android and iOS platforms (there are some community efforts, but it is not the same).

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## JavaFX, current state and perspectives (4)



 Even in the RIA domain, HTML5 is much more popular than JavaFX (even witihin Java comunity).

10/27

11/27



# JavaFX, current state and perspectives (5)

- JavaFX is a more mature product now than it was three years ago.
- Oracle is committed to further improve JavaFX in the years/decades to come.
- JavaFX is packed within JDK now it is not a separated application, as it was before.
- Scene Builder, a tool for GUI building, is mature product now, better connected to RAD tools.
- JavaFX source is now opened by Oracle <u>http://openjdk.java.net/projects/openjfx/</u>
- Market share of JavaFX now surpasses Swing.

12/27



## JavaFX, current state and perspectives (6)

- In the Java world, JavaFX is primary choice for developing parts of businness applications:
  - Big They have many screens.
  - O Complex A lot of rules drive the application processing.
  - O Used by employees The main users of the applications are employees who interact with the applications as part of their daily work.
  - O Long term oriented The lifecycle of an application is long. It may be developed today, sold within the next 7 years, and used at the customer's site for more than 10 years.
- During deployment process, Java Runtime Environment can be packed together with the JavaFX application now.

### Incorporation of the JavaFX into OOP course

#### JavaFX was incorporated into OOP for GUI (instead of Swing) in the academic year 2012/13.

- The process and the first results were described at the DAAD conference in Bansko, Bulgaria in 2013.
- In order to successfully incorporate JavaFX, we had to (as discussed earlier):
  - Restructure the entire course (e.g. generics and annotations should be taught prior to JavaFX, basic aspects of XML should be explained).
  - Put a lot of effort in order to minimize potential problems (knowledge transfer for old 'Swing-based' students, creation of tutorials and repository of assignments and programs).

It is time to evaluate the implemented changes!



### JavaFX within OOP course – positive effects

- Good students prefer to work with up-to-date technologies. They don't like to work with technologies that are considered obsolete (even by its creator).
- 2. JavaFX uses efficient language constructs (like generics and annotations).
- 3. In JavaFX, GUI design can be clearly separated from underlying code.
- Due to the fact that there is no requests for backward compatibility, JavaFX's event model is very clear - much more clear than Swing's.



### JavaFX within OOP course – negative effects

- 1. JavaFX is not the most popular way for programming 'hot' devices (e.g. tablets, iOS and Android smart phones) and it will not be (at least in the foreseeing future).
- 2. Some advanced topics, like generic programming and annotation processing have to be explained before GUI programming, which is a methodological problem.
- 3. JavaFX is mature, but live technology, so still (time after time) there are changes in the technology that have reflection to teaching process (it requires rework of the repository).

16/27



#### Results obtained from empirical data

- In order to evaluate the effects of the changes in the course over last three years, available empirical data were analyzed.
- It is a required course, so the number of students that took the course cannot be an indicator of success.
- The ratio between the number of passed vs. overall number of students cannot be a reliable indicator of the successfully implemented changes.
- Distribution of students' grades cannot be either a reliable indicator of the success.



#### Results obtained from empirical data (2)

- Increased/decreased number of students who would like to have the OOP teacher as adviser for their master theses can have certain significance, but that could not drive us to a definitive conclusion.
- Analyzed empirical data were taken from the opinion poll organized at our Faculty:
  - O It has been organized yearly over past six years.
  - There are questions related to each course taught in that academic year
  - The questionnaire is electronic and anonymous.
  - In order to enroll into next year students have to take part in the poll and answer questions related to every course taken during current academic year.



#### Results obtained from empirical data (3)

- Some questions of the poll were defined at University level, and some were added by Faculty.
- Answers to the questions are graded from 1 (the worst) to 5 (the best).
- Some questions are relevant to change in the course, and some are not relevant or empty:
  - 1. Student is present at all the classes on the course.
  - 2. Classes are realized according to official timetable.
  - 3. Teacher teaches plainly and understandably.
  - 4. Consultation are realized at regular points in time.
  - 5. Teacher teaches clearly and highlights the most important parts.



#### Results obtained from empirical data (4)

Some questions are relevant to change in the course, and some are not relevant or empty:

- 6. Level of understanding and way of presenting of the course materials.
- 7. During lectures, pace of the presentation is adequate.
- 8. Presentation plan is harmonized with scope of the course materials.
- 9. Teacher is well-prepared for the lecture.
- Students are incited to activity, to critical thinking and to creativity.
- 11. Teacher teaches in agreed terms and without delays.
- 12. Classes are helpful to students to master course materials with more easiness.

20/27



### Results obtained from empirical data (5)

- Some questions are relevant to change in the course, and some are not relevant or not existing :
  - Teacher supports inclusion and participation of the students within teaching process.
  - 14. Range and quality of the recommended literature for the course.
  - 15. Teacher gives useful information concerning work of the student after practices, seminars etc.
  - **16.** Teacher gives useful information concerning future work of the student.
  - 17. Teacher answers student's questions and takes care about student's comments.
  - 18. Teacher answers questions and takes care about student's comments.



### Results obtained from empirical data (6)

- Some questions are relevant to change in the course design, and some are not relevant or not existing:
  - 19. Marks that teacher gave so far correspond to the knowledge that student shows.
  - 20. Professionalism and ethics of the teacher within studentteacher communication.
  - 21. Teacher have consultations in regular terms and realize it successfully.
  - 22. Teacher grades student's knowledge in a objective way and without bias.
  - 23. Overall impression.



#### Results obtained from empirical data (7)

- In analyzed polls, Mathematics OOP course (RM04) and Informatics OOP course (P102) are presented separately.
- Due to the large number of students participants, the data obtained represent a very accurate answer (from the student's perspective) to questions that were asked in the questionnaire.
- The questionnaire has changed over past years, so some questions were outdated and replaced.

23/27



#### Results obtained from empirical data (8)

Average	e grades							
Year	Mod	6	10	12	14	16	18	23
2010/1	11	4,64	4,84	4,68	4,6	4,52	4,96	4,8
2011/1	21	4,47	4,53	4,29	4,12	4,65	4,65	4,59
2012/1	31	4,67	4,59	4,63	4,63	4,59	4,78	4,71
2013/1	41	4,5	4,34	4,39	4,43	4,53	4,7	4,56
2014/1	51	4,43	4	3,14	3,57	4	4,57	3,86
2010/1	1 MNVR	4,51	4,61	4,55	4,4	4,56	4,73	4,61
2011/1	2 MNVR	3,94	4,16	3,71	3,83	4,17	4,39	4,14
2012/1	3 MNVR	4,53	4,45	4,35	4,39	4,5	4,68	4,58
2013/1	4 MNVR	4,58	4,57	4,62	4,59	4,64	4,84	4,58
2014/1	5 MNVR	4,42	4,25	4,17	4,08	4,58	4,83	4,42
Numbe	r of partic	ipants						
Year	Mod	. 6	10	12	14	16	18	23
2010/1	11	25	25	25	25	25	24	25
2011/1	21	17	17	17	17	17	17	17
2012/1	3 I	27	27	27	27	27	27	28
2013/1	4	36	35	36	37	34	37	39
2014/1	5 I	7	7	7	7	7	7	7
2010/1	1 MNVR	59	59	58	58	57	59	59
2011/1	2 MNVR	50	50	49	47	46	49	51
2012/1	3 MNVR	68	69	69	70	68	69	72
2013/1	4 MNVR	48	47	47	49	47	49	50
2014/1	5 MNVR	12	12	12	12	12	12	12

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24/27



### Results obtained from empirical data (9)

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25/27



#### Results obtained from empirical data (10)

#### **OOP Mathematics**



26/27



### Conclusion

- JavaFX has not accomplished what was initially foreseen. However, it is a mature technology now and it is reasonable to replace Swing with JavaFX within an OOP course.
- Replacing Swing with JavaFX in an OOP course requires restructuring of entire course.
- There are positive and negative effects of the implemented course modifications.
- In my opinion, positive effects exceed the negative ones. However, the empirical data do not fully confirm this opinion.

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27/27





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Questions?