An Automatic Generator and Corrector of Multiple Choice Tests with Random Answer Keys

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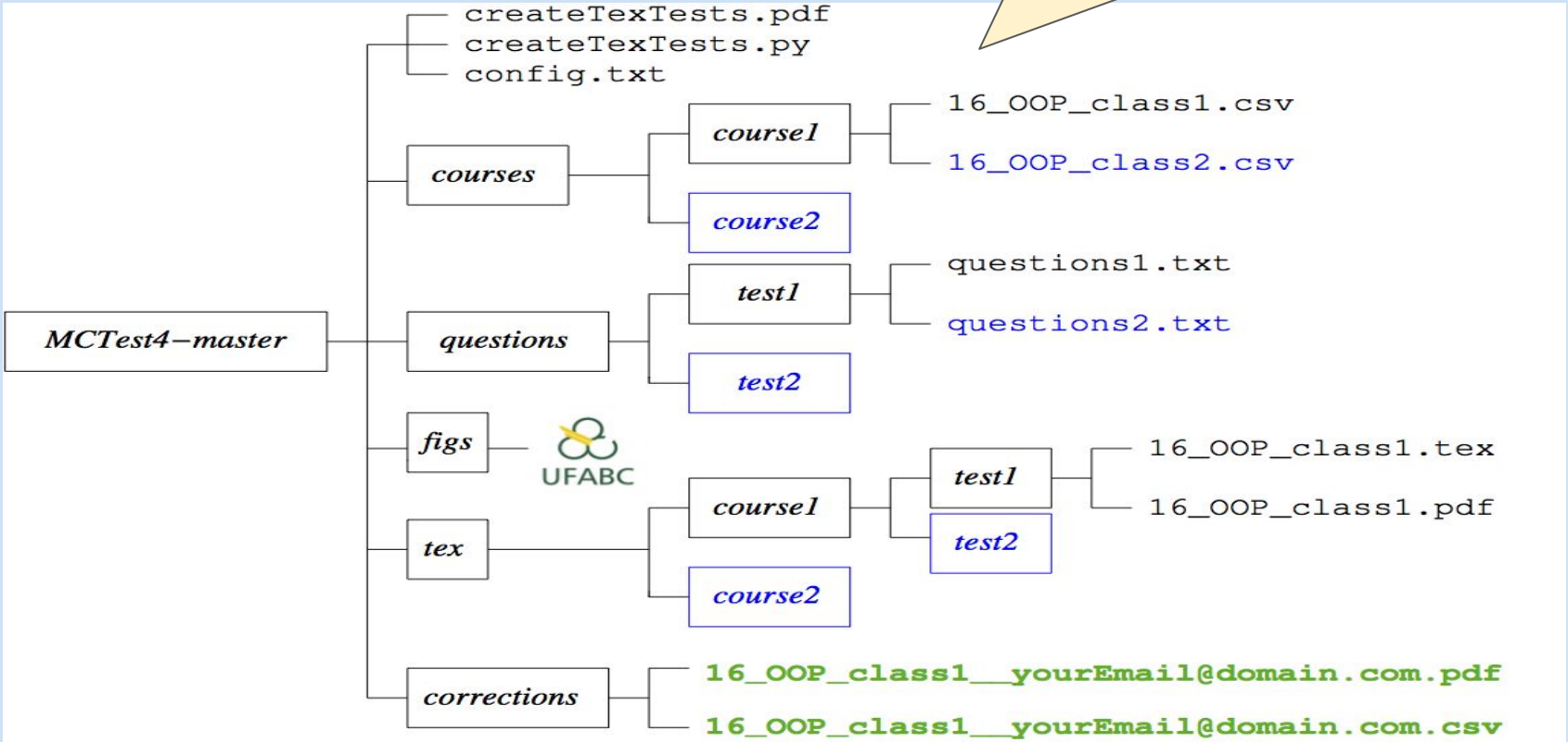
Contents

Motivation

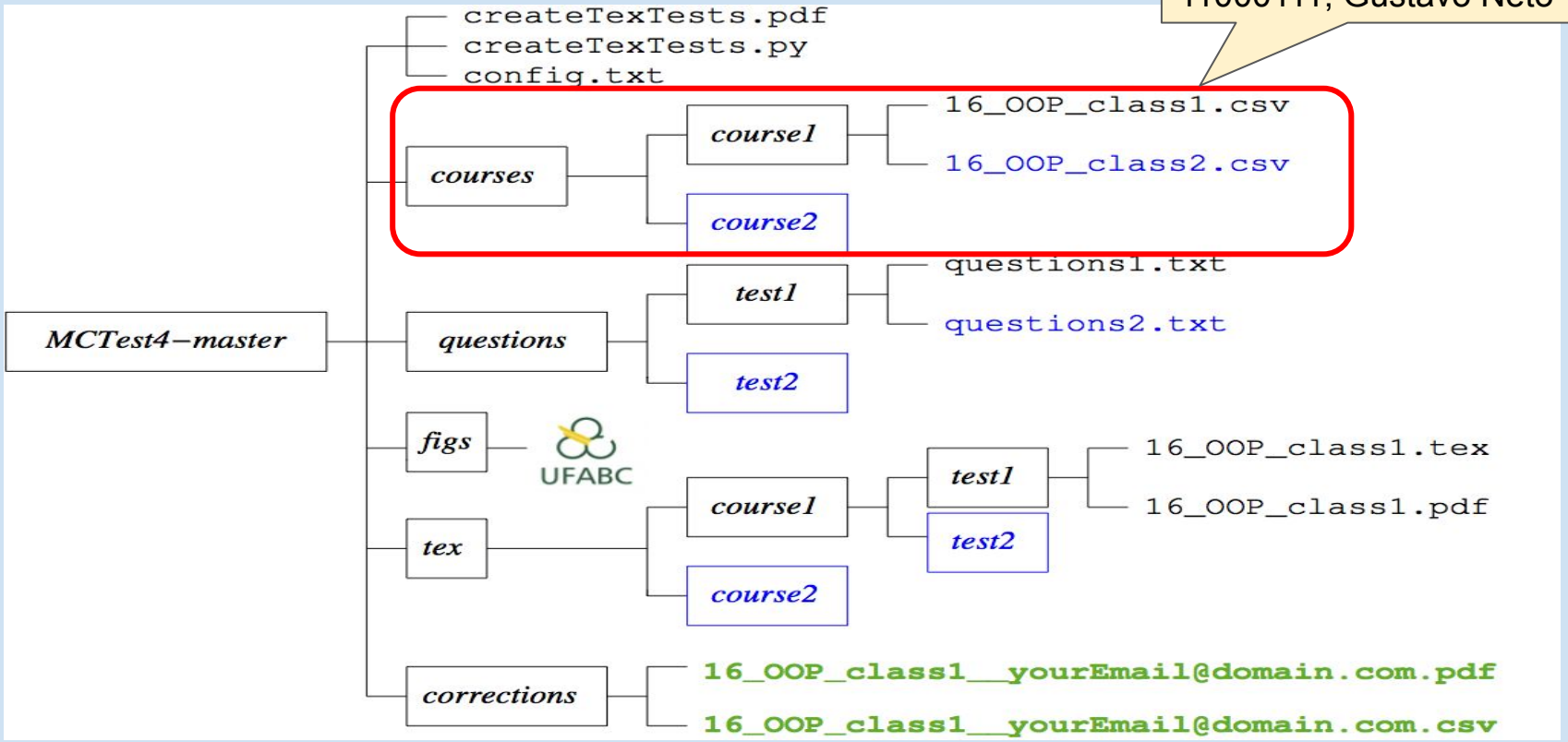
- How to generate tests for many students?
  - For many purposes online test answers aren't reliable.
  - Traditional paper tests are then required.
- How to minimize fraud?
  - A test whose answer key is unique to each student.
- How to correct this test automatically?
  - With computer vision applied to the scanned answer sheets.

Method to Generate Tests

These files and folders are available in:
vision.ufabc.edu.br/MCTest4

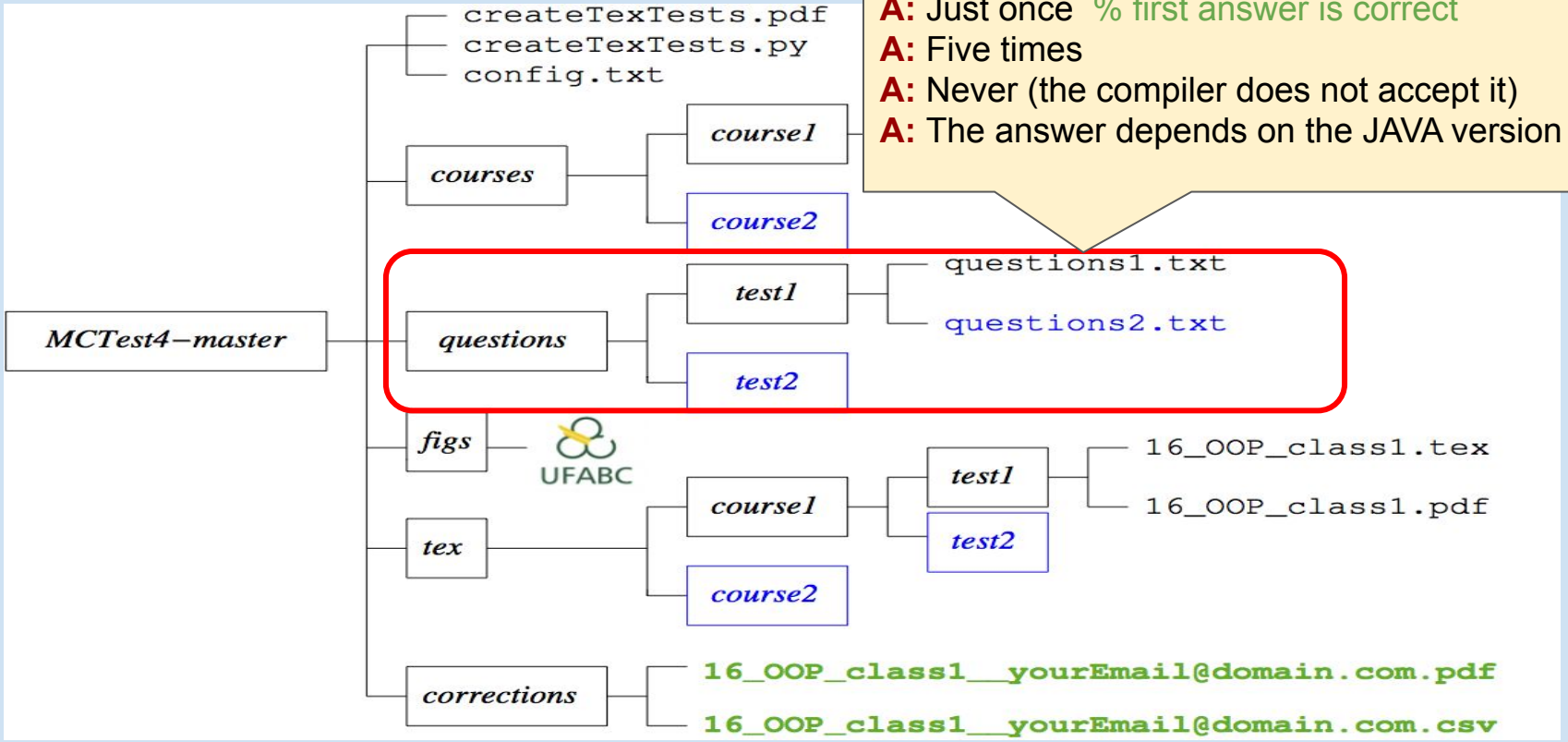


Databanks of Student Classes



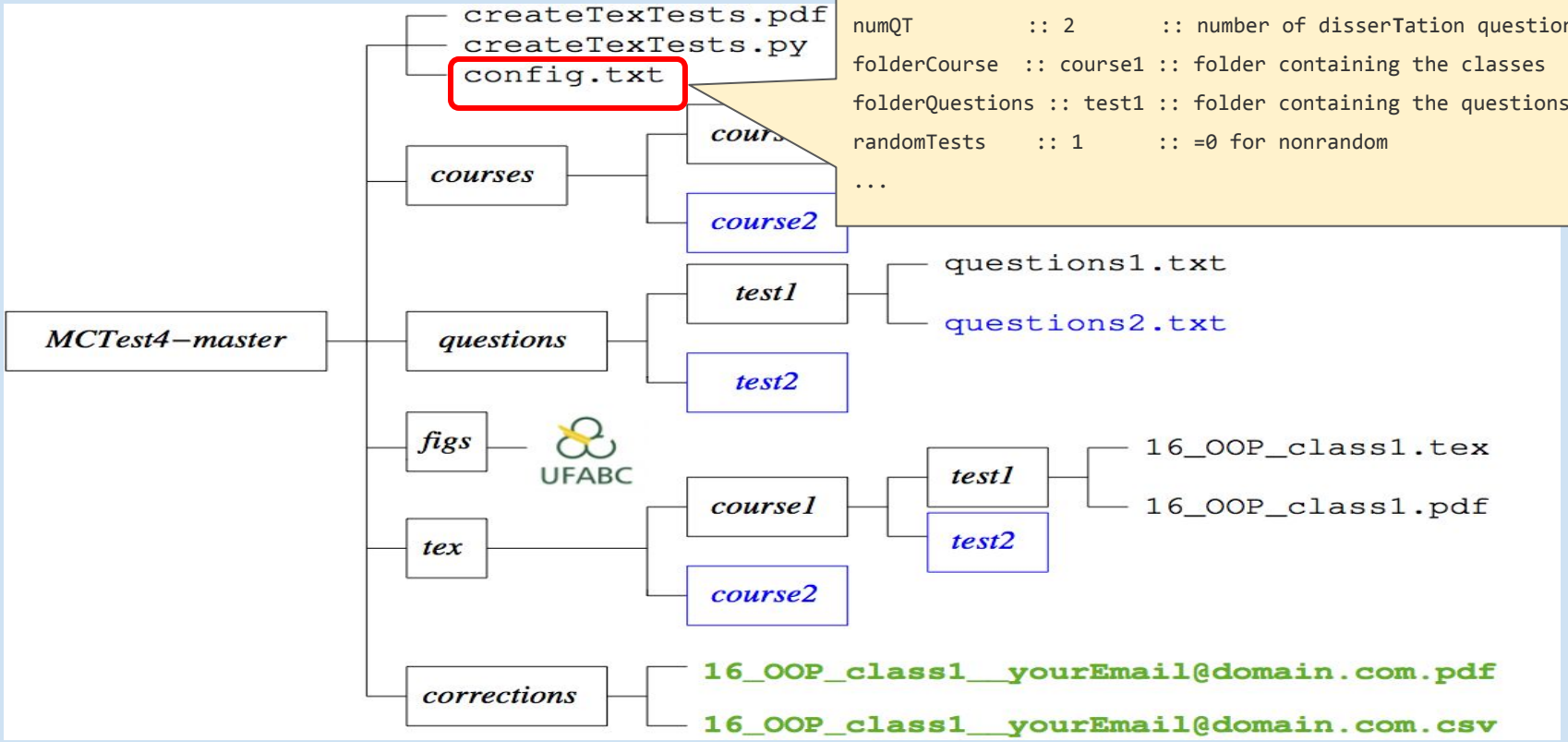
Databanks of Questions

QE:: The JAVA command \{\textbackslash\tt for(int i=0;i<5;i++) i=5;\} will attribute 5 to i
A: Just once % first answer is correct
A: Five times
A: Never (the compiler does not accept it)
A: The answer depends on the JAVA version



Configuration File

```
numQE          :: 4       :: number of Easy questions
numQM          :: 3       :: number of interMediate questions
numQH          :: 2       :: number of Hard questions
numQT          :: 2       :: number of disserTation questions
folderCourse   :: course1 :: folder containing the classes
folderQuestions :: test1  :: folder containing the questions
randomTests    :: 1       :: =0 for nonrandom
...
```

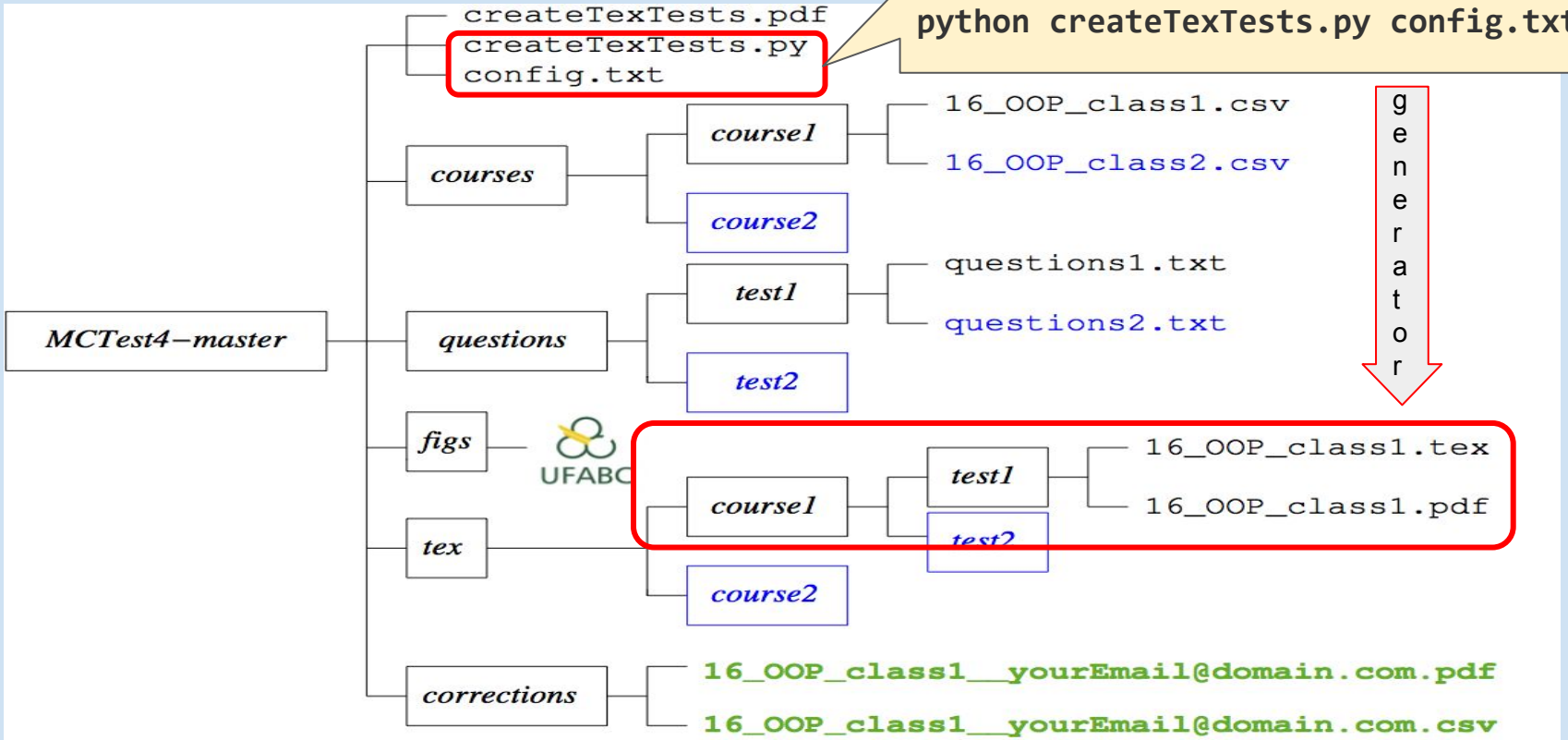


Execution of Test Generator

After installing **python** and **Latex**

Execute at the shell prompt:

python createTexTests.py config.txt

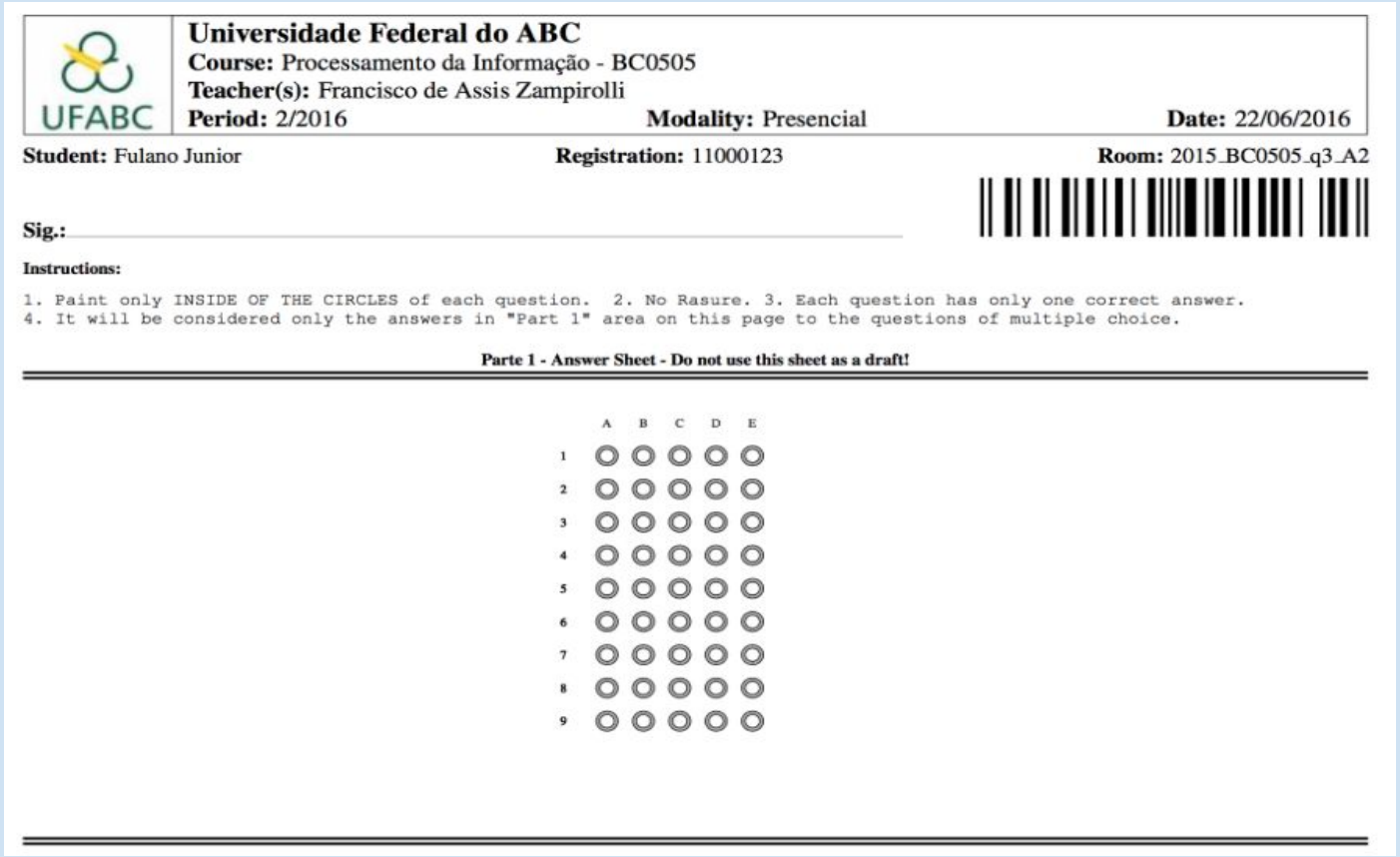


Execution of Test Generator

- In our example, after you get the file **16_OOP_class1.pdf**
- This one is also created (if `randomTests` = 1): **16_OOP_class1_GAB**

This GAB file contains the right answer for each student and will be used in the automatic correction.

Example of Answer Sheet



Universidade Federal do ABC
Course: Processamento da Informação - BC0505
Teacher(s): Francisco de Assis Zampirolli
Period: 2/2016 **Modality:** Presencial **Date:** 22/06/2016

Student: Fulano Junior **Registration:** 11000123 **Room:** 2015_BC0505_q3_A2

Sig.:

Instructions:

1. Paint only INSIDE OF THE CIRCLES of each question. 2. No Rasure. 3. Each question has only one correct answer.
4. It will be considered only the answers in "Part 1" area on this page to the questions of multiple choice.

Parte 1 - Answer Sheet - Do not use this sheet as a draft!

	A	B	C	D	E
1	○	○	○	○	○
2	○	○	○	○	○
3	○	○	○	○	○
4	○	○	○	○	○
5	○	○	○	○	○
6	○	○	○	○	○
7	○	○	○	○	○
8	○	○	○	○	○
9	○	○	○	○	○

Example of Multiple Choice Questions

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Sig.: _____

Instructions:

1. It is prohibited to search books and notes. 2. The use of electronic devices is prohibited. 3. It will be considered only the answers in "Part 1" area of the Multiple-Choice Questions page.

Parte 2 - Multiple-Choice Questions

1. pergunta fácil Q1b2 - com segunda variações da subclasse b:
   A. resposta 1b2-a
   B. resposta 1b2-e
   C. resposta 1b2-d
   D. resposta 1b2-b
   E. resposta 1b2-c
2. pergunta Q14
   A. resposta 14e
   B. resposta 14b
   C. resposta 14a
   D. resposta 14d
   E. resposta 14c
3. pergunta Q2 com exemplo de fórmula em tex: $\sin A \cos B = \frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$

Contents

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  - Databanks of Questions
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- Experiments, Discussions and Performance
- Conclusion and Future Works

Method to Correct Tests Automatically

- Rename the aforementioned GAB file as **16_OOP_class1__yourEmail@domain.com_GAB**

- Scan all students' answer sheets in the file **16_OOP_class1__yourEmail@domain.com.pdf**

Method to Correct Tests Automatically

- Send these two files by ftp:
  ftp vision.ufabc.edu.br

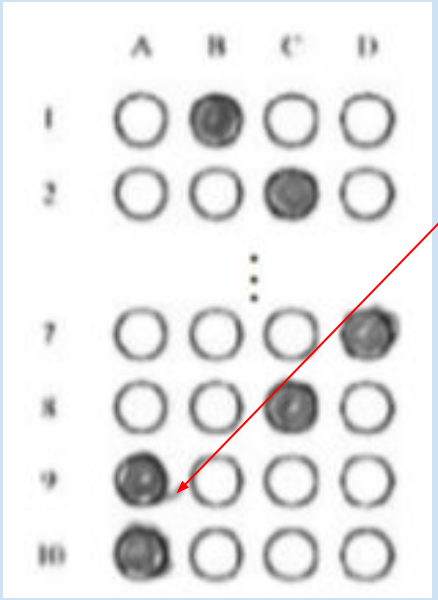
16_OOP_class1__yourEmail@domain.com**_GAB**
16_OOP_class1__yourEmail@domain.com**.pdf**

- In a few minutes the correction will be sent to:
  yourEmail@domain.com

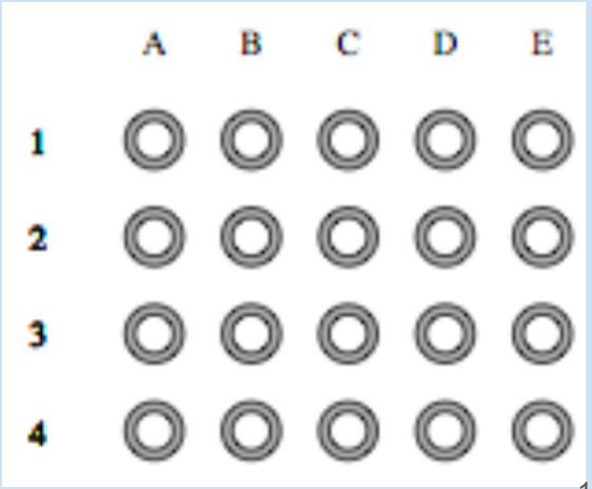
Pag	ID	Answ	Quest	Inv	Final	1	2	3	4	5	6	7	8	9
1	11000123	5	9	2	1	A	A/C	A/B	A/E	A/E	A/D	A/E	0/C	2/E
2	11000111	5	9	0	1	A/E	B/C	C/B	D/B	E/A	D	C/B	B/C	A/C

First Experiment

- Two classes with 136 students and random tests (10 questions each). Only one failure:



this problem is now minimized in our new version



Second Experiment

- Two classes with 130 students and random tests (12 questions each). There wasn't any failure.

In these two experiments we have used:

The **good** resolution of 150 dpi at scanning.

Our random test generator.

Third Experiment (not random/no databanks)

- **Bad** resolution of 75 dpi at scanning
- Comparison with the commercial software REMARK
  - MCTest (our solution)
    - Is fully automatic
    - It runs in a server (vision.ufabc.edu.br)
  - With REMARK
    - one must inform both barcode and answer sheet positions manually
    - It runs on the desktop

Third Experiment (not random/no databanks)

Comparisons of our solution with REMARK

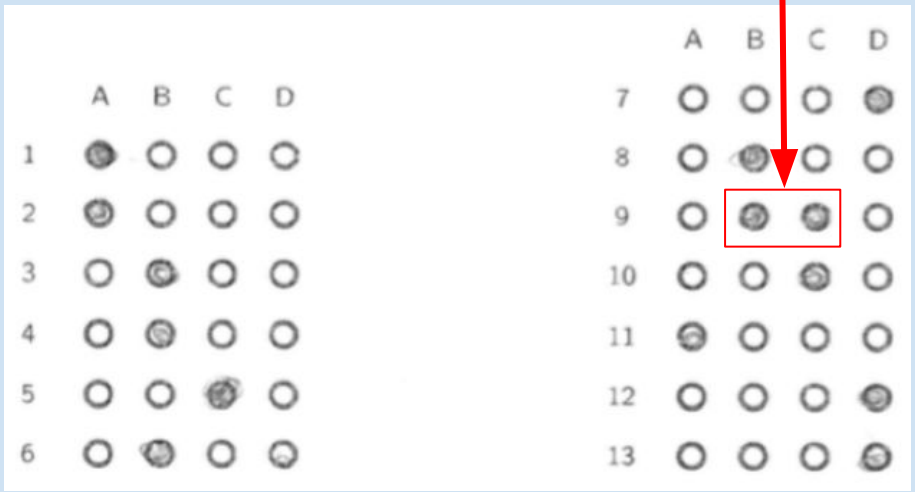
	Primary School		Secondary School	
Tests	3224		3548	
Software	MCTest	REMARK	MCTest	REMARK
Barcode Reading Errors	39	10	63	11
Marking Reading Errors	2	21	0	0
Blank (no Marking)	36	31	17	14
Duplicate Markings	102	65	59	29

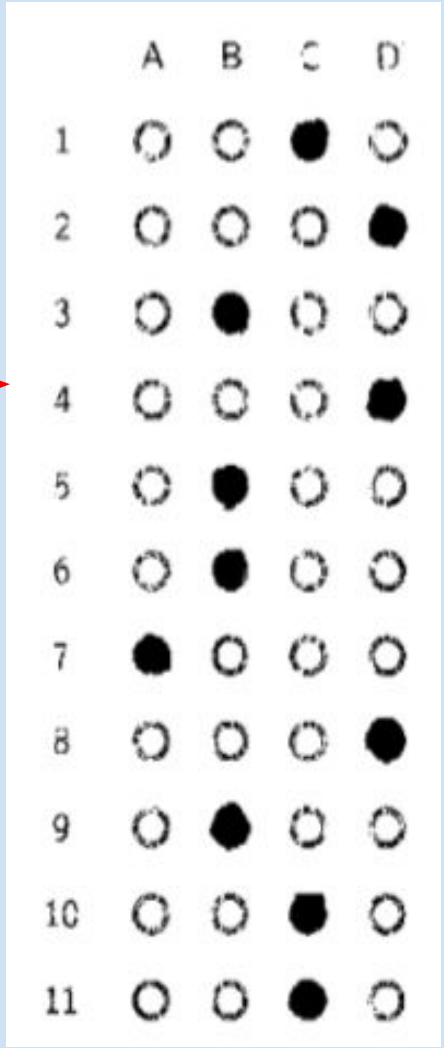
MCTest marked duplicate: 9B and 9C

only 9B

Discussions (3rd Experiment)

- **Bad** resolution of 75 dpi at scanning
- **Low** toner to print tests
- **Failure** to mark answers





Performance of MCTest (3rd Experiment)

- For 6,772 tests
  102 minutes
  0.9 second per test

- The correction is entirely automatic

- Students filled in wrongly on 67 occasions (only 1.88% of the tests)

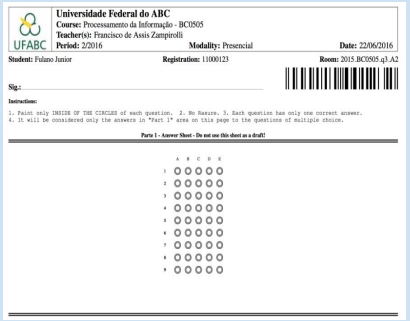
Conclusion

- Our solution helps answer the questions:
  - How to generate tests for many students?

    Traditional paper tests are required because online answers aren't reliable.
  - How to minimize fraud?

    A test whose answer key is unique to each student.
  - How to correct tests automatically?

    With computer vision applied to the scanned answer sheets.



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2	11000111	5	9	0	1	A/E	B/C	C/B	D/B	E/A	D	C/B	B/C	A/C

Future Works

- Create dynamic questions

- Using eLearning system
  - such as Moodle

Thanks!

Questions?

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