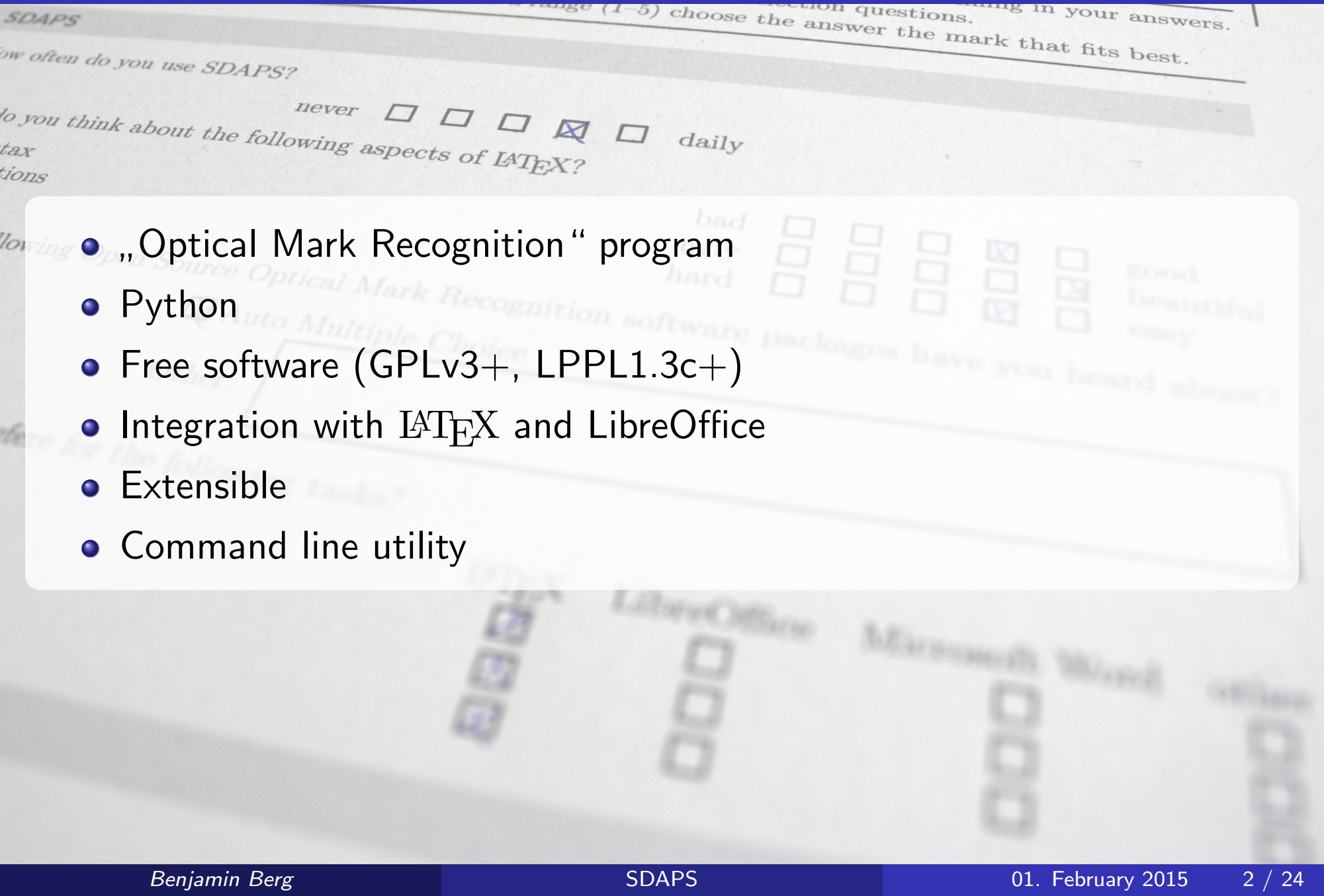
SDAPS

Surveying Made Easy

Benjamin Berg

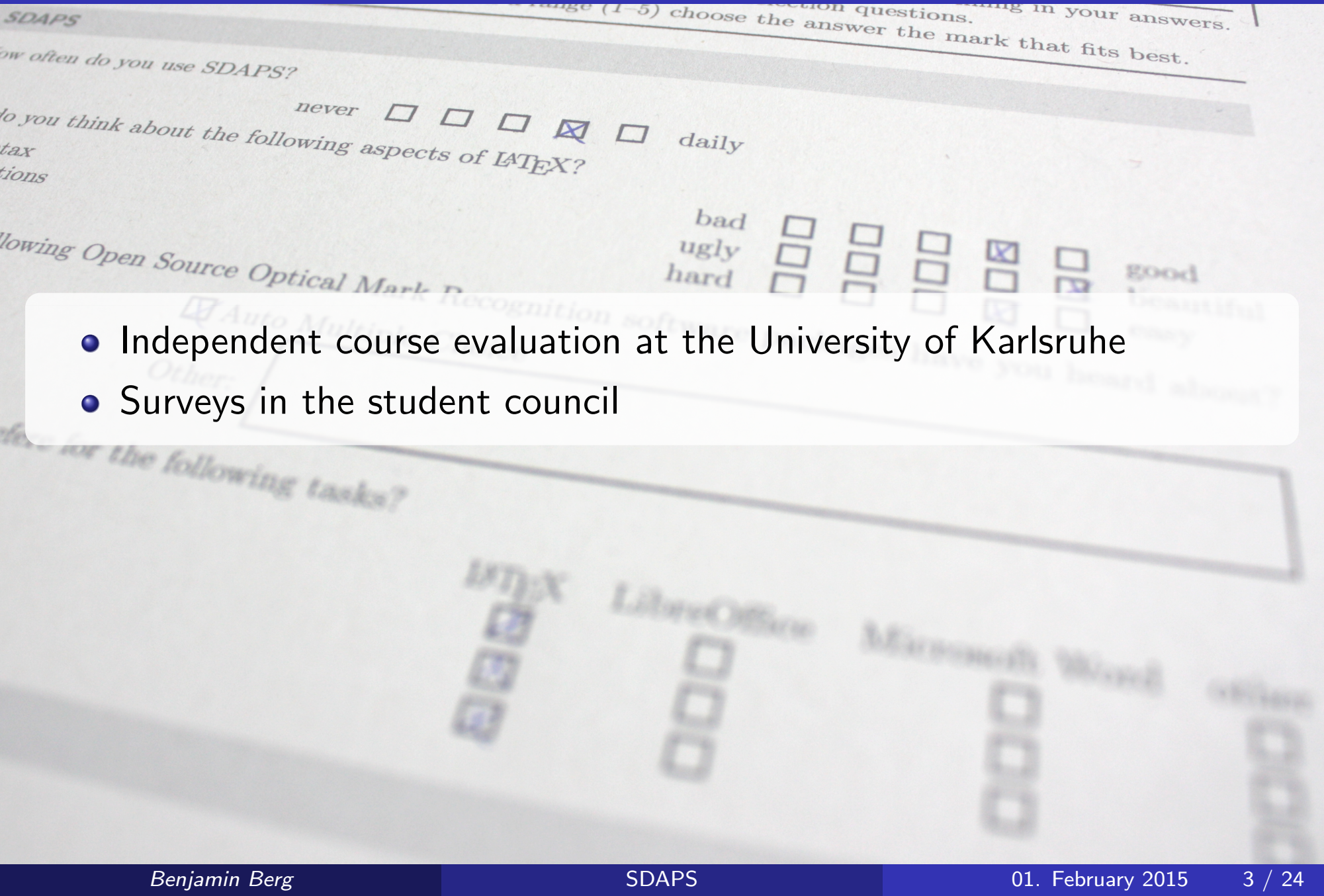
01. February 2015

SDAPS



- „Optical Mark Recognition“ program
- Python
- Free software (GPLv3+, LPPL1.3c+)
- Integration with LaTeX and LibreOffice
- Extensible
- Command line utility

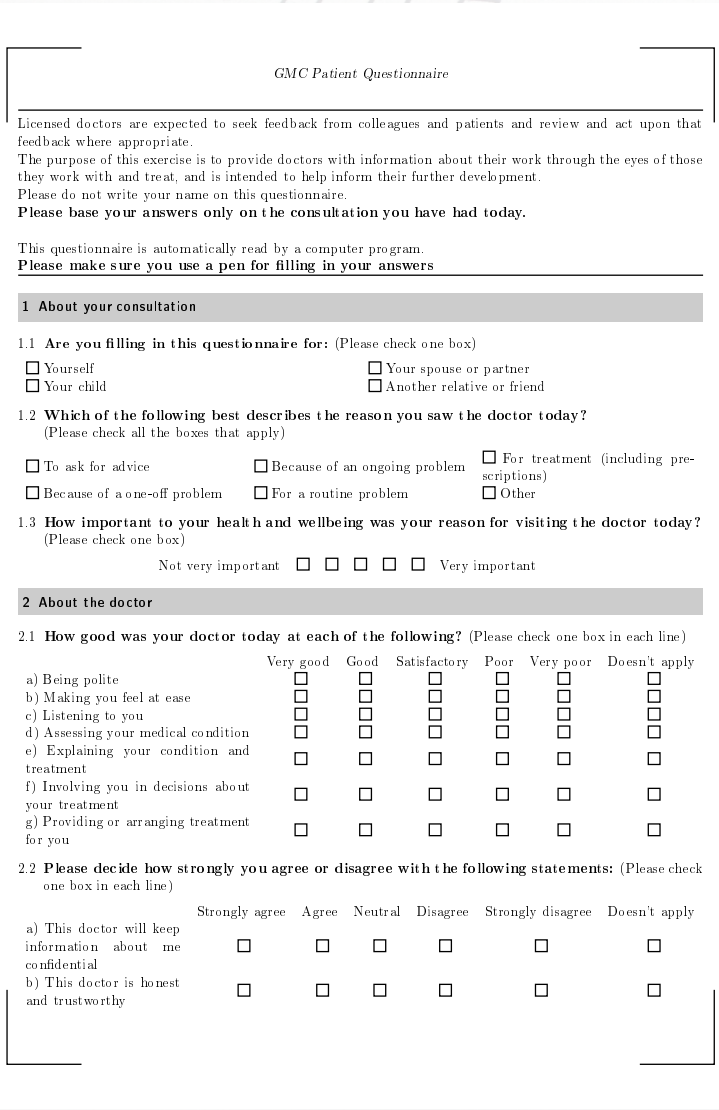
History



- Independent course evaluation at the University of Karlsruhe
- Surveys in the student council

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**



GMC Patient Questionnaire

Licensed doctors are expected to seek feedback from colleagues and patients and review and act upon that feedback where appropriate.
The purpose of this exercise is to provide doctors with information about their work through the eyes of those they work with and treat, and is intended to help inform their further development.
Please do not write your name on this questionnaire.
Please base your answers only on the consultation you have had today.

This questionnaire is automatically read by a computer program.
Please make sure you use a pen for filling in your answers

1 About your consultation

1.1 **Are you filling in this questionnaire for:** (Please check one box)

☐ Yourself ☐ Your spouse or partner
☐ Your child ☐ Another relative or friend

1.2 **Which of the following best describes the reason you saw the doctor today?** (Please check all the boxes that apply)

☐ To ask for advice ☐ Because of an ongoing problem ☐ For treatment (including prescriptions)
☐ Because of a one-off problem ☐ For a routine problem ☐ Other

1.3 **How important to your health and wellbeing was your reason for visiting the doctor today?** (Please check one box)

Not very important ☐ ☐ ☐ ☐ ☐ Very important

2 About the doctor

2.1 **How good was your doctor today at each of the following?** (Please check one box in each line)

	Very good	Good	Satisfactory	Poor	Very poor	Doesn't apply
a) Being polite	☐	☐	☐	☐	☐	☐
b) Making you feel at ease	☐	☐	☐	☐	☐	☐
c) Listening to you	☐	☐	☐	☐	☐	☐
d) Assessing your medical condition	☐	☐	☐	☐	☐	☐
e) Explaining your condition and treatment	☐	☐	☐	☐	☐	☐
f) Involving you in decisions about your treatment	☐	☐	☐	☐	☐	☐
g) Providing or arranging treatment for you	☐	☐	☐	☐	☐	☐

2.2 **Please decide how strongly you agree or disagree with the following statements:** (Please check one box in each line)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Doesn't apply
a) This doctor will keep information about me confidential	☐	☐	☐	☐	☐	☐
b) This doctor is honest and trustworthy	☐	☐	☐	☐	☐	☐

© GP TOOLS

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**

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surveys **examinations** **walk & call sheets** **voting**

Physik für Maschinenbau WS14/15, Übung 10, 15.12.2014 / 5.1.2015

Rheinisch Westfälische Technische Hochschule Aachen

I. Physikalisches Institut, Prof. Dr. S. Schael, Dr. T. Siedenburg

Name, Vorname | Matrikel-Nummer | Prüfungs-Nummer

Eigenhändige Unterschrift

Studiengang

Prüfungs-Nummer bitte auch ankreuzen:

	0	1	2	3	4	5	6	7	8	9
1000	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
100	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Mit dunklem Kugelschreiber so ankreuzen: Akzeptierte Auswahl: ☒ **Nicht** ausgewählt: ☐ oder ■

Alle Aufgaben sind gleichwertig mit 4 Fragen zu Ansatz, Endformel, Zahlenwert und/oder Einheit.

1

Der Treibsatz einer 250 g schweren Silvesterrakete erzeugt für 1,5 s eine Schubkraft von 6 N senkrecht nach oben. Welche maximale Höhe erreicht die Rakete unter Vernachlässigung von Luftreibung und Massenverlust des Treibsatzes ? (**)

1.1 Ansatz:

- ☐ $E_{kin} = \frac{1}{2}Mv^2; \quad E_{pot} = Mgh$
- ☐ $\tau = M/\gamma; \quad v_\infty = F_0/\gamma$
- ☐ $v_{ph} = \lambda f$
- ☐ $x(t) = x_0 + v_0 t + \frac{1}{2}\frac{F_0}{M}t^2$
- ☐ $x(t) = x_0 + v_\infty t - \tau(v_\infty - v_0)(1 - e^{-t/\tau})$
- ☐ $F_{schwer} = M \cdot g$

1.2 Endformel:

- ☐ $\frac{F}{2M}(\frac{F}{Mg} - 1)t^2$
- ☐ $1/2(\frac{F}{M} - g)t^2$
- ☐ $(Ft/M)^2/(2g)$
- ☐ $(F/M)t^2$
- ☐ $\frac{F}{2M}(\frac{F}{Mg} + 1)t^2$
- ☐ keine der angegebenen Formeln

1.3 Zahlenwert:

78,11	39,06	54,00	15,96	93,06	66,06	anderer
☐	☐	☐	☐	☐	☐	☐

1.4 Einheit:

%	Nm	ms	t	m	kg·m/s²	s	m·s	m/s	mg	kg/s	ohne
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5460

Concept T.Siedenburg — powered by SDAPS 1.1.7 and LaTeXCalc 1.0

593402361 0001

RWTH AACHEN UNIVERSITY

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**

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☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

5460

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593402361 0001

Usage Scenarios

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COS 226	Algorithms and Data Structures	Fall 2014
	Final	

This test has 13 questions worth a total of 100 points. You have 180 minutes. The exam is closed book, with the exception of a one page cheatsheet. No calculators or other electronic devices are permitted. **Write out and sign the Honor Code pledge just before turning in the test.**

This exam is preprocessed by computer. Please use a pen; if you use a pencil, be sure to write darkly. Do not write any answers outside of the designated frames. And do not write on the corners.

"*I pledge my honor that I have not violated the Honor Code during this examination.*"

Name:

netID:

Room:

Precept: P01 P02 P03 P03A P04 P04A

Problem	Score	Problem	Score
0		7	
1		8	
2		9	
3		10	
4		11	
5		12	
6		13	
Sub 1		Sub 2	

Total	

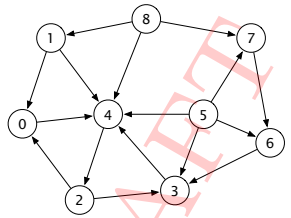
P01	F 9	Andy Guna
P02	F 10	Jérémie Lumbroso
P03	F 11	Josh Wetzel
P03A	F 11	Jérémie Lumbroso
P04	F 12:30	Robert MacDavid
P04A	F 13:30	Shivam Agarwal

0. **Initialization** (2 points)

In the space provided on the front of the exam, write your name and Princeton netID; fill in your precept number; write the name of the room in which you are taking the exam; and write and sign the honor code.

1. **Digraph Traversal** (6 points)

Consider the following digraph. Assume the adjacency lists are in sorted order: for example, when iterating through the edges pointing from vertex 5, consider the edge $5 \to 3$ before the others.



(a) Starting from vertex 0, run a depth-first search of the digraph, and list the vertices in *reverse postorder*.

(b) Starting from vertex 0, run a depth-first search of the digraph, and list the vertices in *preorder*.

NONE

2659614456 0002

DRAFT DRAFT

PRINCETON UNIVERSITY

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**

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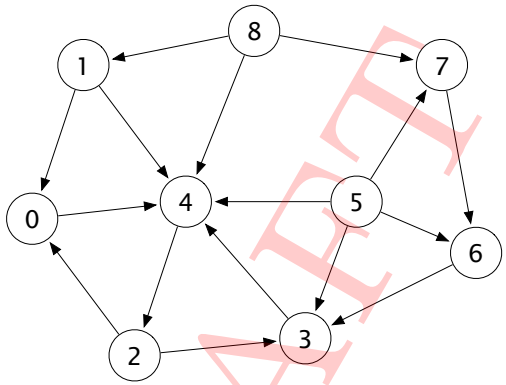

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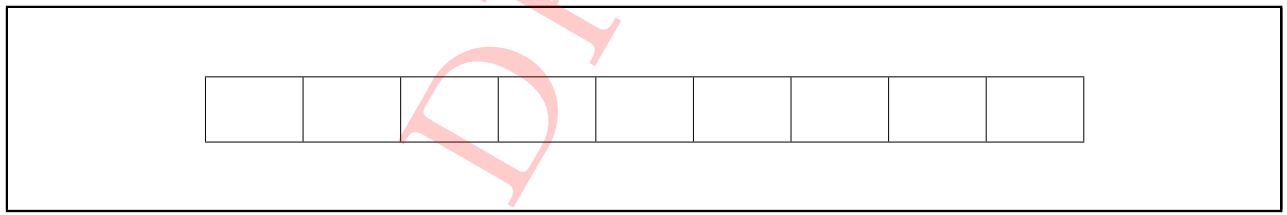

(b) Starting from vertex 0, run a depth-first search of the digraph, and list the vertices in *preorder*.

DRAFT

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**

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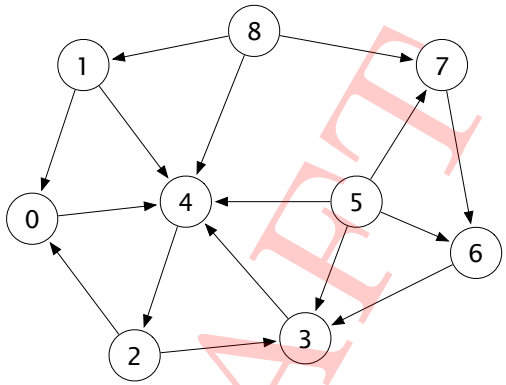

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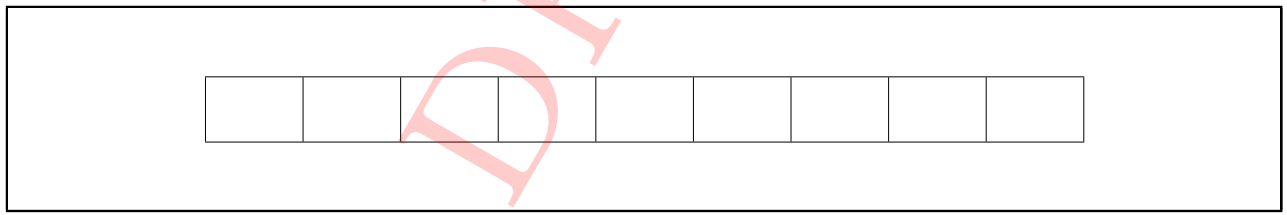

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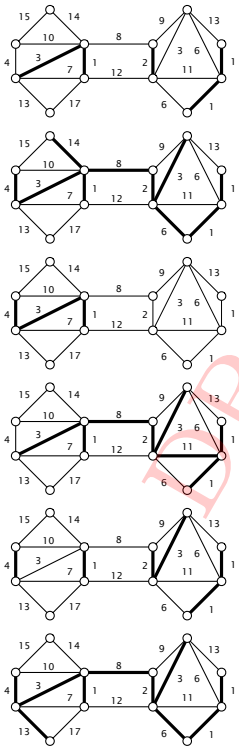
DRAFT

Usage Scenarios

surveys **examinations** **walk & call sheets** **voting**

5. **Minimum Spanning Tree Algorithms** (6 points)

Each of the figures below represents a partial spanning tree. Determine whether it could possibly be obtained from (a prematurely stopped) Prim's algorithm, (a prematurely stopped) Kruskal's algorithm, both or neither.



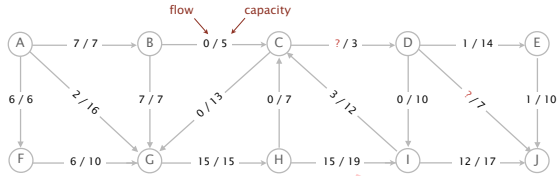
Prim	Kruskal	Both	Neither
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

NONE

2659614456 0006

6. **Maximum Flow** (7 points)

Consider the following flow network and feasible flow f from from the source vertex A to the sink vertex J.



(a) Check the value of the flow on edge $C \to D$?

0 ○ 1 ○ 2 ○ 3 ○ 4 ○

(b) Check the value of the flow f.

0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○ 11 ○ 12 ○ 13 ○ 14 ○ 15 ○

16 ○ 17 ○ 18 ○ 19 ○ 20 ○ 21 ○ 22 ○ 23 ○ 24 ○ 25 ○ 26 ○ 27 ○ 28 ○ 29 ○ 30 ○

(c) Starting from the flow f, perform one iteration of the Ford-Fulkerson algorithm. List the sequence of vertices on the augmenting path.

(d) Check the value of the maximum flow?

0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○ 11 ○ 12 ○ 13 ○ 14 ○ 15 ○

16 ○ 17 ○ 18 ○ 19 ○ 20 ○ 21 ○ 22 ○ 23 ○ 24 ○ 25 ○ 26 ○ 27 ○ 28 ○ 29 ○ 30 ○

(e) Check the vertices on the source side of a minimum cut.

A ○ B ○ C ○ D ○ E ○ F ○ G ○ H ○ I ○ J ○

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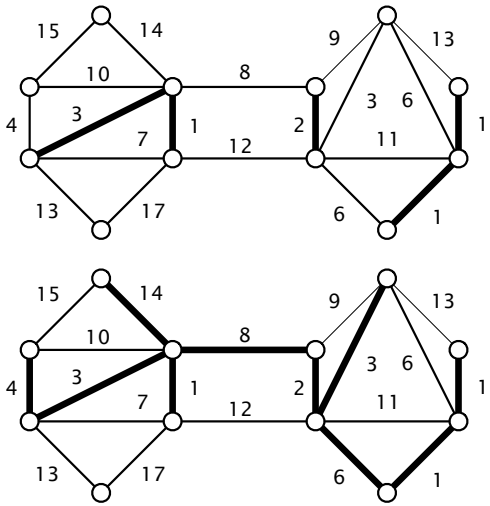
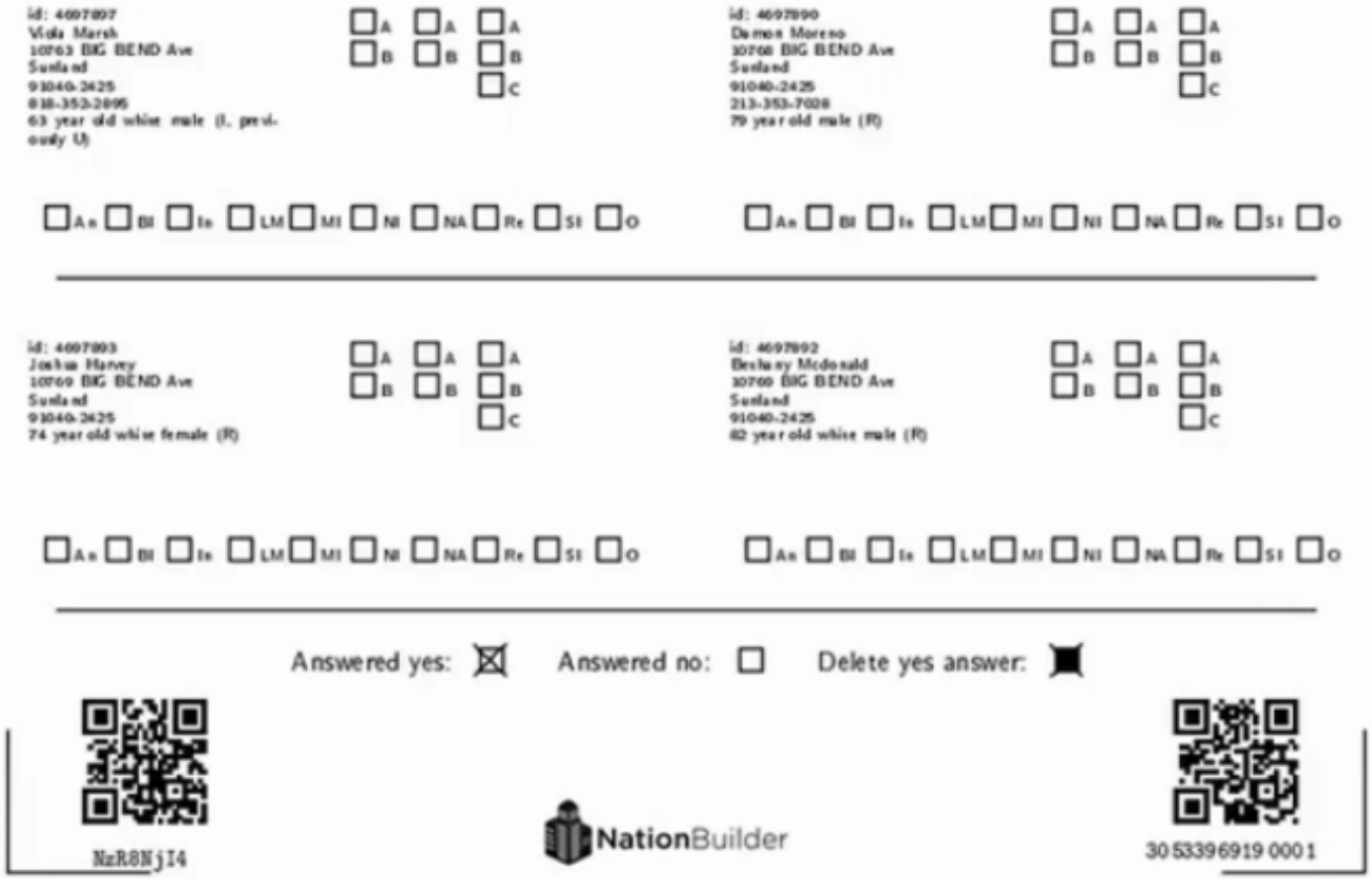


Prim	Kruskal	Both	Neither
○	○	○	○
○	○	○	○

Usage Scenarios

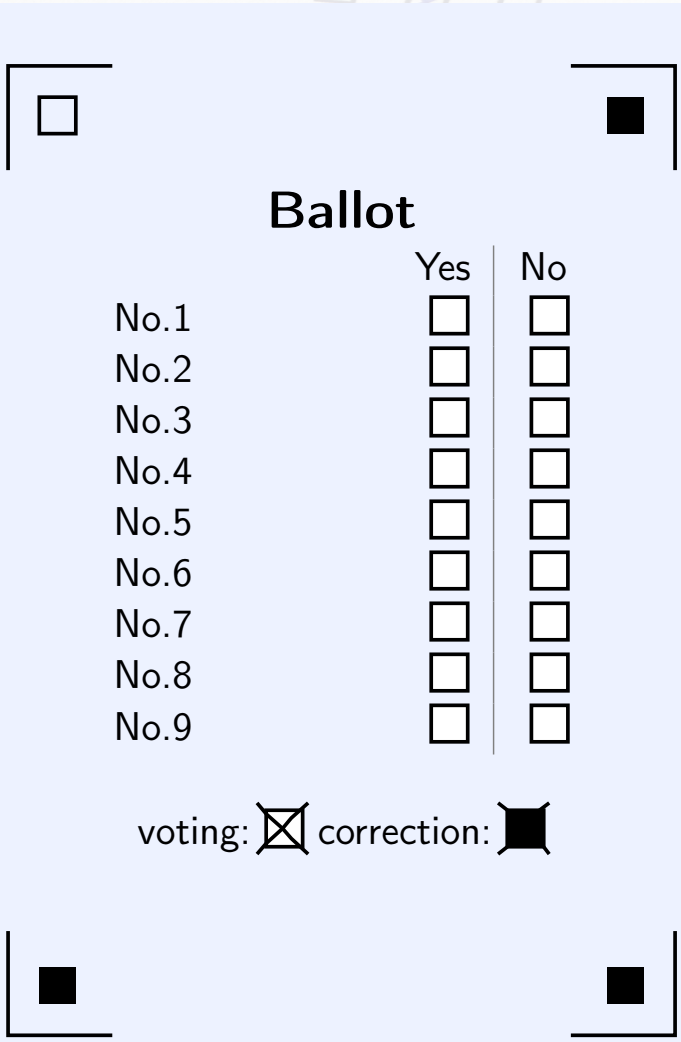
surveys **examinations** **walk & call sheets** **voting**



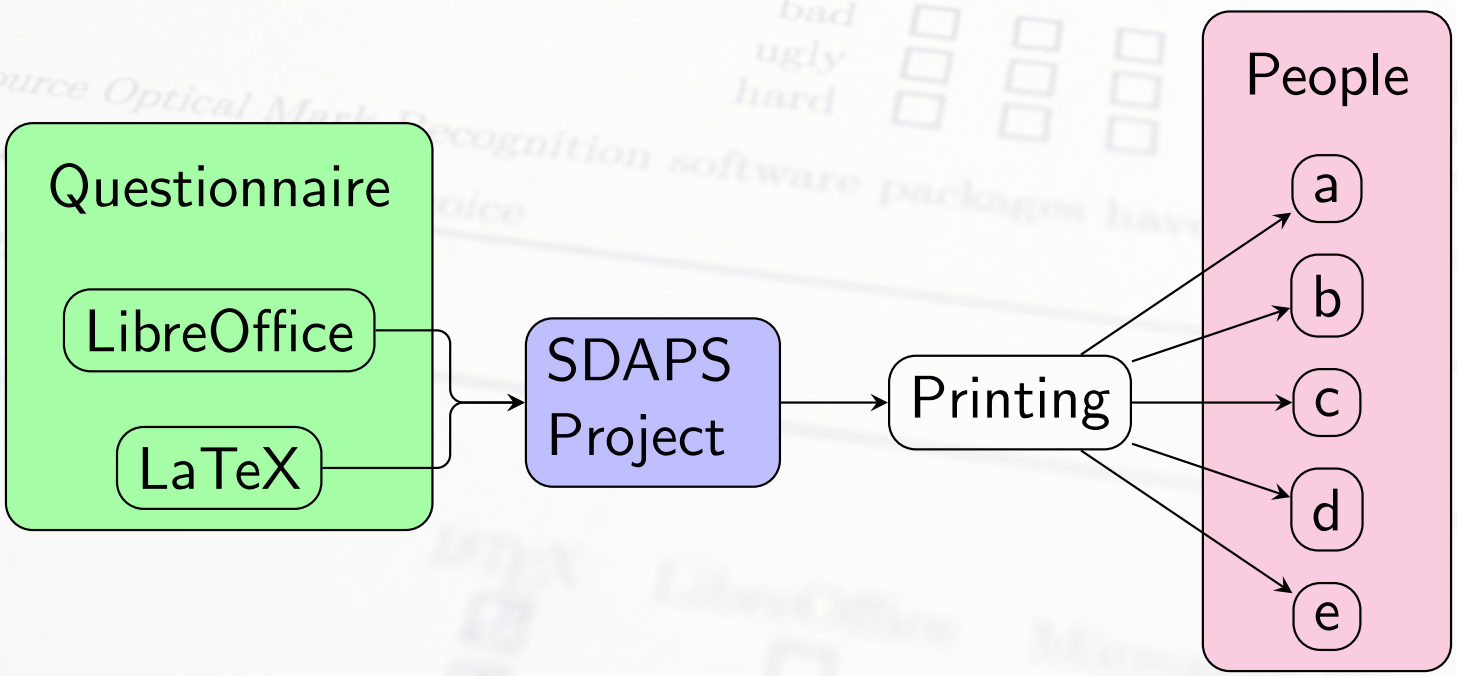
© NationBuilder

Usage Scenarios

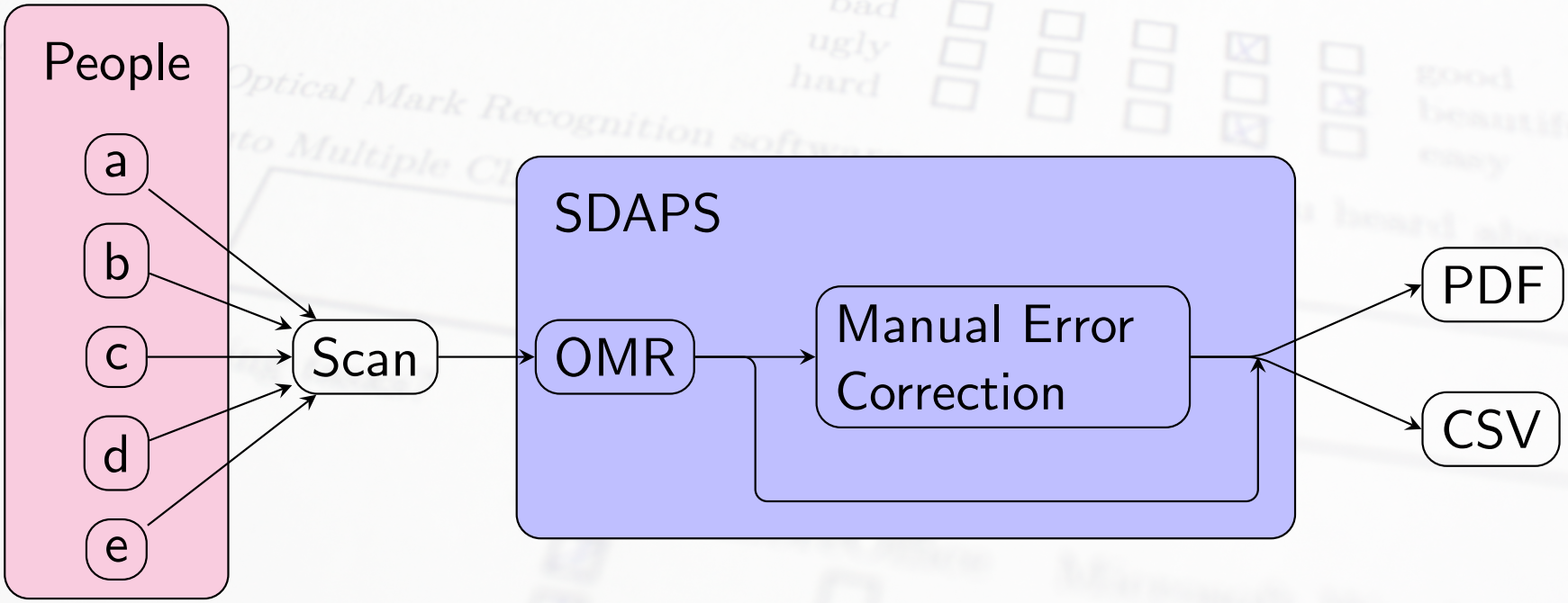
surveys **examinations** **walk & call sheets** **voting**



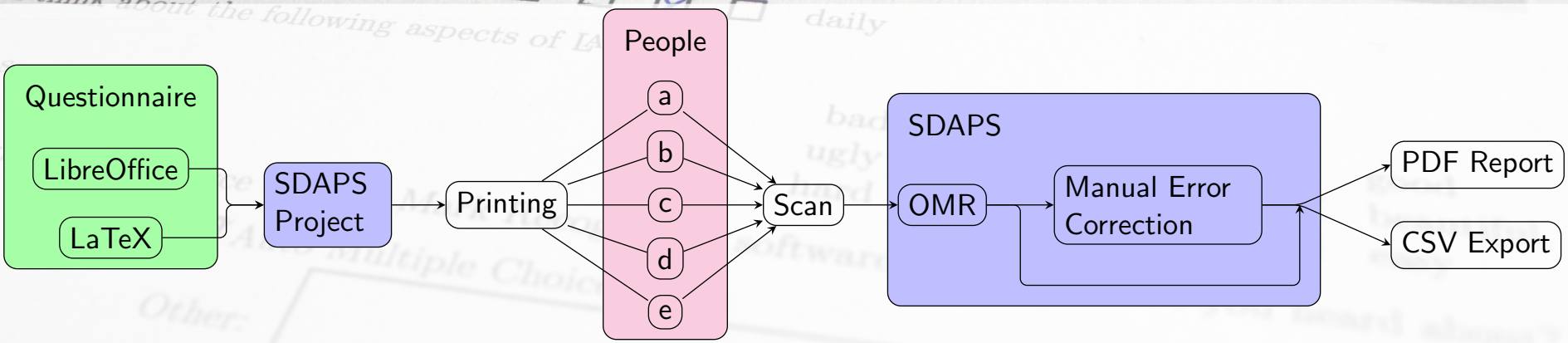
SDAPS


Questionnaire
LibreOffice
LaTeX
SDAPS Project
Printing
People
a
b
c
d
e

SDAPS


People
a
b
c
d
e
Scan
SDAPS
OMR
Manual Error Correction
PDF
CSV

Design Considerations



- Command line utility
- Modular
- External layout engine
- Single source document

Design Considerations

- Multipage handling
- Reproducable Form identification

→ Pseudorandom barcode (Survey-ID)

Design Considerations

- Multipage handling
- Reproducable Form identification
- Event identification
- → User defined barcode (Global-ID)

Design Considerations

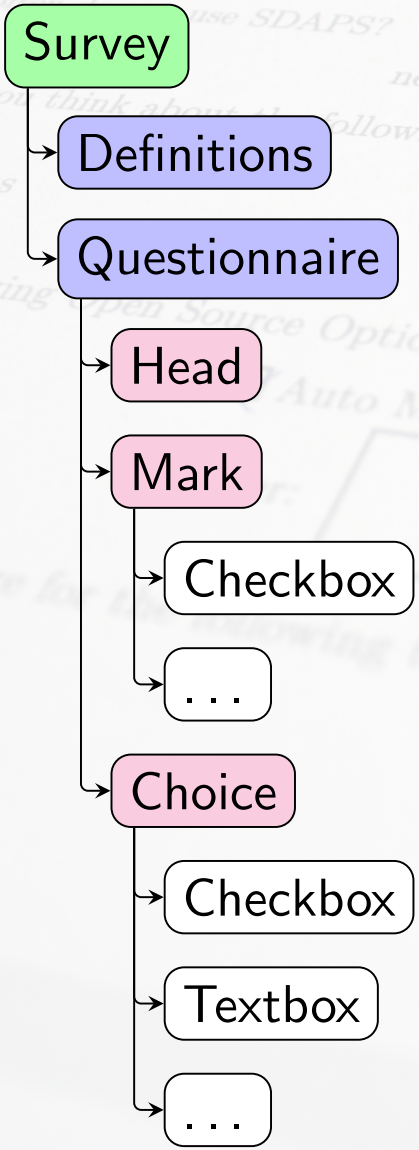
- Multipage handling
- Reproducable Form identification
- Event identification
- Unique printout

→ Random/user defined barcode (Questionnaire-ID)

Design Considerations

- Multipage handling
- Reproducable Form identification
- Event identification
- Unique printout
- Optical Mark Recognition
- Workflow/Automation

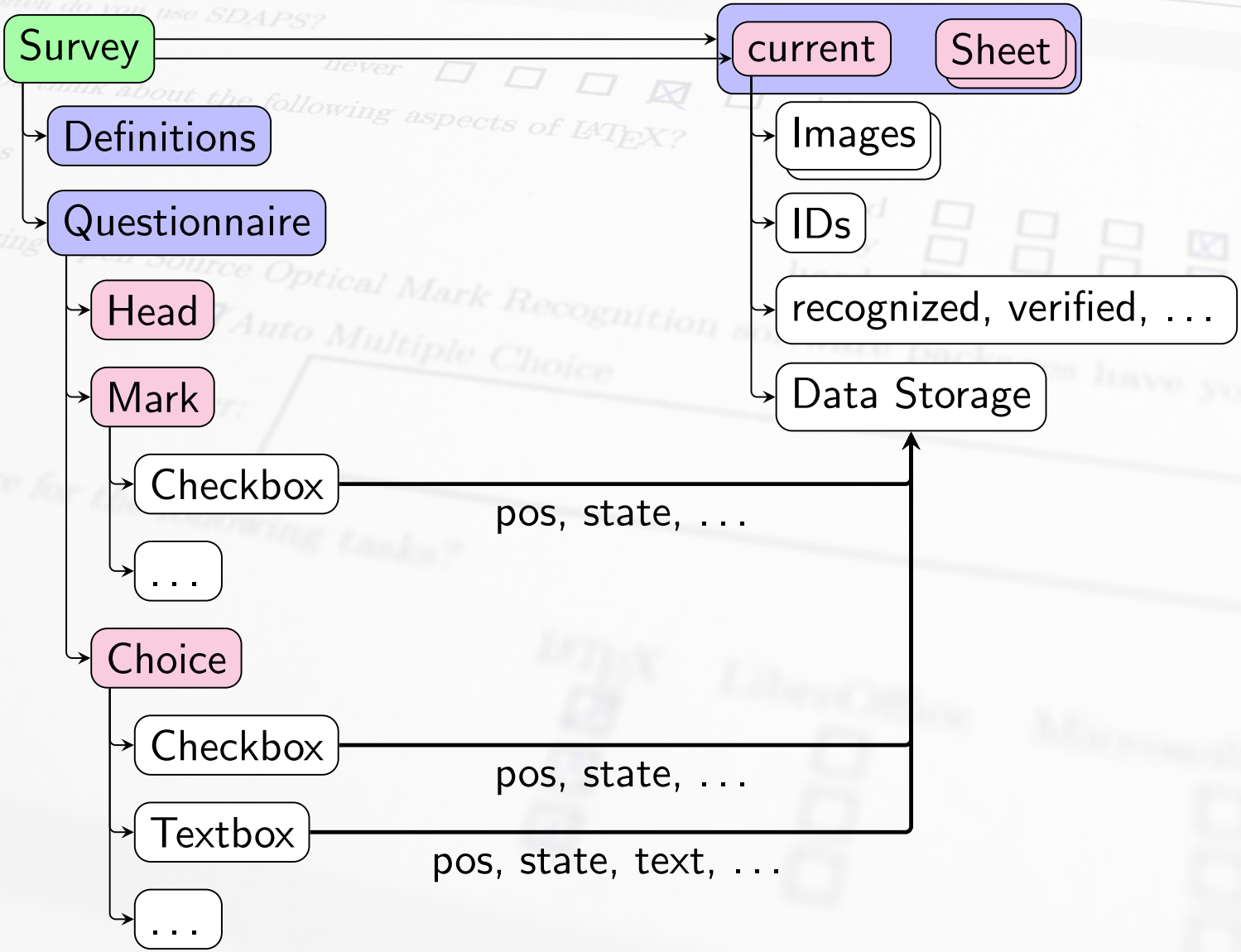
Datamodel


Survey
Definitions
Questionnaire
Head
Mark
Checkbox
...
Choice
Checkbox
Textbox
...

Datamodel

- Survey → title, IDs, sheets, path, ...
  - Definitions → paper size, style, ...
  - Questionnaire
    - Head → title
    - Mark → question, page
      - Checkbox → text, position, size
      - ...
    - Choice → question, page
      - Checkbox → text, position, size
      - Textbox → text, position, size
      - ...

Datamodel


Survey
Definitions
Questionnaire
Head
Mark
Checkbox
...
Choice
Checkbox
Textbox
...
current
Sheet
Images
IDs
recognized, verified, ...
Data Storage
pos, state, ...
pos, state, ...
pos, state, text, ...

The Author
The Title

This questionnaire is automatically read by a computer program. Please use a pen for filling in your answers.

Check: ☒ You can check any number of boxes in selection questions.

Uncheck to correct: ☒ For questions with a range (1–5) choose the answer the mark that fits best.

1 Section Heading

1.1 Mark Question

lower bound ☐ ☐ ☐ ☐ ☐ upper bound

1.2 Some choices

☐ first ☐ second Other:

1.3 A Textbox

3420821876 0001

Code

```
\documentclass[draft,english,pdf,pagemark,stamp]{sdaps}
\author{The Author} \title{The Title}

\begin{document}
  \begin{questionnaire}
    \section{Section Heading}

    \singlemark{Mark Question}{lower bound}{upper bound}

    \begin{choicequestion}[4]{Some choices}
      \choiceitem{first}                    \choiceitem{second}
      \choiceitemtext{1.2cm}{2}{Other:}
    \end{choicequestion}

    \textbox{5cm}{A Textbox}
  \end{questionnaire}
\end{document}
```

Metadata

```
Author=The Author
Title=The Title
PrintQuestionnaireId=0
PrintSurveyId=1
Pages=2
PageSize=597.50793pt, 845.04694pt
Duplex=True
Style=code128
GlobalID=
GlobalIDLabel=
Date=10.03.2013

QObject-Head=1. Range Questions
QObject-Mark=1.1. How often do you use SDAPS?
Answer-Mark=never
Box=Checkbox, 1, 249.85788pt, 622.04944pt, 9.95845pt, 9.95845pt, box
Box=Checkbox, 1, 271.81631pt, 622.04944pt, 9.95845pt, 9.95845pt, box
Box=Checkbox, 1, 293.77475pt, 622.04944pt, 9.95845pt, 9.95845pt, box
Box=Checkbox, 1, 315.73318pt, 622.04944pt, 9.95845pt, 9.95845pt, box
Box=Checkbox, 1, 337.69162pt, 622.04944pt, 9.95845pt, 9.95845pt, box
Answer-Mark=daily
QObject-Head=1.2. What do you think about the following aspects of \LaTeX  ?
QObject-Mark=equation syntax
Answer-Mark=bad
Box=Checkbox, 1, 402.38083pt, 582.03963pt, 9.95845pt, 9.95845pt, box
Box=Checkbox, 1, 424.33926pt, 582.03963pt, 9.95845pt, 9.95845pt, box
[...]
```

LaTeX3 development

Current code:

- Optimized for simple surveys
- Few layout options
- Blocks further development

LaTeX3 development

Current code:

- Optimized for simple surveys
- Few layout options
- Blocks further development

New code:

- LaTeX3
- Separate support package
- New layout options
- Overlays
- Name variables

LaTeX3 choicearray

vertical/horizontal switching

```
\begin{choicearray}[horizontal,var=tool]{Which of these tool do you
    think is appropriate for the following tasks (multiple answers are
    allowed)}
  \choice[var=latex,text=LaTeX]{\LaTeX}
  \choice[var=lo]{LibreOffice}
  \choice[var=msword]{Microsoft Word}

  \question[var=letter]{Writing Letters}
  \question[var=surveys]{Creating surveys}
\end{choicearray}
```

	LaTeX	LibreOffice	Microsoft Word
Writing Letters	○	○	○
Creating surveys	○	○	○

vertical/horizontal switching

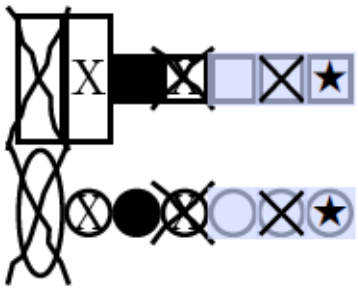
```
\begin{choicearray}[vertical,var=tool]{Which of these tool do you
    think is appropriate for the following tasks (multiple answers are
    allowed)}
  \choice[var=latex,text=LaTeX]{\LaTeX}
  \choice[var=lo]{LibreOffice}
  \choice[var=msword]{Microsoft Word}

  \question[var=letter]{Writing Letters}
  \question[var=surveys]{Creating surveys}
\end{choicearray}
```

	Writing Letters	Creating surveys
LaTeX	○	○
LibreOffice	○	○

LaTeX3 overlays

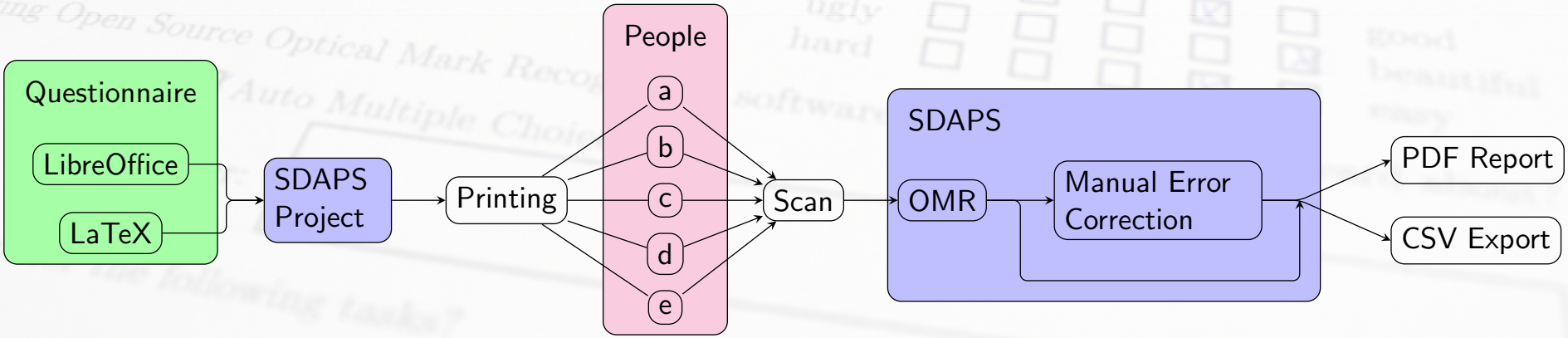
- Customize design
- Versatile textbox layout
- Overlay support
- PDF forms
- Pre-fill data



form data asdf

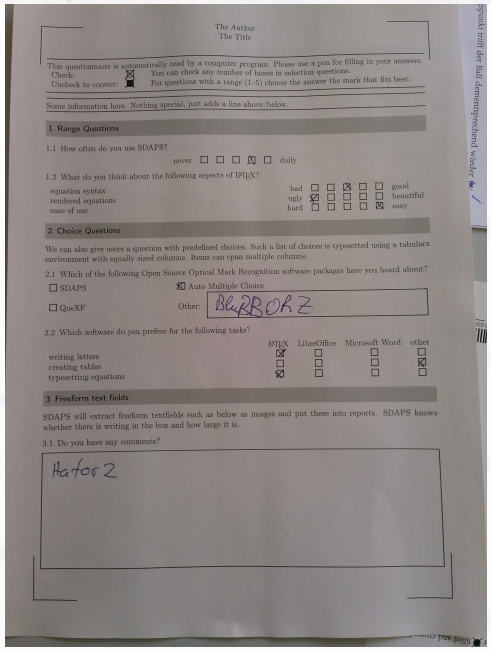
This is a test for a stretching textbox:

SDAPS


Questionnaire
LibreOffice
LaTeX
SDAPS Project
Printing
People
a
b
c
d
e
Scan
SDAPS
OMR
Manual Error Correction
PDF Report
CSV Export

Optical Mark Recognition

- Correction matrix (rotation, scale, skew)
- Inaccurate scannerns and printers
- Correlation for exact position
- Center of fields is analysed
- Heuristics: (C implementation)
  - black level
  - line detection
  - empty areas



Optical Mark Recognition

- Correction matrix (rotation, scale, skew)
- Inaccurate scannerns and printers
- Correlation for exact position
- Center of fields is analysed
- Heuristics: (C implementation)
  - black level
  - line detection
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Optical Mark Recognition

- Correction matrix (rotation, scale, skew)
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- Correlation for exact position
- Center of fields is analysed
- Heuristics: (C implementation)
  - black level
  - line detection
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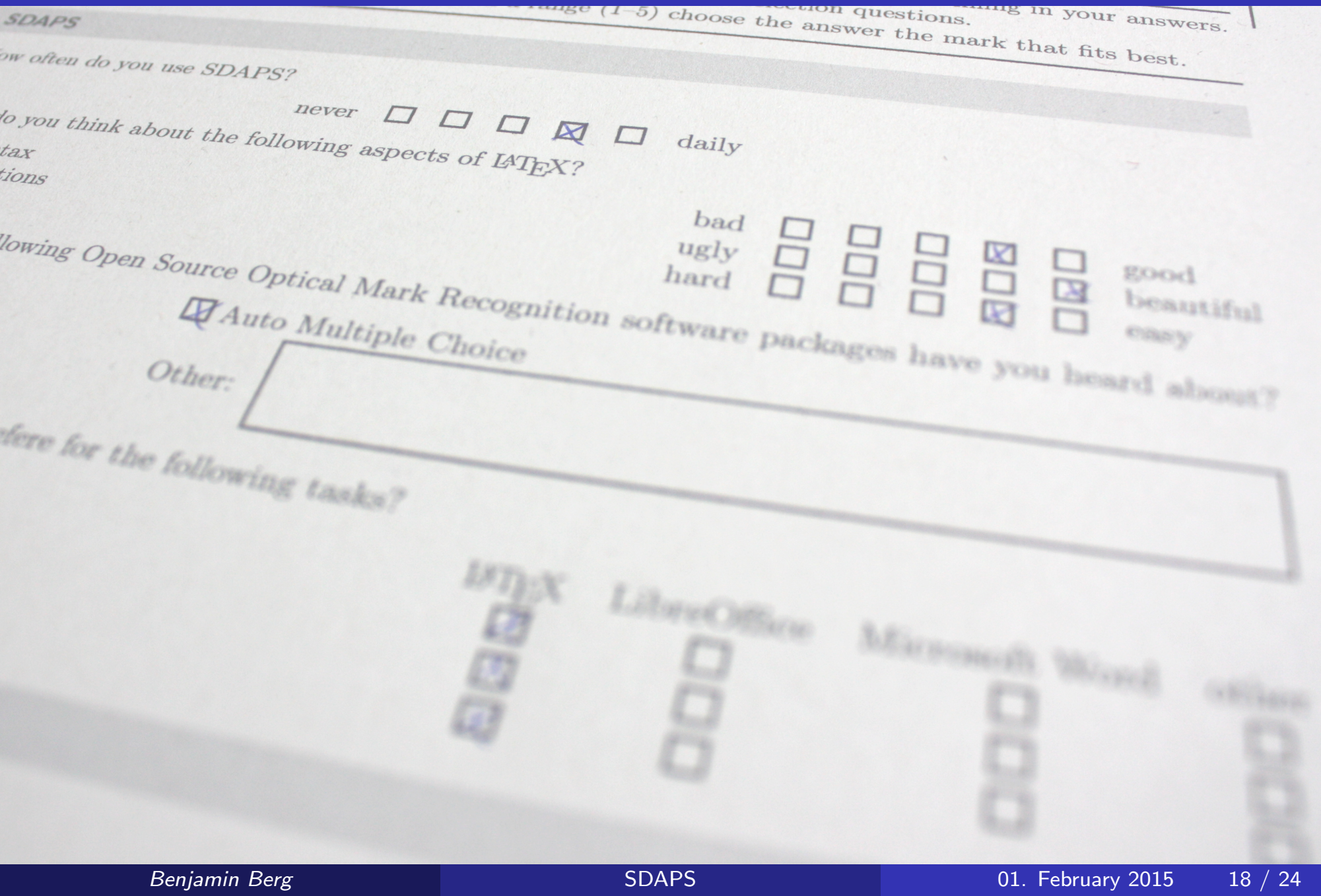
Optical Mark Recognition

- Correction matrix (rotation, scale, skew)
- Inaccurate scannerns and printers
- Correlation for exact position
- Center of fields is analysed
- Heuristics: (C implementation)
  - black level
  - line detection
  - empty areas

0.52

Demo


SDAPS
choose the answer the mark that fits best.
never
daily
bad
ugly
hard
good
beautiful
easy
Auto Multiple Choice
Other:
LaTeX
LibreOffice
Microsoft Word

Customizations

RWTH Aachen:

- Used for Tutorials (and Examinations)
- 4 pages (folded A3 sheet)
- Conversion scripts
- Custom handling for corrections
- Automatic selection for manual inspection

Customizations

8

Licht der Wellenlänge 540 nm fällt als ebene Welle senkrecht auf einen 1,9 mm breiten Spalt. Berechnen Sie in Kleinwinkelnäherung den Abstand, in dem ein Schirm hinter dem Spalt senkrecht zur Ausbreitungsrichtung aufgestellt werden muß, damit darauf die Breite des Hauptmaximums - zwischen den beiden ersten Minima links und rechts der Mitte - der halben Spaltbreite entspricht ? (*)

8.1 Ansatz:
- ☐ $n = c/v_{ph}$
- ☐ $n_1 \sin(\alpha_1) = n_2 \sin(\alpha_2)$
- ☐ $\Delta\varphi = (2n+1)\pi$
- ☐ $I = I_0(\sin(x)/x)^2$
- ☐ $LOO = (n+1)\lambda_n/2$
- ☐ $\sin(\alpha_n) = n\lambda/s$

8.2 Endformel:
- ☐ $s^2/(2\lambda)$
- ☐ $s/2$
- ☐ $\lambda/2$
- ☐ $2s$
- ☐ $s/(2\tan(\arcsin(\lambda/s)))$
- ☐ keine der angegebenen Formeln

8.3 Zahlenwert: ☐ 167,1 ☐ 3,343 ☐ 1,671 ☐ $1{,}671\cdot10^{-3}$ ☐ $3{,}800\cdot10^{-3}$ ☐ $270{,}0\cdot10^{-9}$ ☐ $950{,}0\cdot10^{-6}$ ☐ 3,343 ☐ anderer

8.4 Einheit: ☐ % ☐ ms ☐ Nm ☐ m/s^2 ☐ mg ☐ N ☐ $kg\cdot m/s^2$ ☐ s ☐ kg/s ☐ m·s ☐ t ☐ kg·m/s ☐ N/m ☐ m ☐ ohne

9

Zwei gekoppelte Pendel schwingen reibungsfrei bei Anfangsbedingungen [x1(0)=x0; x2(0)=v1(0)=v2(0)=0] mit einer Schwebungsperiodendauer von 20 s, während der sie 30 Schwingungsperioden durchlaufen.
Mit welcher Kreisfrequenz schwingen sie bei [x1(0)=-x2(0)=x0; v1(0)=v2(0)=0] ? (**)

9.1 Ansatz:
- ☐ $\omega = 2\pi/T$
- ☐ $x(t) = x_0\cos((\omega_A-\omega_0)t/2)\cos((\omega_A+\omega_0)t/2)$
- ☐ $\omega_{schwebung} = (\omega_A+\omega_0)/2$
- ☐ $\omega_o^2 = D/M$
- ☐ $\omega_A^2 = \omega_o^2 + 2d/M$

9.2 Endformel:
- ☐ $2\pi\cdot N/T_{Schweb}$
- ☐ $2\pi\cdot(N-1)/T_{Schweb}$
- ☐ $(N+1)/T_{Schweb}$
- ☐ $(N-1)/T_{Schweb}$
- ☐ $2\pi\cdot(N+1)/T_{Schweb}$
- ☐ keine der angegebenen Formeln

9.3 Zahlenwert: ☐ 9,111 ☐ 9,739 ☐ 1,550 ☐ 9,425 ☐ 9,739 ☐ 1,450 ☐ anderer

9.4 Einheit: ☐ kg/s ☐ m ☐ % ☐ f ☐ N ☐ s ☐ Nm ☐ mg ☐ t ☐ N/m ☐ ms ☐ kg·m/s ☐ m/s ☐ s^{-1} ☐ ohne

10

Auf dem Boden eines 2 m tiefen, mit Wasser (n=1,33) gefüllten Beckens liegt ein Gegenstand, den ein am Beckenrand stehender Beobachter aus 1,7 m Höhe in Luft (n=1) unter einem Winkel von 28 ° zur Wasseroberfläche sieht. In welcher Entfernung zur Beckenwand unter dem Beobachter befindet sich der Gegenstand ? (*)

10.1 Ansatz:
- ☐ $\sin(\alpha_n) = n\lambda/s$
- ☐ $n_1\sin(\alpha_1) = n_2\sin(\alpha_2)$
- ☐ $v/v_{ph} = 1/sin(\alpha)$
- ☐ $\sin(\alpha_1) >= n_2/n_1$
- ☐ $\alpha_{ein} = \alpha_{aus}$
- ☐ $n = c/v_{ph}$

10.2 Endformel:
- ☐ $(H+T)/\tan\beta$
- ☐ $H/\tan\beta + T\cdot\tan(\arcsin(\frac{n_L}{n_W}\cos\beta))$
- ☐ $H/\tan\beta + T\cdot\tan(\arcsin(\frac{n_L}{n_W}\sin\beta))$
- ☐ $H/\tan\beta + T\cdot\tan(\arcsin(\frac{n_W}{n_L}\sin\beta))$
- ☐ $H/\sin\beta + T\cdot\sin(\arcsin(\frac{n_L}{n_W}\cos\beta))$
- ☐ keine der angegebenen Formeln

10.3 Zahlenwert: ☐ 4,796 ☐ 4,973 ☐ -8,138 ☐ 6,959 ☐ 4,949 ☐ 3,952 ☐ -5,624 ☐ anderer

10.4 Einheit: ☐ f ☐ kg/s ☐ kg·m/s ☐ s^{-1} ☐ Nm ☐ s ☐ m ☐ mg ☐ ms ☐ m·s ☐ % ☐ N ☐ m/s ☐ N/m ☐ ohne

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Physik für Maschinenbau WS14/15, Übung 10, 15.12.2014 / 5.1.2015

Rheinisch Westfälische Technische Hochschule Aachen

I. Physikalisches Institut, Prof. Dr. S. Schael, Dr. T. Siedenburg

Name, Vorname | Matrikel-Nummer | Prüfungs-Nummer

Eigenhändige Unterschrift

Studiengang

Prüfungs-Nummer bitte auch ankreuzen:

	0	1	2	3	4	5	6	7	8	9
1000	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
100	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Mit dunklem Kugelschreiber so ankreuzen: Akzeptierte Auswahl: ☒ **Nicht** ausgewählt: ☐ oder ■

Alle Aufgaben sind gleichwertig mit 4 Fragen zu Ansatz, Endformel, Zahlenwert und/oder Einheit.

Pro Frage 1 Punkt, wenn jeweils alle richtigen und keine falschen Optionen angekreuzt sind.

Ansatz: Eine oder mehrere richtige Optionen. Nur zur Lösung der Aufgabe nötige Formeln sind hier richtig.
Endformel, Wert, Einheit: Genau eine richtige Option ist hier jeweils anzukreuzen.

Symbole und Konstanten sind definiert gemäß Formelsammlung WS 2014/15 – falls nicht abweichend angegeben.
Zahlenwerte sind exakt bis auf ±1 in der letzten angegebenen Stelle.

Die Klausur gilt als bestanden, wenn
a) 60% der gestellten Fragen richtig beantwortet sind oder
b) die Zahl der zutreffend beantworteten Fragen um nicht mehr als 22% die durchschnittliche Prüfungsleistung der Kandidatinnen und Kandidaten unterschreitet, die erstmals an der Prüfung teilgenommen haben.

ERGEBNIS Punkte _____ Note _____

nach MP am _____ Note _____

1

Der Treibsatz einer 250 g schweren Silvesterrakete erzeugt für 1,5 s eine Schubkraft von 6 N senkrecht nach oben. Welche maximale Höhe erreicht die Rakete unter Vernachlässigung von Luftreibung und Massenverlust des Treibsatzes ? (**)

1.1 Ansatz:
- ☐ $E_{kin} = \frac{1}{2}Mv^2; \quad E_{pot} = Mgh$
- ☐ $\tau = M/\gamma; \quad v_\infty = F_0/\gamma$
- ☐ $v_{ph} = \lambda f$
- ☐ $x(t) = x_0 + v_0 t + \frac{1}{2}\frac{F_0}{M}t^2$
- ☐ $x(t) = x_0 + v_\infty t - \tau(v_\infty - v_0)(1-e^{-t/\tau})$
- ☐ $F_{schwer} = M\cdot g$

1.2 Endformel:
- ☐ $\frac{F}{2M}(\frac{F}{Mg}-1)t^2$
- ☐ $1/2(\frac{F}{M}-g)t^2$
- ☐ $(Ft/M)^2/(2g)$
- ☐ $(F/M)t^2$
- ☐ $\frac{F}{2M}(\frac{F}{Mg}+1)t^2$
- ☐ keine der angegebenen Formeln

1.3 Zahlenwert: ☐ 78,11 ☐ 39,06 ☐ 54,00 ☐ 15,96 ☐ 93,06 ☐ 66,06 ☐ anderer

1.4 Einheit: ☐ % ☐ Nm ☐ ms ☐ t ☐ m ☐ $kg\cdot m/s^2$ ☐ s ☐ m·s ☐ m/s ☐ mg ☐ kg/s ☐ ohne

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Concept T.Siedenburg — powered by SDAPS 1.1.7 and LaTeXCalc 1.0

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Customizations

2

Auf ein 1,6 t schweres Auto mit einer Querschnittsfläche A = 2,5 m² und einem Luftwiderstandsbeiwert $c_W = 0{,}26$ wirkt die turbulente Luftwiderstandskraft $F_W = \frac{1}{2}\rho v^2 A \cdot c_W$. Bei welcher Geschwindigkeit wird die Antriebsleistung von 108 kW komplett in die Überwindung des Luftwiderstands umgesetzt ? (*)

2.1 Ansatz:

- ☐ $P = F \cdot v$
- ☐ $I = P/A;\quad I = \epsilon v_{ph};\quad \epsilon = \frac{1}{2}\rho u^2$
- ☐ $v_\infty = F_0/\gamma;\quad F_{reib} = -\gamma\dot{x}$
- ☐ $p = M \cdot v$
- ☐ $P = F/A$
- ☐ $v_{ph} = \sqrt{1/(\kappa\rho)};\quad 1/\kappa = F/A$

2.2 Endformel:

- ☐ $2M/(\rho \cdot c_W)$
- ☐ $\sqrt[3]{(2P\sqrt{A})/(M \cdot c_W)}$
- ☐ $\sqrt[3]{(2P)/(\rho \cdot A)}$
- ☐ $\sqrt[3]{(2P)/(\rho \cdot A \cdot c_W)}$
- ☐ $v_{ph}^{Luft}\sqrt{c_W/2}$
- ☐ keine der angegebenen Formeln

2.3 Zahlenwert: 149,8 ☐ 93,64 ☐ 234,7 ☐ 36,92 ☐ 23,47 ☐ 6,518 ☐ 65,18 ☐ 10,26 ☐ 445,2 ☐ 123,7 ☐ 337,1 ☐ 41,60 ☐ anderer ☐

2.4 Einheit: m·s ☐ t ☐ km/h ☐ kg·m/s² ☐ s ☐ m/s² ☐ kg/s ☐ ms ☐ Nm ☐ m ☐ ohne ☐

3

Ein Schlitten erreicht einen Hang mit 26 ° Gefälle und viskoser Reibung, die seine Endgeschwindigkeit auf 50 km/h begrenzt. Wie groß ist seine Geschwindigkeit 3 s nachdem er den Hang mit einer Anfangsgeschwindigkeit von 15 km/h erreicht hat ? (**)

3.1 Ansatz:

- ☐ $F_{hang} = M \cdot g \cdot sin(\alpha)$
- ☐ $x(t) = x_0 + v_\infty t - \tau(v_\infty - v_0)(1 - e^{-t/\tau})$
- ☐ $\tau = \gamma/M$
- ☐ $x(t) = x_0 + v_0 t + \frac{1}{2}\frac{F_0}{M}t^2$
- ☐ $v_\infty = F_0/\gamma$
- ☐ $E_{kin} = \frac{1}{2}Mv^2\quad E_{pot} = Mgh$
- ☐ $x(t) = 2 \cdot x_0 + v_0 t + \frac{1}{2}\frac{F_0}{M}t^2$

3.2 Endformel:

- ☐ $v_{end} \cdot e^{-t \cdot v_0/(g \cdot \sin(\alpha))}$
- ☐ $v_{end} - (v_{end} - v_0)e^{-t \cdot g \cdot \sin(\alpha)/v_{end}}$
- ☐ $\sqrt{2g \cdot v_0 \cdot t \cdot \sin(\alpha)}$
- ☐ $v_{end} - (v_{end} - v_0)e^{-t \cdot v_{end}/(g \cdot \sin(\alpha))}$
- ☐ $v_0 \cdot e^{-t \cdot g \cdot \sin(\alpha)/v_{end}}$
- ☐ keine der angegebenen Formeln

3.3 Zahlenwert: 5,925 ☐ 1,646 ☐ 43,04 ☐ 37,33 ☐ 10,05 ☐ 36,18 ☐ 10,37 ☐ 13,89 ☐ 22,96 ☐ 50,00 ☐ 2,733 ☐ anderer ☐

3.4 Einheit: % ☐ kg/s ☐ m ☐ mg ☐ ms ☐ kg·m/s² ☐ Nm ☐ m/s² ☐ m/s ☐ t ☐ m·s ☐ s ☐ ohne ☐

4

Eine Masse von 4 kg schwingt ungedämpft an einer Feder mit einer Federkonstanten von 245 N/m. Zu dem Zeitpunkt, an dem die Auslenkung 12 cm in Bezug auf die Ruhelage beträgt, ist die Geschwindigkeit 0,3 m/s. Wo, in Bezug auf die Ruhelage, befindet sich die Masse 1,4 s später ? (*)

4.1 Ansatz:

- ☐ $x_r = F_0/D;\quad F_{Schwer} = Mg$
- ☐ $\omega_0^2 = D/M$
- ☐ $x(t) = x_r + (x_0 - x_r)\cos(\omega_0 t) + (v_0/\omega_0)\sin(\omega_0 t)$
- ☐ $x(t) = x_r + A\cos(\omega_0 t - \varphi)$
- ☐ $\omega_A^2 = \omega_0^2 + 2d/M$
- ☐ $x(t) = x_0 + v_0 t + \frac{F_0}{2M}t^2$
- ☐ $x(t) = x_0\cos((\omega_A - \omega_0)t/2)\cos((\omega_A + \omega_0)t/2)$

4.2 Endformel:

- ☐ $\sqrt{A^2 + v^2/(D/M)}\cos(t\sqrt{D/M} - \arctan(v/(A\sqrt{D/M})))$
- ☐ $A\cos(t\sqrt{D/M}(\sqrt{3}-1)/2)\cdot\cos(t\sqrt{D/M}(\sqrt{3}+1)/2)$
- ☐ $\frac{M\cdot g}{D} + (A - \frac{M\cdot g}{D})\cos(t\sqrt{D/M}) + \frac{v}{\sqrt{D/M}}\sin(t\sqrt{D/M})$
- ☐ $A + v \cdot t + g \cdot t^2$
- ☐ $A\cos(t\sqrt{D/M}) + (v/\sqrt{D/M})\sin(t\sqrt{D/M})$
- ☐ keine der angegebenen Formeln

4.3 Zahlenwert: 5,718 ☐ 12,51 ☐ -4,296 ☐ -3,364 ☐ 19,77 ☐ -50,43 ☐ 12,34 ☐ anderer ☐

4.4 Einheit: mg ☐ cm ☐ kg·m/s² ☐ m/s² ☐ % ☐ Nm ☐ s ☐ ms ☐ t ☐ kg/s ☐ m·s ☐ ohne ☐

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5

In einem mittig eingespannten Metallstab der Länge 1.2 m mit 12 mm Durchmesser und einem Gewicht von 366 g wird für die longitudinale Grundschwingung eine Frequenz von 2.1 kHz gemessen.
Wie groß ist das Elastizitätsmodul des Materials ? (**)

5.1 Ansatz:

- ☐ $L_{OG} = (2n+1)\lambda_n/4$
- ☐ $E = (F/A)/(\Delta L/L)$
- ☐ $v_{ph} = \sqrt{1/(\kappa\rho)}$
- ☐ $E_{Feder} = \frac{1}{2}Dx^2;\quad \omega_0^2 = D/M$
- ☐ $n(\lambda) = A + B/\lambda^2$
- ☐ $v_{ph} = \lambda f$

5.2 Endformel:

- ☐ $4(Lf)/(\pi d^3)$
- ☐ $64(LMf^2)/(\pi d^2)$
- ☐ $2M(\pi Lf)^2$
- ☐ $4(LMf^2)/d^2$
- ☐ $16(LMf^2)/(\pi d^2)$
- ☐ keine der angegebenen Formeln

5.3 Zahlenwert: 53,80·10⁹ ☐ 274,0·10⁹ ☐ 274,0·10³ ☐ 1,857·10⁹ ☐ 685,0·10⁶ ☐ 45,88·10⁶ ☐ 53,80·10¹² ☐ 68,50·10⁹ ☐ anderer ☐

5.4 Einheit: kg·m/s² ☐ m ☐ mg ☐ Nm ☐ m·s ☐ m/s² ☐ t ☐ % ☐ s ☐ Pa ☐ ms ☐ N/m ☐ kg/s ☐ ohne ☐

6

Eine Masse von 400 kg ruht im Schwerefeld der Erde viskos gedämpft auf einer Feder, so daß sie in kürzest möglicher Zeit in die Ruhelage zurückkehrt, bei der die Feder um 12 cm ausgelenkt ist.
Wie groß ist der Impulsübertrag, der die Masse um maximal 25 cm aus der Ruhelage auslenkt ? (**)

6.1 Ansatz:

- ☐ $x(t) = x_0 + v_0 t + \frac{F_0}{2M}t^2$
- ☐ $F_{Schwer} = Mg;\quad \omega_0^2 = D/M$
- ☐ $1/\tau = \gamma/M$
- ☐ $x(t) = x_r + \left[(x_0 - x_r)(1 + \frac{t}{2\tau})|v_0 t\right]e^{-t/(2\tau)}$
- ☐ $x(t) = x_r + (x_0 - x_r)\cos(\omega_0 t) + (v_0/\omega_0)\sin(\omega_0 t)$
- ☐ $x_r = F_0/D;\quad \omega_0 = 1/(2\tau)$

6.2 Endformel:

- ☐ $eMx_r\sqrt{g/x_m}$
- ☐ $Mx_m\sqrt{g/x_r}$
- ☐ $M\sqrt{2gx_m}$
- ☐ $eMx_m\sqrt{g/x_r}$
- ☐ $M\sqrt{2gx_r}$
- ☐ keine der angegebenen Formeln

6.3 Zahlenwert: 885,9 ☐ 194,1 ☐ 817,3 ☐ 904,2 ☐ 777,2 ☐ 2,458 ☐ 2458 ☐ 613,8 ☐ 280,1 ☐ anderer ☐

6.4 Einheit: N/m ☐ % ☐ m/s² ☐ t ☐ s ☐ m·s ☐ m ☐ kg·m/s² ☐ ms ☐ N ☐ Nm ☐ kg·m/s ☐ kg/s ☐ mg ☐ ohne ☐

7

Eine Schallwelle trifft in flüssigem Wasser senkrecht auf Eis (ρ = 925 kg/m^3, v_{ph} =3260 m/s). Wie groß ist die Schalldruckintensität an der Grenzfläche im Wasser in Bezug auf die der einlaufenden Welle ? (**)

7.1 Ansatz:

- ☐ $R = |z_1 - z_2|/|z_1 + z_2|$
- ☐ $I = P/A$
- ☐ $I \propto A^2$
- ☐ $I_E = I_R + I_T$
- ☐ $\Delta\varphi_p = \pi$
- ☐ $z = \rho \cdot v_{ph}$

7.2 Endformel:

- ☐ $\left(1 - (v_{ph}^E\rho_E - v_{ph}^W\rho_W)/(v_{ph}^E\rho_E + v_{ph}^W\rho_W)\right)^2$
- ☐ $\left(1 + (v_{ph}^E\rho_E - v_{ph}^W\rho_W)/(v_{ph}^E\rho_E + v_{ph}^W\rho_W)\right)^2$
- ☐ $\left(1 + (v_{ph}^E\rho_E - v_{ph}^W\rho_W)/(v_{ph}^E\rho_E + v_{ph}^W\rho_W)\right)$
- ☐ $\left(1 - (v_{ph}^E\rho_E - v_{ph}^W\rho_W)/(v_{ph}^E\rho_E + v_{ph}^W\rho_W)\right)$
- ☐ $\left((v_{ph}^E\rho_E - v_{ph}^W\rho_W)/(v_{ph}^E\rho_E + v_{ph}^W\rho_W)\right)^2$
- ☐ keine der angegebenen Formeln

7.3 Zahlenwert: 1,362 ☐ 2,681 ☐ 638,4·10⁻³ ☐ 407,6·10⁻³ ☐ 185,4 ☐ 1,854 ☐ 6,173 ☐ 130,7·10⁻³ ☐

7.4 Zahlenwert in dB: 1,340 ☐ 268,1·10⁻³ ☐ 2,681 ☐ -8,837 ☐ 1,854 ☐ -1,949 ☐ -3,898 ☐ 6,173 ☐

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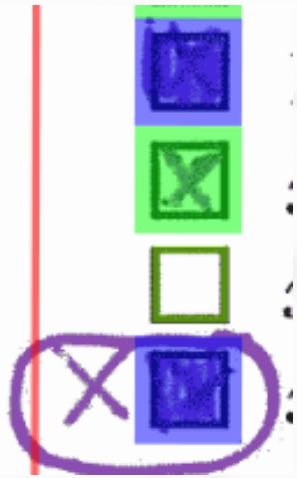
Customizations

Correction Handling

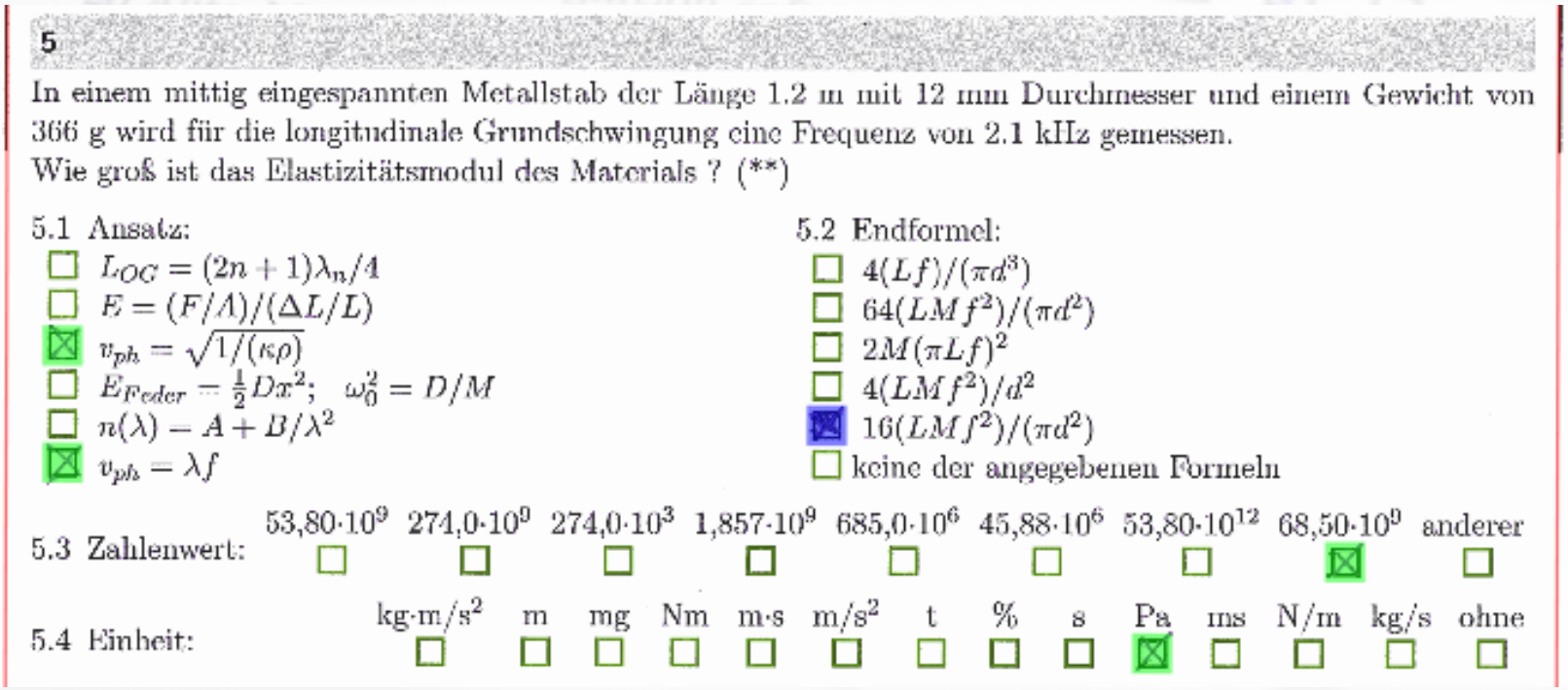
- Students should be able to correct errors
  - Fill to correct once
  - Correcting twice not possible in SDAPS
- Solution:
  - Different colored pen used by supervisor
  - Exam noted down for manual inspection



Customizations

Customized UI for Error handling

- Modified checkbox state handling
- Decide in favor of student
- Modified SDAPS that shows colored scans



5

In einem mittig eingespannten Metallstab der Länge 1.2 m mit 12 mm Durchmesser und einem Gewicht von 366 g wird für die longitudinale Grundschwingung eine Frequenz von 2.1 kHz gemessen.
Wie groß ist das Elastizitätsmodul des Materials ? (**)

5.1 Ansatz:

- ☐ $L_{OC} = (2n+1)\lambda_n/4$
- ☐ $E = (F/A)/(\Delta L/L)$
- ☒ $v_{ph} = \sqrt{1/(\kappa\rho)}$
- ☐ $E_{Feder} = \frac{1}{2}Dx^2; \quad \omega_0^2 = D/M$
- ☐ $n(\lambda) = A + B/\lambda^2$
- ☒ $v_{ph} = \lambda f$

5.2 Endformel:

- ☐ $4(Lf)/(\pi d^3)$
- ☐ $64(LMf^2)/(\pi d^2)$
- ☐ $2M(\pi Lf)^2$
- ☐ $4(LMf^2)/d^2$
- ☒ $16(LMf^2)/(\pi d^2)$
- ☐ keine der angegebenen Formeln

5.3 Zahlenwert:

$53{,}80\cdot10^9$	$274{,}0\cdot10^9$	$274{,}0\cdot10^3$	$1{,}857\cdot10^9$	$685{,}0\cdot10^6$	$45{,}88\cdot10^6$	$53{,}80\cdot10^{12}$	$68{,}50\cdot10^9$	anderer
☐	☐	☐	☐	☐	☐	☐	☒	☐

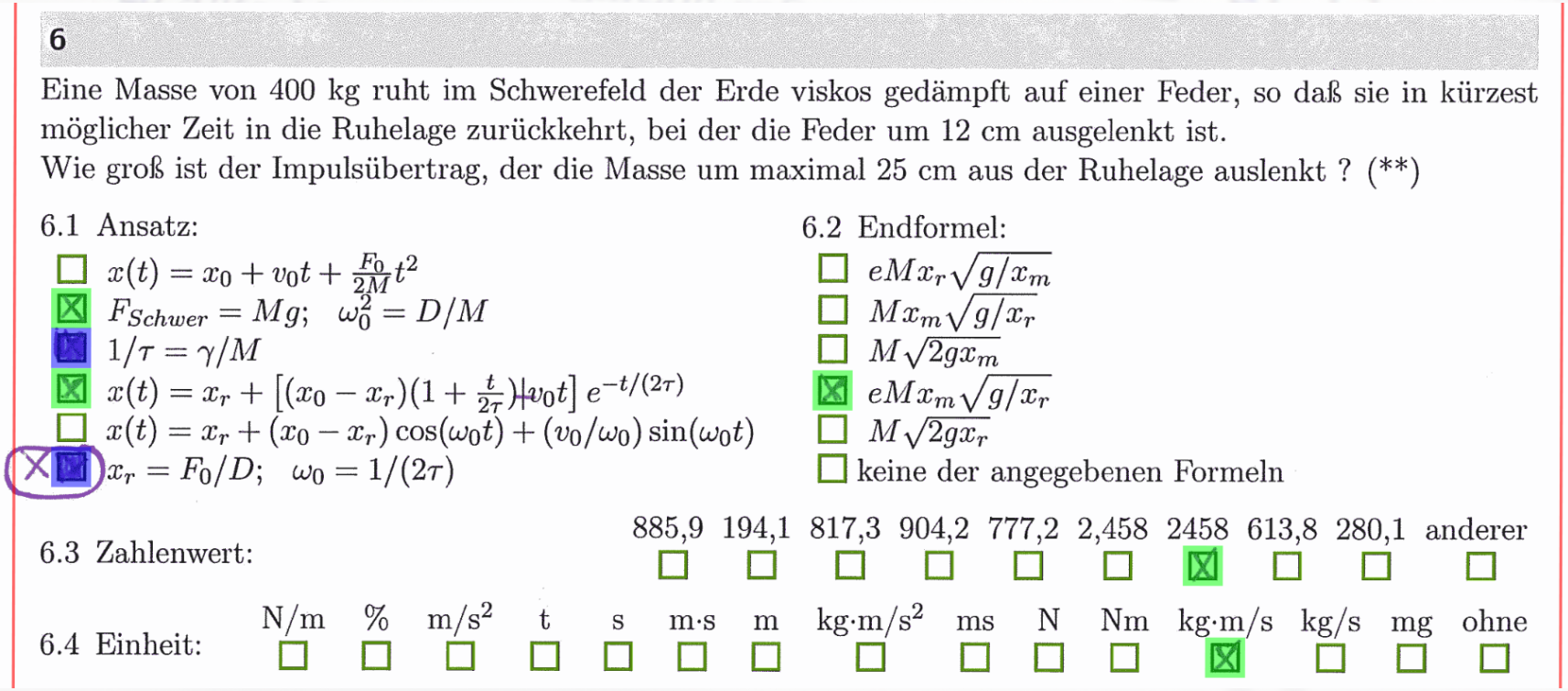
5.4 Einheit:

$kg\cdot m/s^2$	m	mg	Nm	m·s	m/s^2	t	%	s	Pa	ms	N/m	kg/s	ohne
☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐

Customizations

Customized UI for Error handling

- Modified checkbox state handling
- Decide in favor of student
- Modified SDAPS that shows colored scans



6

Eine Masse von 400 kg ruht im Schwerefeld der Erde viskos gedämpft auf einer Feder, so daß sie in kürzest möglicher Zeit in die Ruhelage zurückkehrt, bei der die Feder um 12 cm ausgelenkt ist.
Wie groß ist der Impulsübertrag, der die Masse um maximal 25 cm aus der Ruhelage auslenkt ? (**)

6.1 Ansatz:

- ☐ $x(t) = x_0 + v_0 t + \frac{F_0}{2M} t^2$
- ☒ $F_{Schwer} = Mg; \quad \omega_0^2 = D/M$
- ☒ $1/\tau = \gamma/M$
- ☒ $x(t) = x_r + \left[(x_0 - x_r)(1 + \frac{t}{2\tau}) + v_0 t\right] e^{-t/(2\tau)}$
- ☐ $x(t) = x_r + (x_0 - x_r)\cos(\omega_0 t) + (v_0/\omega_0)\sin(\omega_0 t)$
- ☒ $x_r = F_0/D; \quad \omega_0 = 1/(2\tau)$

6.2 Endformel:

- ☐ $eMx_r\sqrt{g/x_m}$
- ☐ $Mx_m\sqrt{g/x_r}$
- ☐ $M\sqrt{2gx_m}$
- ☒ $eMx_m\sqrt{g/x_r}$
- ☐ $M\sqrt{2gx_r}$
- ☐ keine der angegebenen Formeln

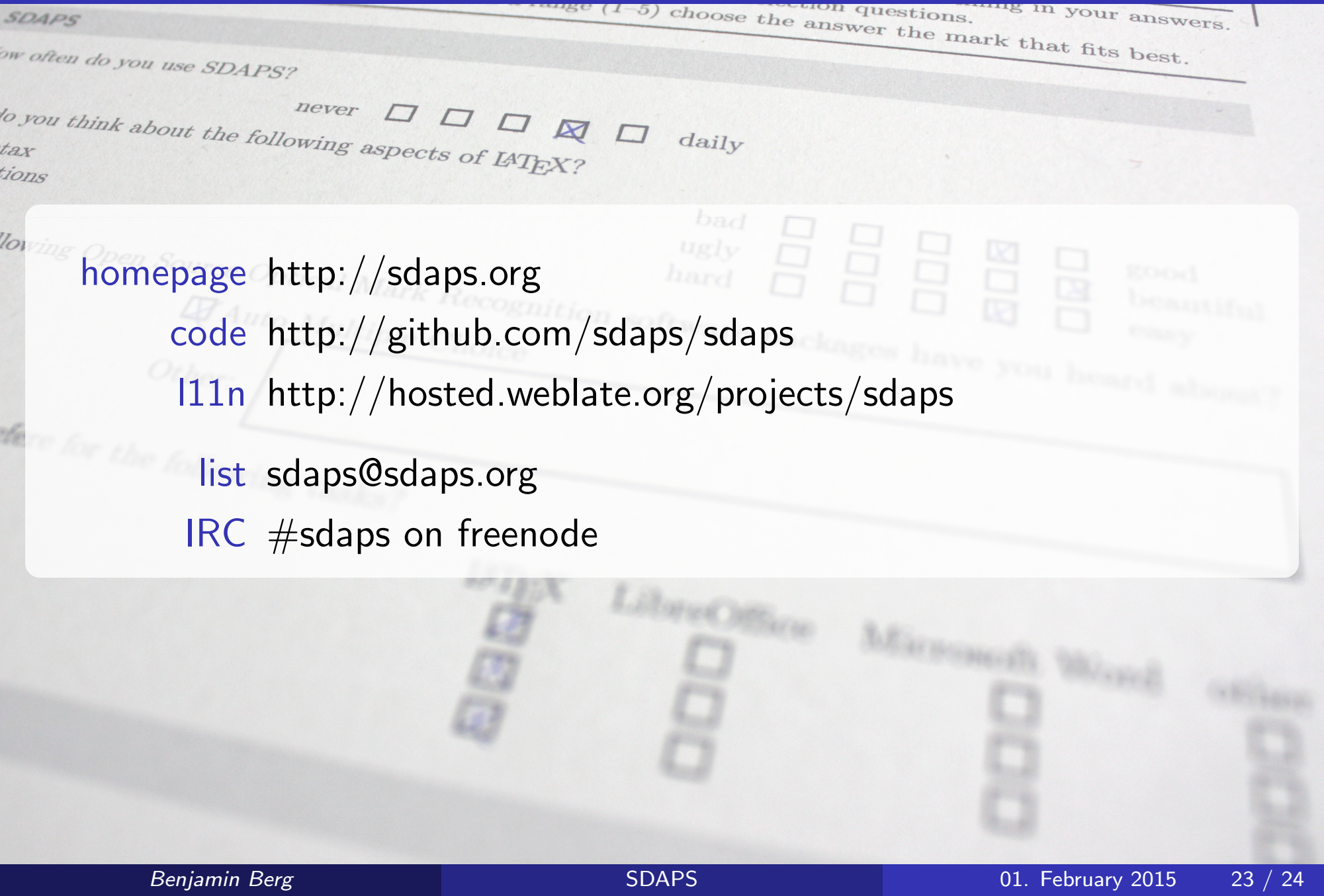
6.3 Zahlenwert:

885,9	194,1	817,3	904,2	777,2	2,458	2458	613,8	280,1	anderer
☐	☐	☐	☐	☐	☐	☒	☐	☐	☐

6.4 Einheit:

N/m	%	m/s²	t	s	m·s	m	kg·m/s²	ms	N	Nm	kg·m/s	kg/s	mg	ohne
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐

Resources



homepage http://sdaps.org

code http://github.com/sdaps/sdaps

l11n http://hosted.weblate.org/projects/sdaps

list sdaps@sdaps.org

IRC #sdaps on freenode

So, what I can say is that SDAPS is a great tool, with great flexibility (because of the CLI it is extremely easy to use with scripts for generation questionnaires in an automatic way) and extremely reliable.

– João Gândara (Escola Superior Agrária de Coimbra)

For October, running up to the end of US elections in November, we were able to process over 22,000 unique contacts, resulting in saving hundreds of hours of volunteer time from inputting and verifying data manually.

– NationBuilder