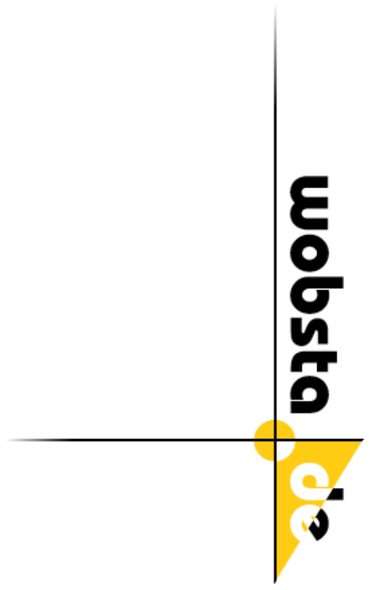
Physicist in IT:
Physics in Advent

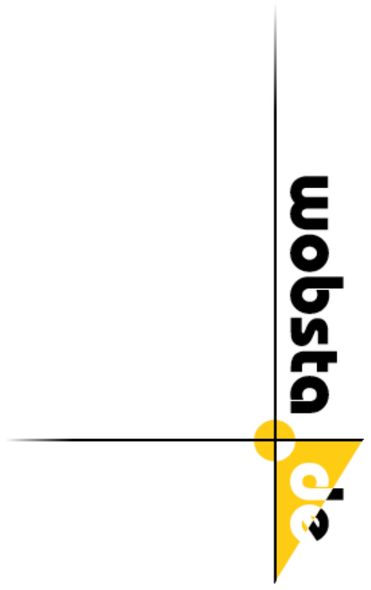
https://www.physics-in-advent.org
https://www.physik-im-advent.de

André Wobst
https://www.wobsta.de
contact@wobsta.de



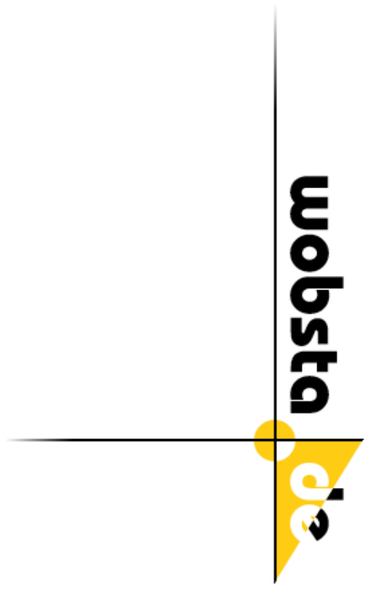
Outline

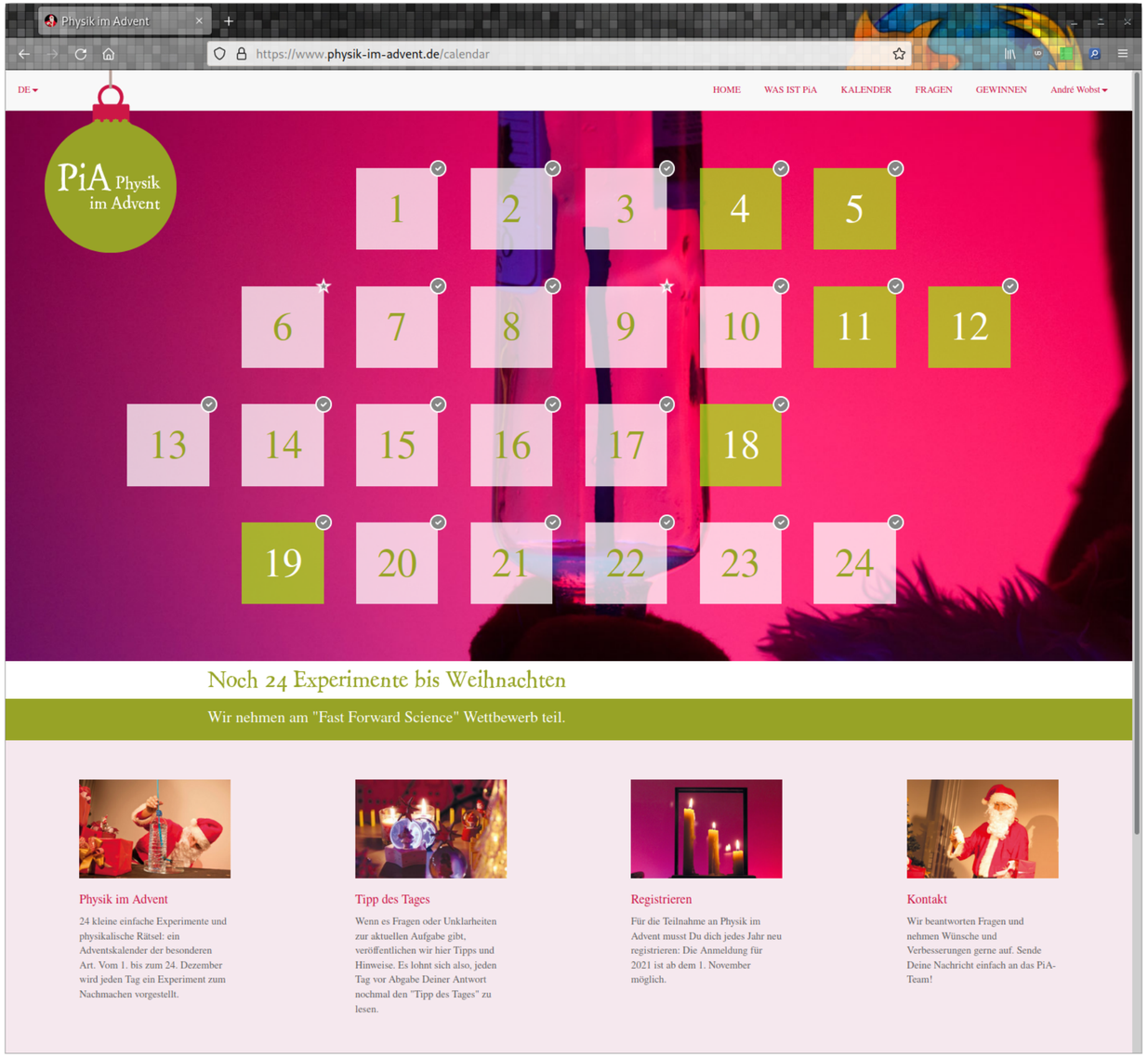
- About the project, infrastructure etc.
- Look behind the scene
- Lessons learned



About Physics in Advent

- Online advent calendar for pupils, teachers, others
- Individual prizes as well as class and school prizes
- Questions at 5am, closing at 11pm, answers at 8am next day
- Initiator and coordinator: Prof. Dr. Arnulf Quadt (Göttingen)
- Started in 2013 (using some adopted PHP software)
- got involved in fall 2014 (ssl cert, archive, monitoring ...)
- Redesign + rebuilt from ground up in 2016
- Being project DevOp ever since




Physik im Advent
https://www.physik-im-advent.de/calendar
DE
HOME
WAS IST PiA
KALENDER
FRAGEN
GEWINNEN
André Wobst
PiA Physik im Advent
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 23 24
Noch 24 Experimente bis Weihnachten
Wir nehmen am "Fast Forward Science" Wettbewerb teil.
Physik im Advent
24 kleine einfache Experimente und physikalische Rätsel: ein Adventskalender der besonderen Art. Vom 1. bis zum 24. Dezember wird jeden Tag ein Experiment zum Nachmachen vorgestellt.
Tipp des Tages
Wenn es Fragen oder Unklarheiten zur aktuellen Aufgabe gibt, veröffentlichen wir hier Tipps und Hinweise. Es lohnt sich also, jeden Tag vor Abgabe Deiner Antwort nochmal den "Tipp des Tages" zu lesen.
Registrieren
Für die Teilnahme an Physik im Advent musst Du dich jedes Jahr neu registrieren: Die Anmeldung für 2021 ist ab dem 1. November möglich.
Kontakt
Wir beantworten Fragen und nehmen Wünsche und Verbesserungen gerne auf. Sende Deine Nachricht einfach an das PiA-Team!

Physik im Advent
https://www.physik-im
DE
PiA Physik im Advent
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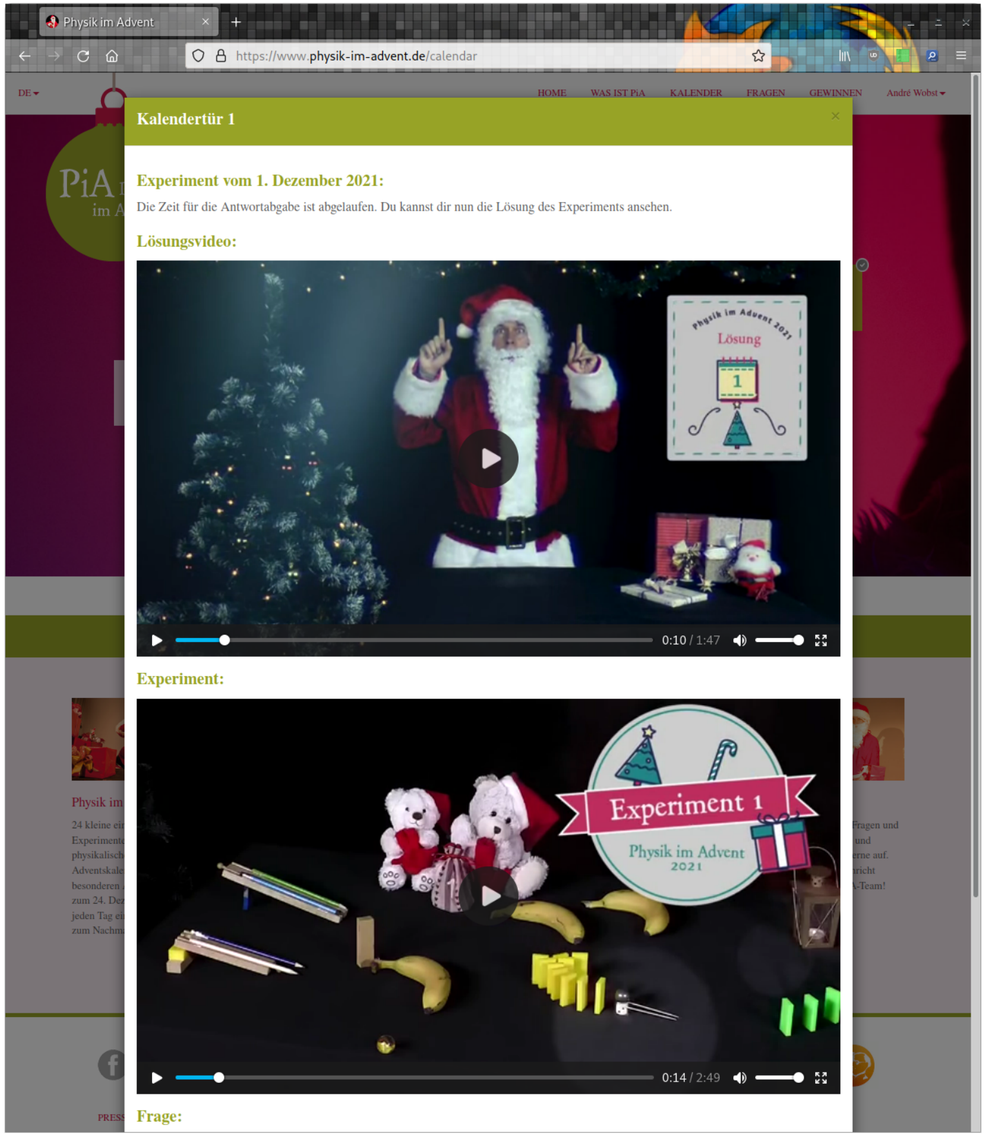
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Kalendertür 1
Experiment vom 1. Dezember 2021:
Die Zeit für die Antwortabgabe ist abgelaufen. Du kannst dir nun die Lösung des Experiments ansehen.
Lösungsvideo:
Physik im Advent 2021
Lösung
1
0:10 / 1:47
Experiment:
Experiment 1
Physik im Advent
2021
0:14 / 2:49
Frage:

Infrastructure/Implementation

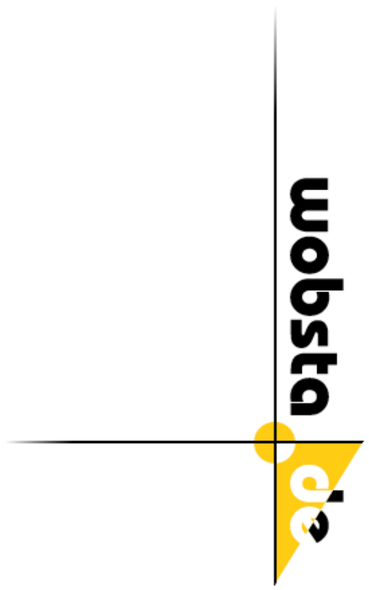
- Design by Aron Jungermann (also doing Flyers etc.)
- Responsive HTML using Twitter bootstrap
- Linux VM (Debian) at GWDG Göttingen
- Python (Flask) behind nginx and uwsgi
- Two instances (green/blue deployment with zero downtime)
- Postgres (with SQLAlchemy and Alembic)
- Video hosting at youtube (local hosting by mp4 videos for China)
- LaTeX (attendee certificates, class codes, prize letters)
- exim4 (without smarthost)
- git+gitlab (DPG), zabbix (wobsta), matomo (PiA), otrs+mailman (GWDG)

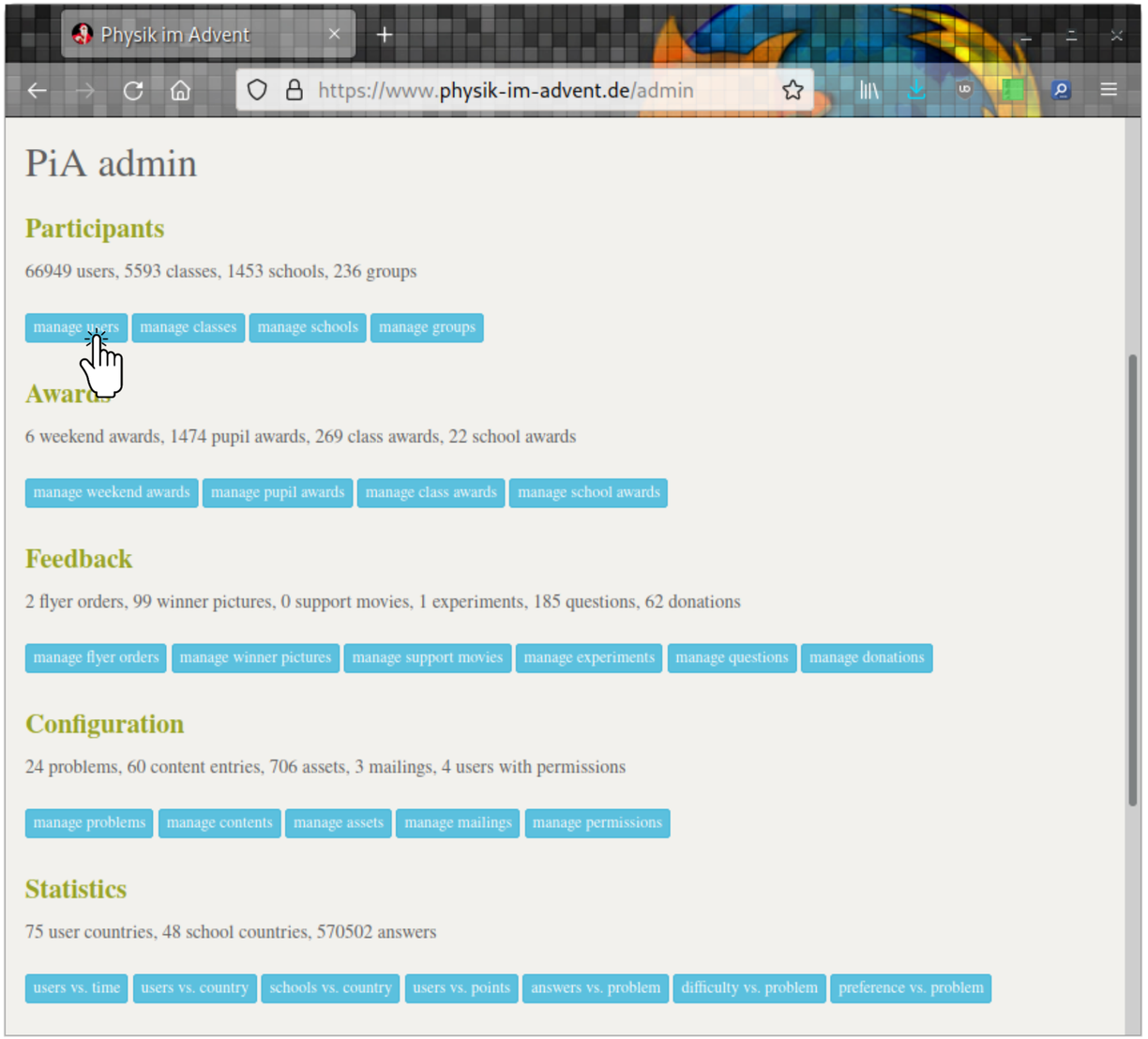
Cycle throughout the year

- (Summer: Video production)
- October: Archive of the existing instance (httrack)
- October: System and software updates
- October: New instance (new database, updated content and config)
- November: Registration
- December: Calendar
- Januar: Dice winners and send prizes
- February: Remove personal data, dump to excel

Behind the scene

- Public website just the tip of the iceberg
- Everything is english (incl. country names etc.)
- Every time/date is UTC
- No limit on user input (bad idea and revoked already, see conclusions)
- Let's have a look ...

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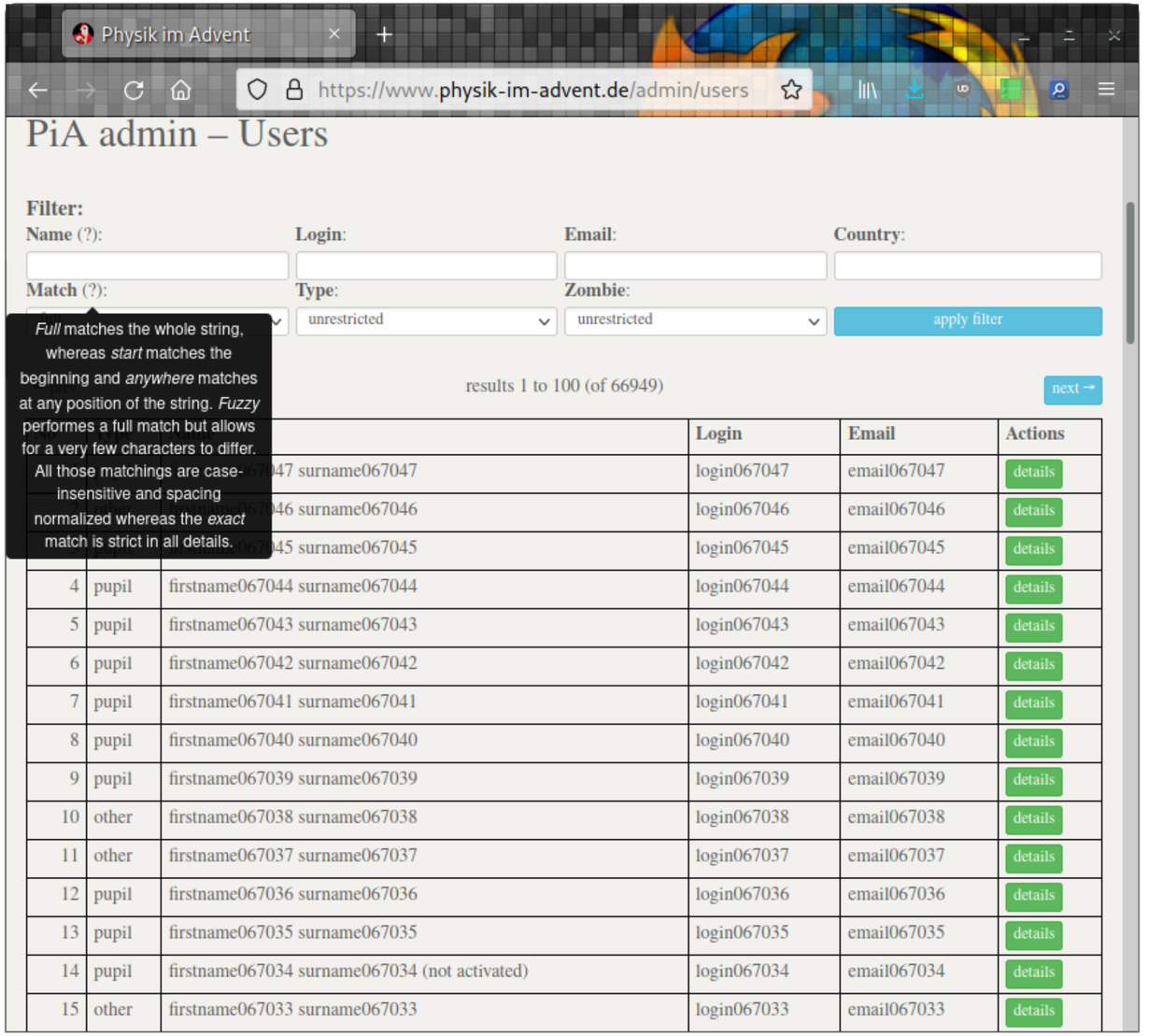
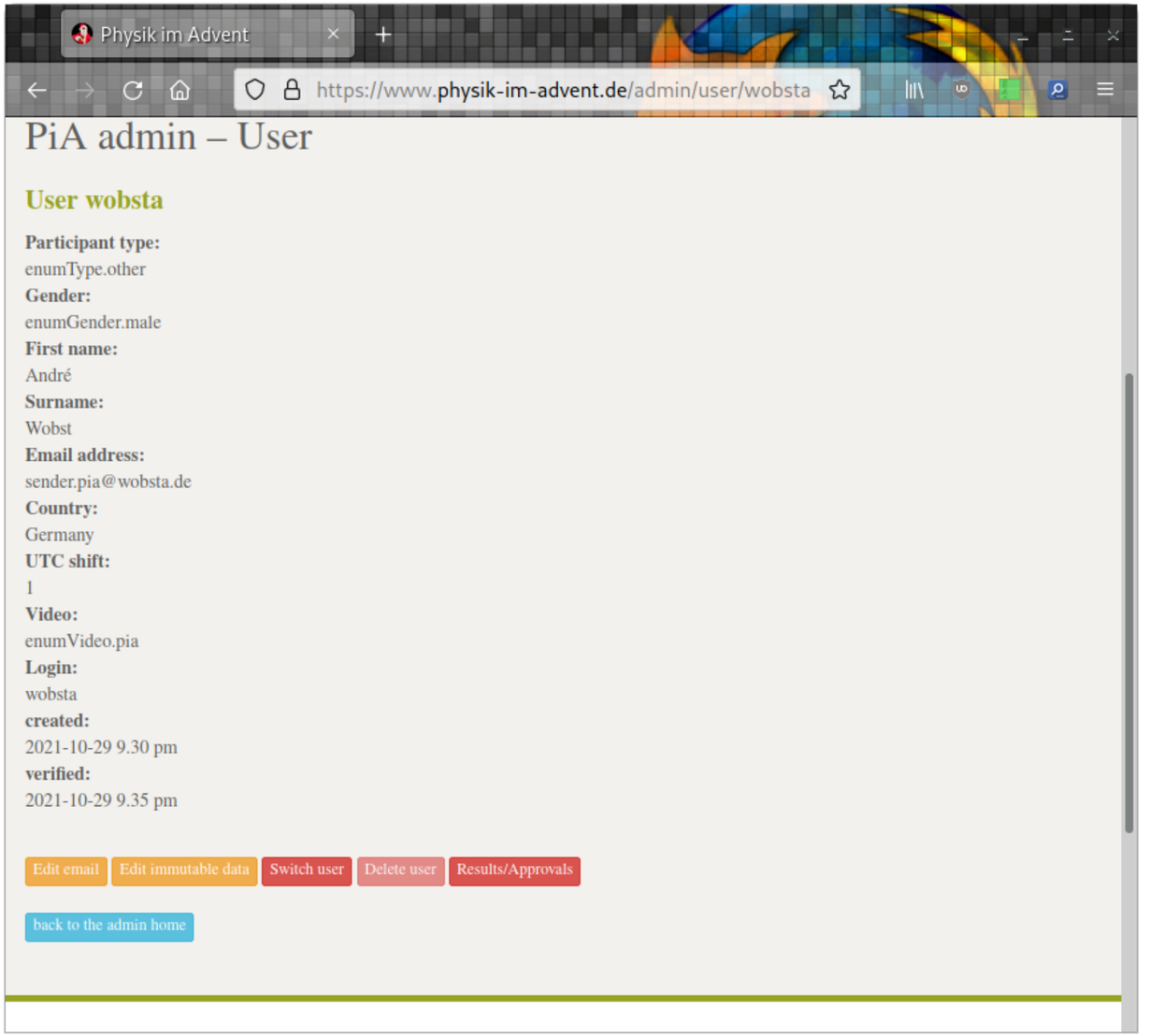
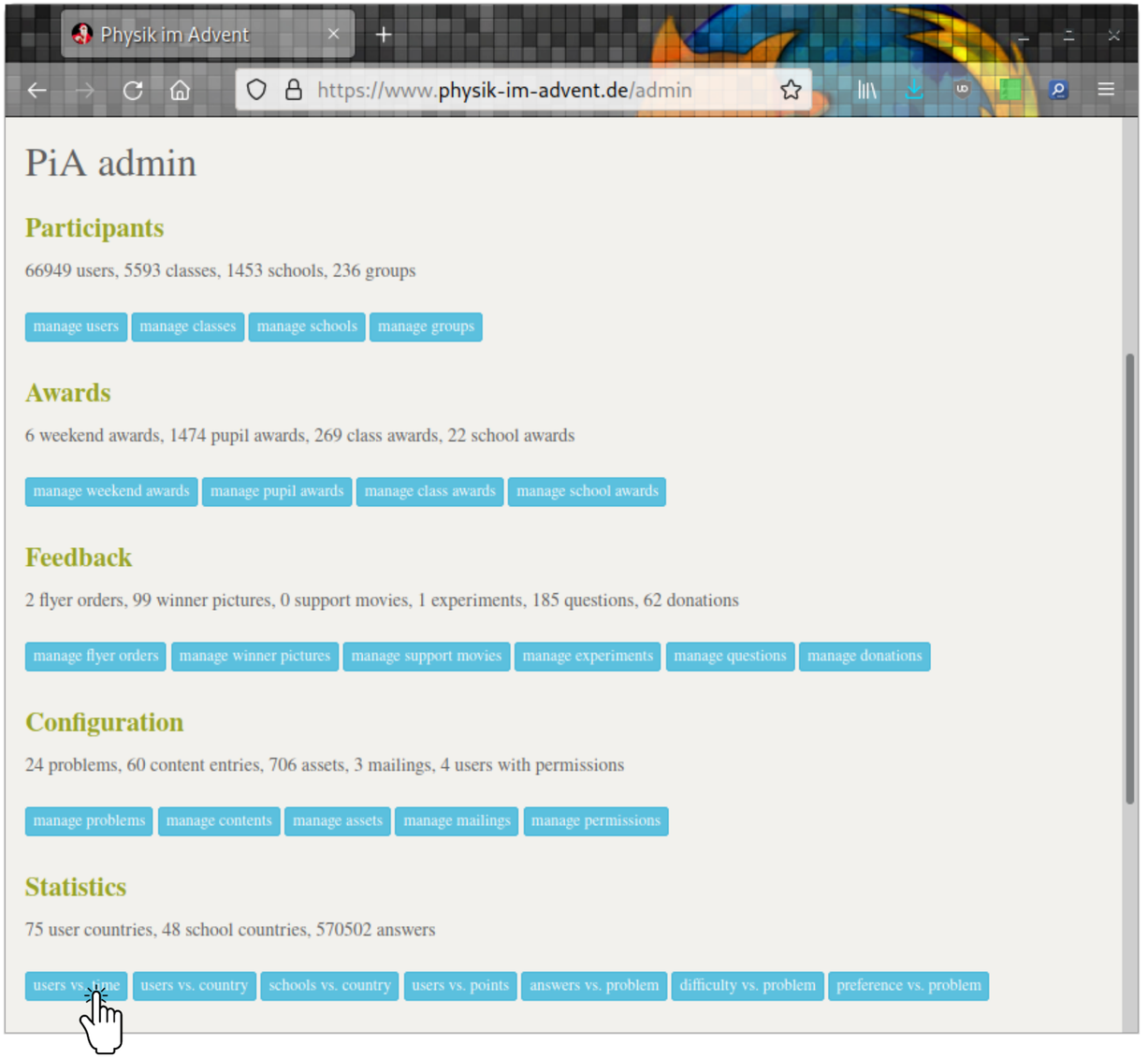
users vs. points
answers vs. problem
difficulty vs. problem
preference vs. problem


Physik im Advent
https://www.physik-im-advent.de/admin/users
PiA admin – Users
Filter:
Name (?):
Login:
Email:
Country:
Match (?):
Type:
Zombie:
unrestricted
unrestricted
apply filter
Full matches the whole string, whereas start matches the beginning and anywhere matches at any position of the string. Fuzzy performes a full match but allows for a very few characters to differ. All those matchings are case-insensitive and spacing normalized whereas the exact match is strict in all details.
results 1 to 100 (of 66949)
next →
Login
Email
Actions
login067047
email067047
details
login067046
email067046
details
login067045
email067045
details
4 pupil firstname067044 surname067044
login067044
email067044
details
5 pupil firstname067043 surname067043
login067043
email067043
details
6 pupil firstname067042 surname067042
login067042
email067042
details
7 pupil firstname067041 surname067041
login067041
email067041
details
8 pupil firstname067040 surname067040
login067040
email067040
details
9 pupil firstname067039 surname067039
login067039
email067039
details
10 other firstname067038 surname067038
login067038
email067038
details
11 other firstname067037 surname067037
login067037
email067037
details
12 pupil firstname067036 surname067036
login067036
email067036
details
13 pupil firstname067035 surname067035
login067035
email067035
details
14 pupil firstname067034 surname067034 (not activated)
login067034
email067034
details
15 other firstname067033 surname067033
login067033
email067033
details


Physik im Advent
https://www.physik-im-advent.de/admin/user/wobsta
PiA admin – User
User wobsta
Participant type:
enumType.other
Gender:
enumGender.male
First name:
André
Surname:
Wobst
Email address:
sender.pia@wobsta.de
Country:
Germany
UTC shift:
1
Video:
enumVideo.pia
Login:
wobsta
created:
2021-10-29 9.30 pm
verified:
2021-10-29 9.35 pm
Edit email
Edit immutable data
Switch user
Delete user
Results/Approvals
back to the admin home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schools vs. country
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difficulty vs. problem
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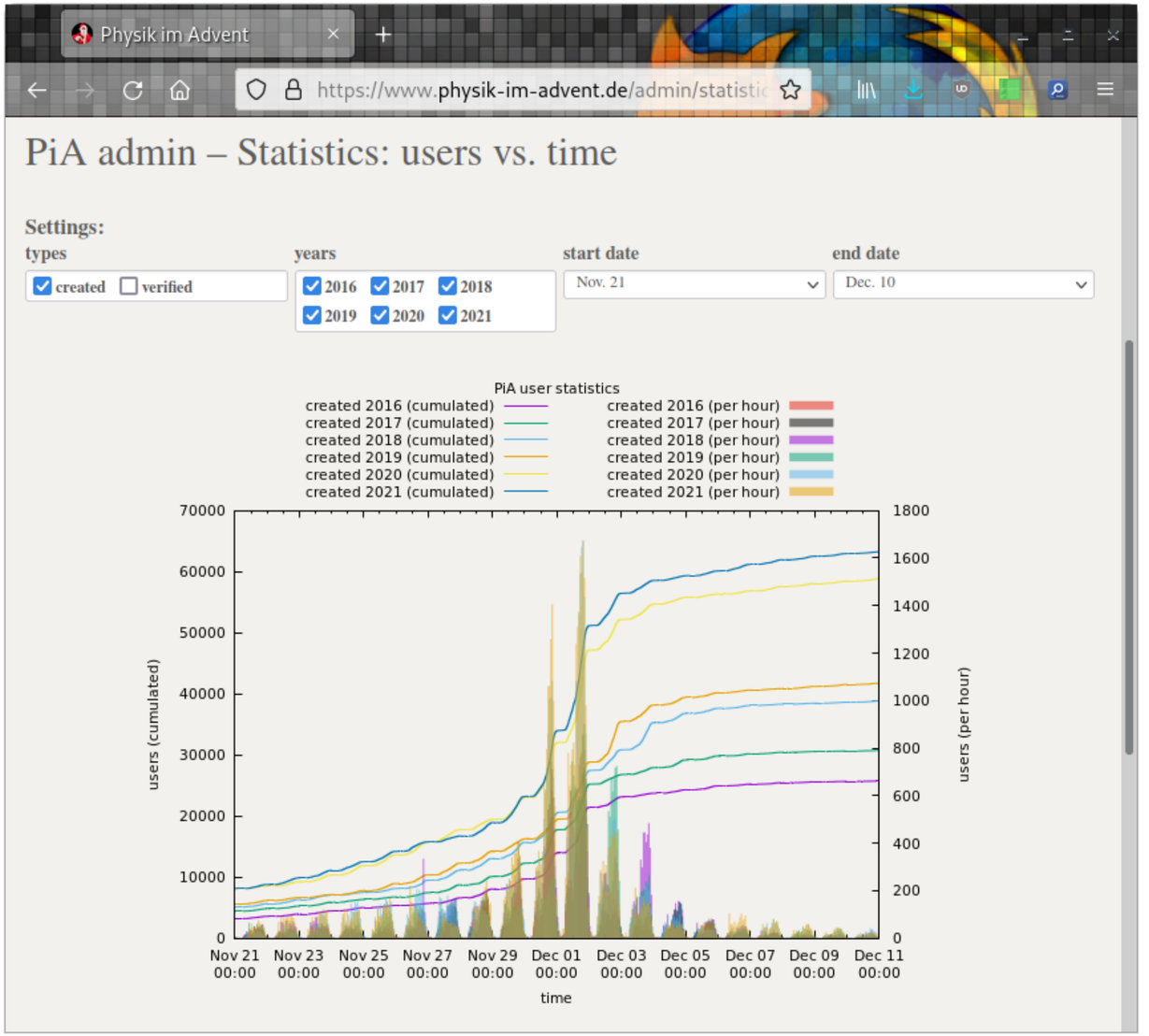

Physik im Advent
https://www.physik-im-advent.de/admin/statistic
PiA admin – Statistics: users vs. time
Settings:
types
created
verified
years
2016
2017
2018
2019
2020
2021
start date
Nov. 21
end date
Dec. 10
PiA user statistics
created 2016 (cumulated)
created 2017 (cumulated)
created 2018 (cumulated)
created 2019 (cumulated)
created 2020 (cumulated)
created 2021 (cumulated)
created 2016 (per hour)
created 2017 (per hour)
created 2018 (per hour)
created 2019 (per hour)
created 2020 (per hour)
created 2021 (per hour)
users (cumulated)
users (per hour)
time
Nov 21 00:00
Nov 23 00:00
Nov 25 00:00
Nov 27 00:00
Nov 29 00:00
Dec 01 00:00
Dec 03 00:00
Dec 05 00:00
Dec 07 00:00
Dec 09 00:00
Dec 11 00:00

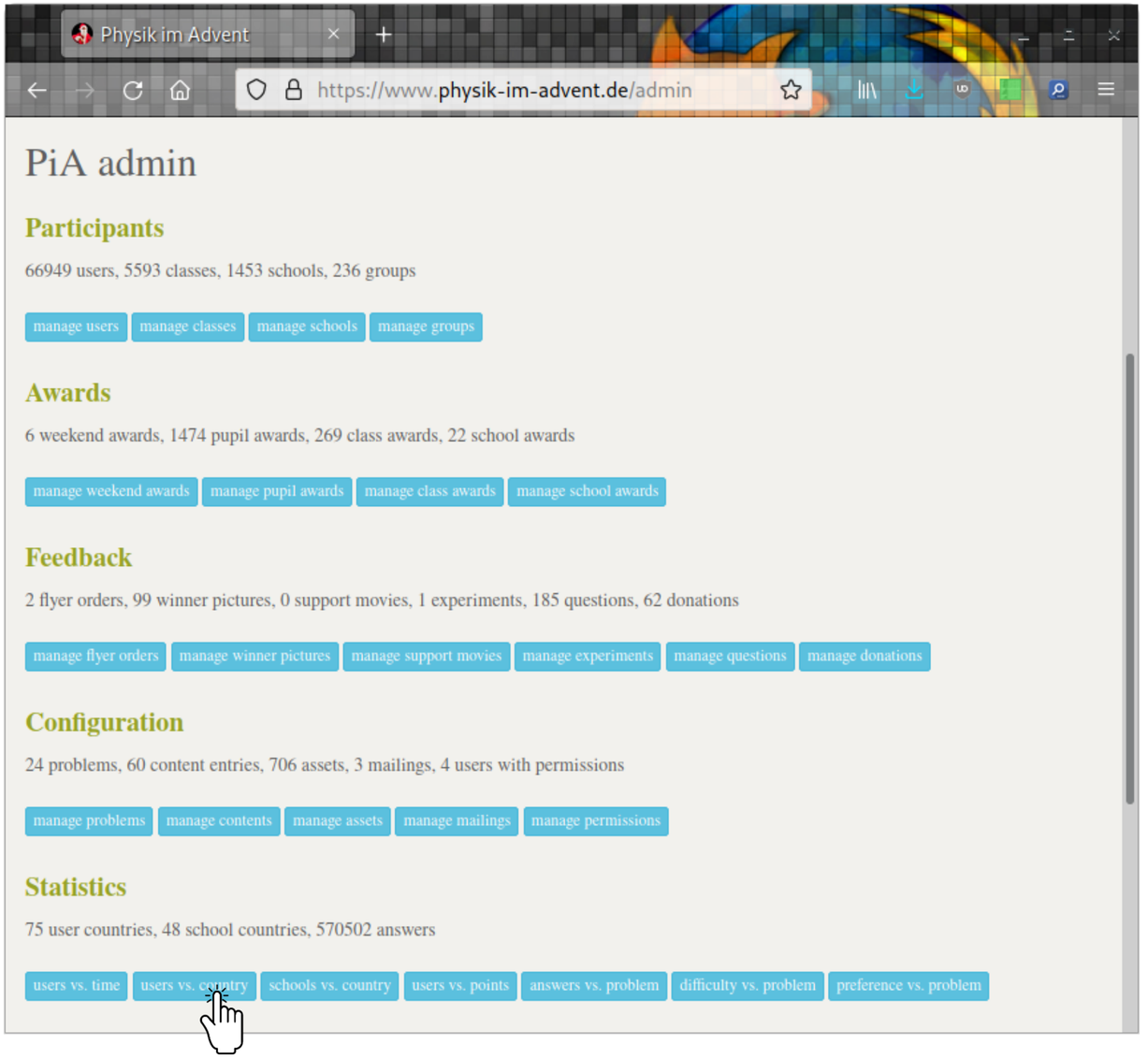
- in real time (using solely the automatic filled column `created`)
- total users:

```
SELECT to_char(created, 'DD.MM. HH24:MI:SS'), count(*) OVER (ORDER BY created)
FROM "user" ORDER BY created;
```

- users per hour:

```
SELECT to_char(date_trunc('hour', created) + INTERVAL '30 minutes', 'DD.MM. HH24:MI:SS'), count(*)
FROM "user" GROUP BY date_trunc('hour', created) ORDER BY date_trunc('hour', created);
```

```
...
01.12. 12:30:00|728
01.12. 13:30:00|1239
01.12. 14:30:00|1312
01.12. 15:30:00|1375
01.12. 16:30:00|1609
01.12. 17:30:00|1537
01.12. 18:30:00|1670
01.12. 19:30:00|1515
01.12. 20:30:00|980
...
```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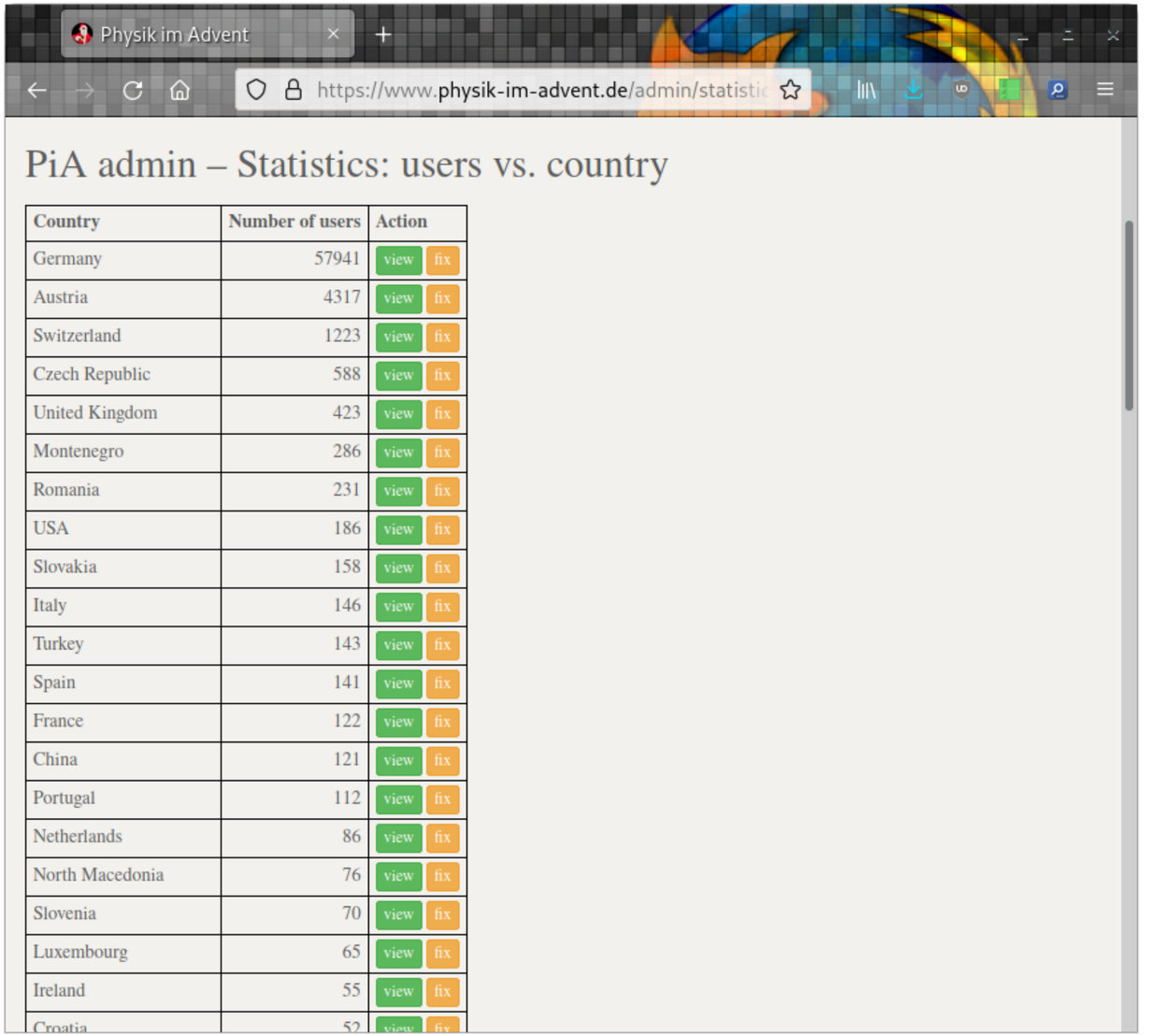
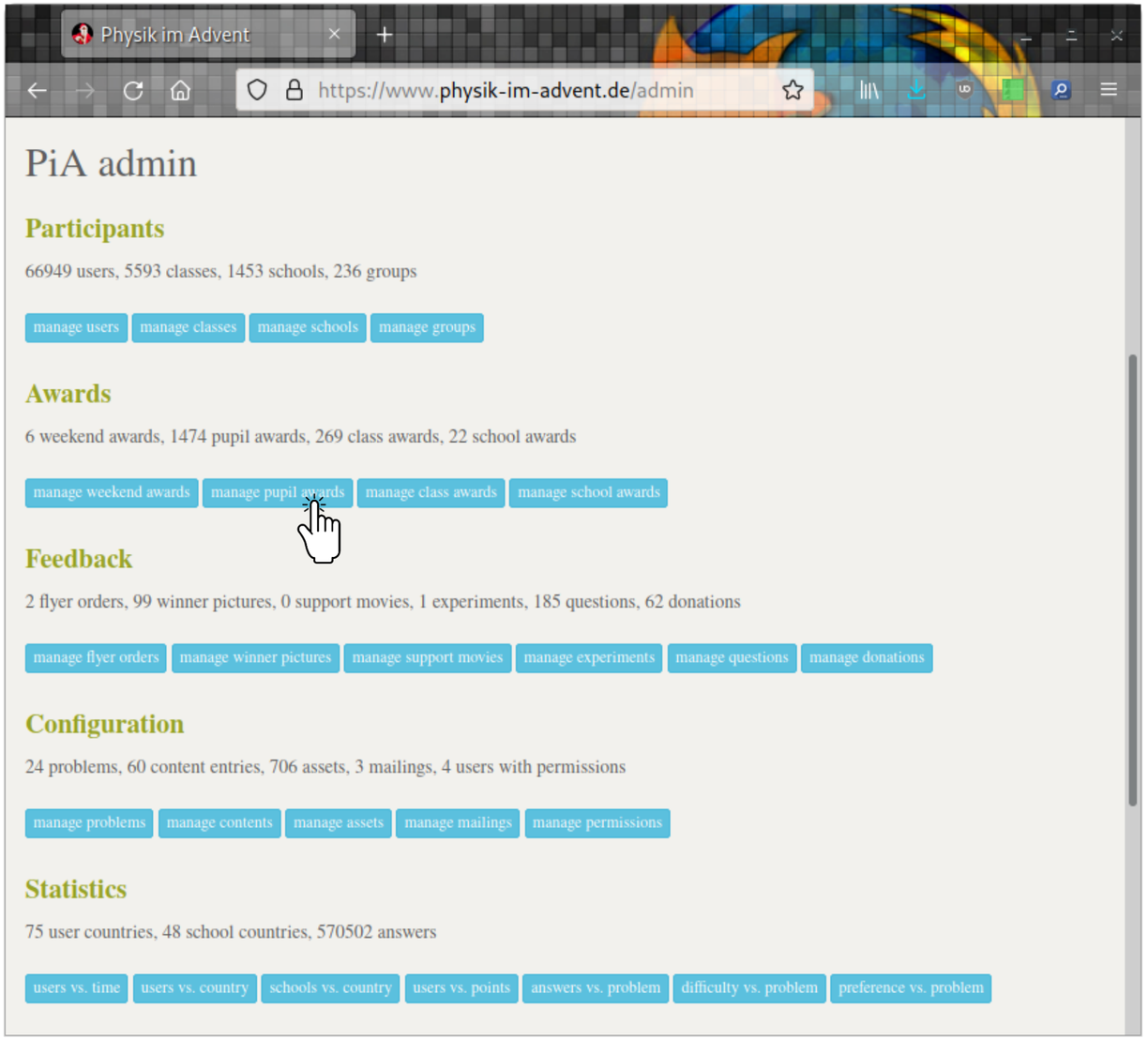


PiA admin – Statistics: users vs. country

Country	Number of users	Action
Germany	57941	view fix
Austria	4317	view fix
Switzerland	1223	view fix
Czech Republic	588	view fix
United Kingdom	423	view fix
Montenegro	286	view fix
Romania	231	view fix
USA	186	view fix
Slovakia	158	view fix
Italy	146	view fix
Turkey	143	view fix
Spain	141	view fix
France	122	view fix
China	121	view fix
Portugal	112	view fix
Netherlands	86	view fix
North Macedonia	76	view fix
Slovenia	70	view fix
Luxembourg	65	view fix
Ireland	55	view fix
Croatia	52	view fix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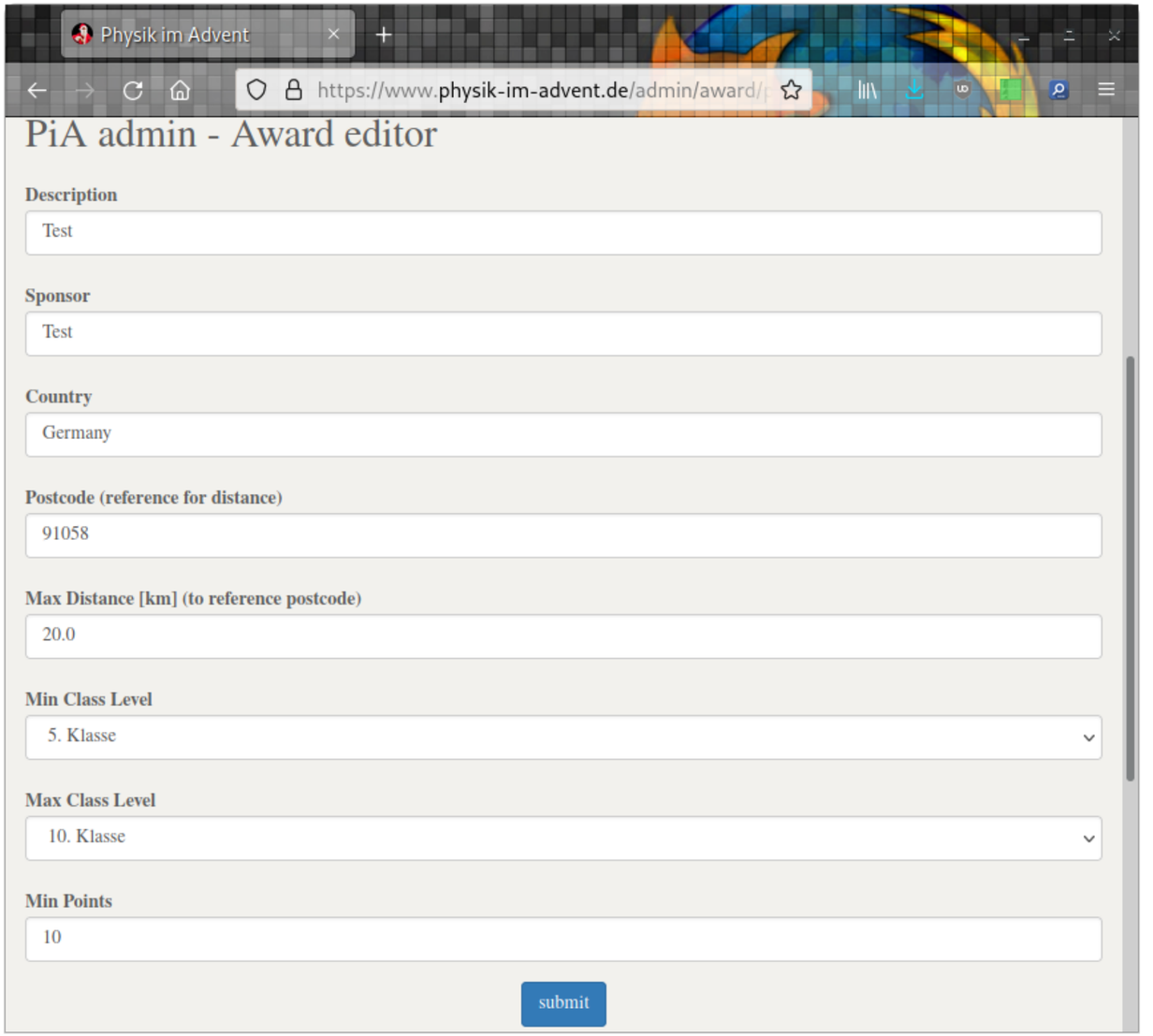
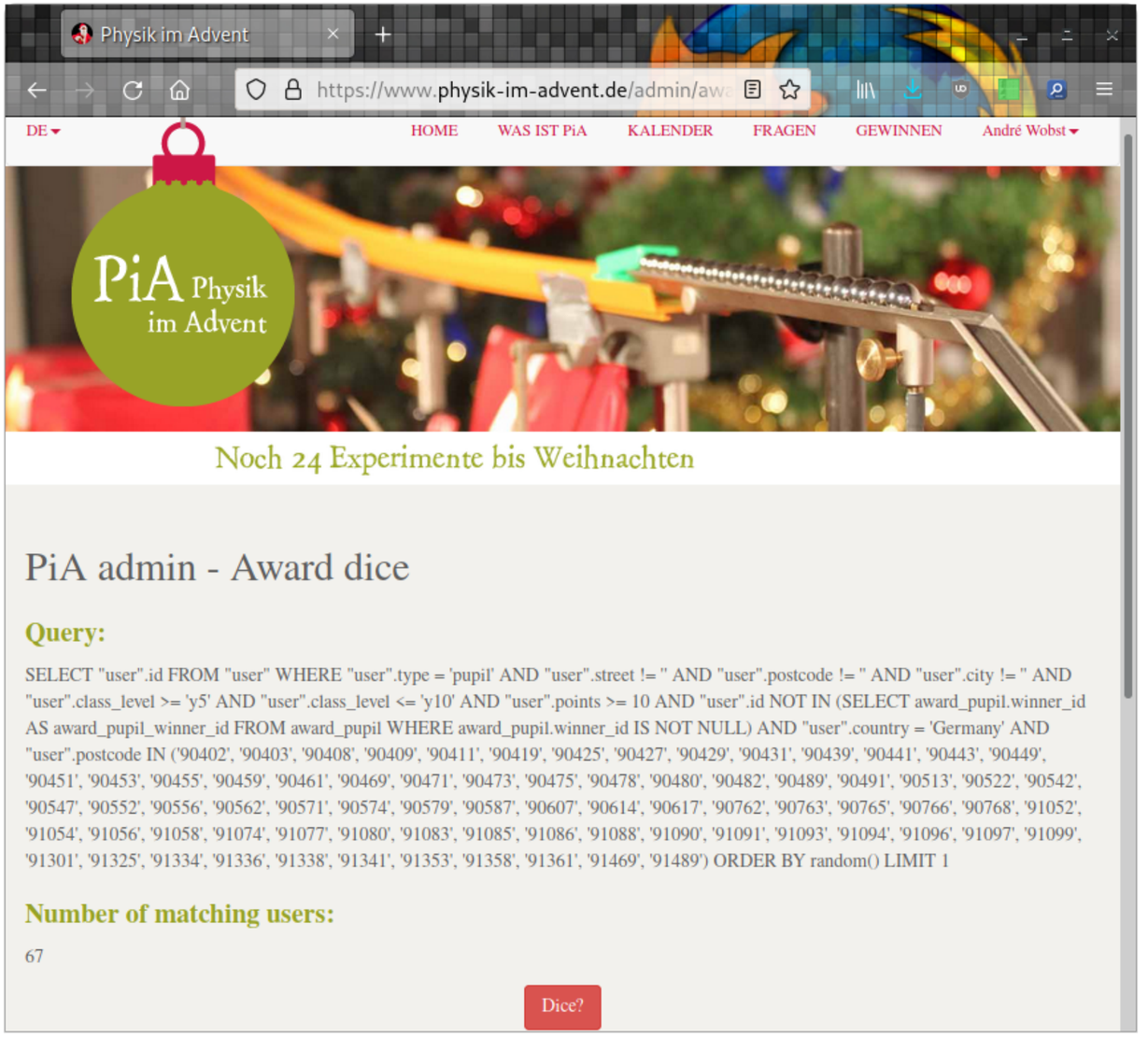


(a few additional fields are removed in this screenshot)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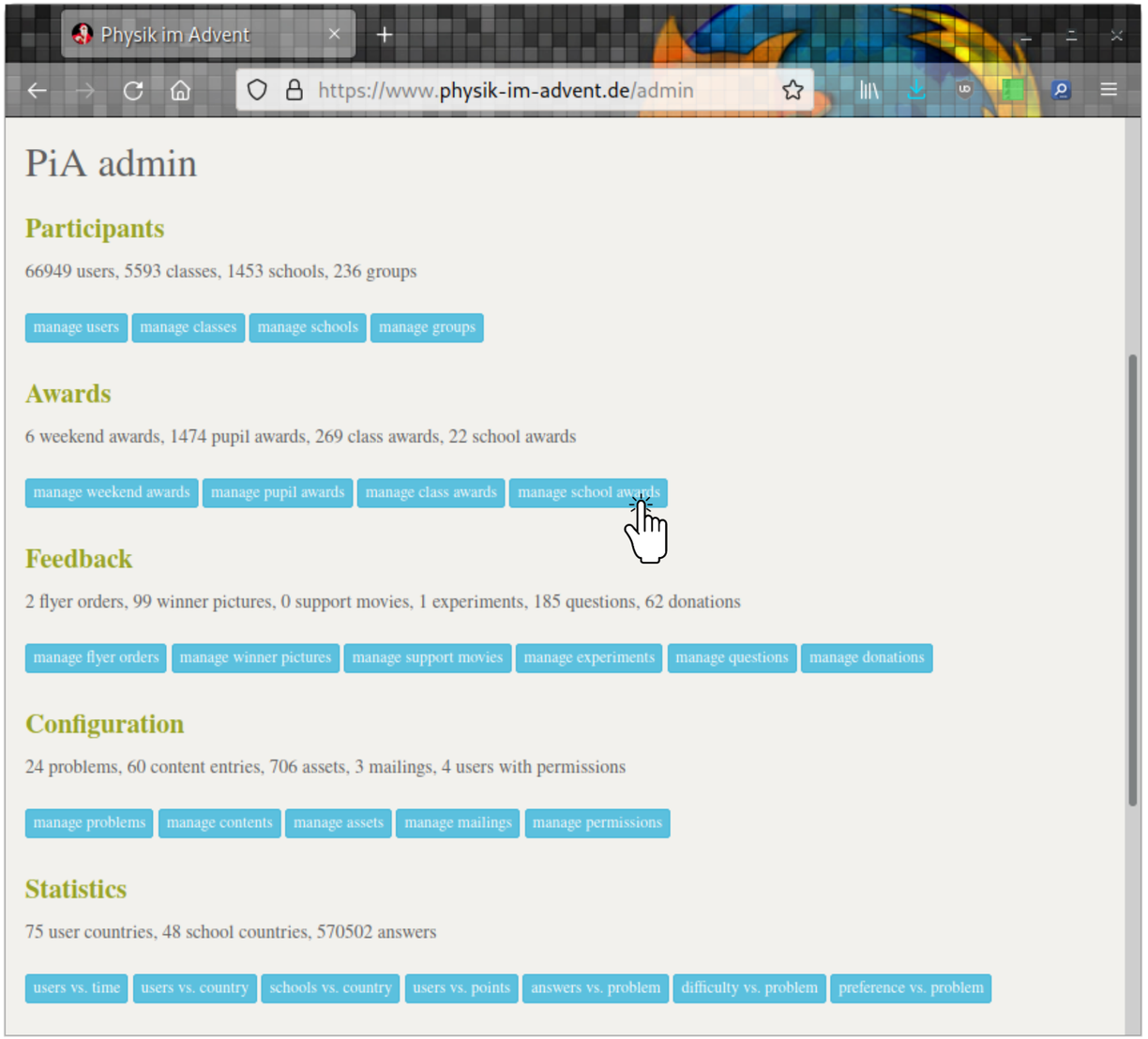
Noch 24 Experimente bis Weihnachten
PiA admin - Award dice
Query:
SELECT "user".id FROM "user" WHERE "user".type = 'pupil' AND "user".street != '' AND "user".postcode != '' AND "user".city != '' AND "user".class_level >= 'y5' AND "user".class_level <= 'y10' AND "user".points >= 10 AND "user".id NOT IN (SELECT award_pupil.winner_id AS award_pupil_winner_id FROM award_pupil WHERE award_pupil.winner_id IS NOT NULL) AND "user".country = 'Germany' AND "user".postcode IN ('90402', '90403', '90408', '90409', '90411', '90419', '90425', '90427', '90429', '90431', '90439', '90441', '90443', '90449', '90451', '90453', '90455', '90459', '90461', '90469', '90471', '90473', '90475', '90478', '90480', '90482', '90489', '90491', '90513', '90522', '90542', '90547', '90552', '90556', '90562', '90571', '90574', '90579', '90587', '90607', '90614', '90617', '90762', '90763', '90765', '90766', '90768', '91052', '91054', '91056', '91058', '91074', '91077', '91080', '91083', '91085', '91086', '91088', '91090', '91091', '91093', '91094', '91096', '91097', '91099', '91301', '91325', '91334', '91336', '91338', '91341', '91353', '91358', '91361', '91469', '91489') ORDER BY random() LIMIT 1
Number of matching users:
67
Dice?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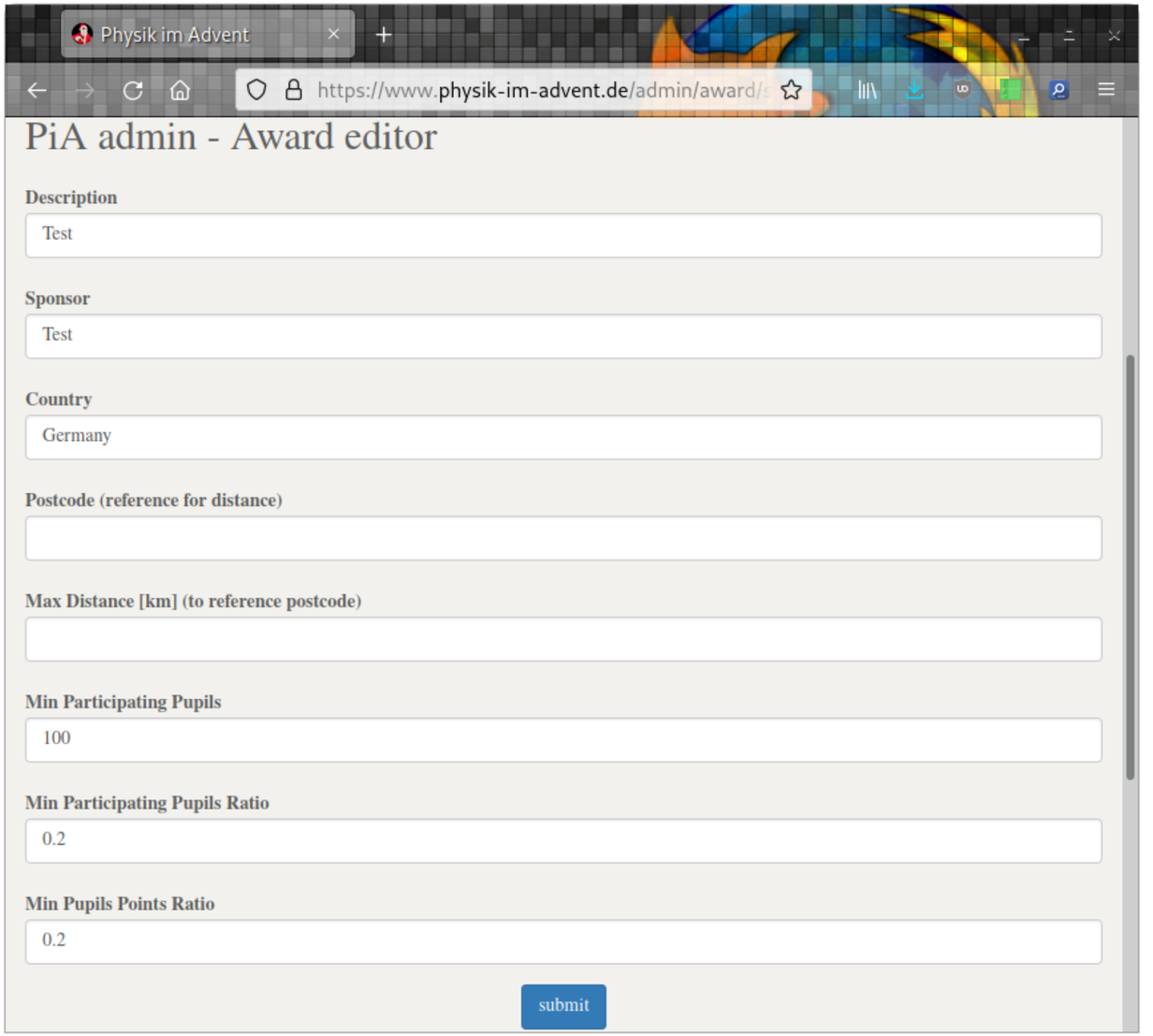

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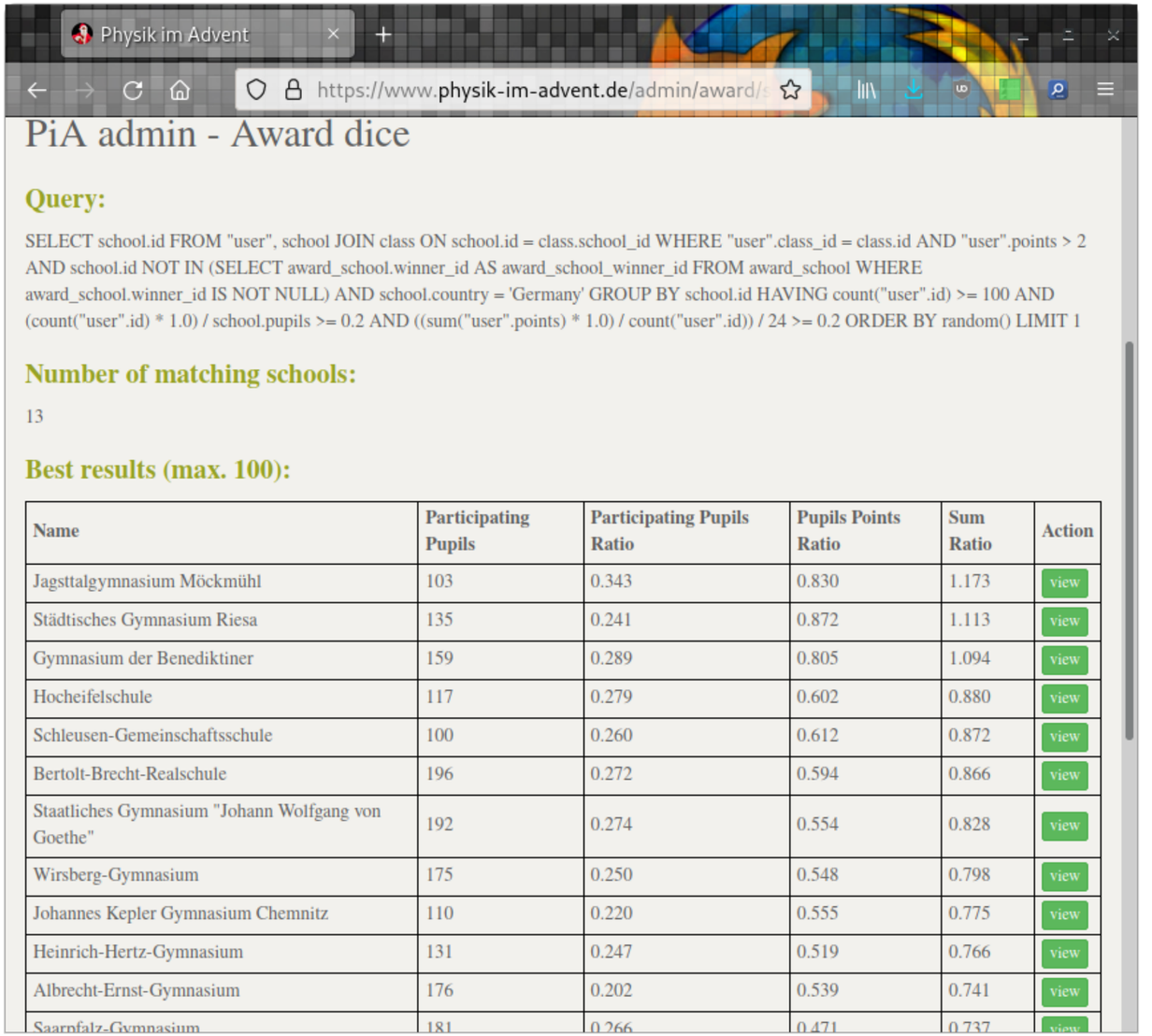


PiA admin - Award dice

Query:

SELECT school.id FROM "user", school JOIN class ON school.id = class.school_id WHERE "user".class_id = class.id AND "user".points > 2 AND school.id NOT IN (SELECT award_school.winner_id AS award_school_winner_id FROM award_school WHERE award_school.winner_id IS NOT NULL) AND school.country = 'Germany' GROUP BY school.id HAVING count("user".id) >= 100 AND (count("user".id) * 1.0) / school.pupils >= 0.2 AND ((sum("user".points) * 1.0) / count("user".id)) / 24 >= 0.2 ORDER BY random() LIMIT 1

Number of matching schools:

13

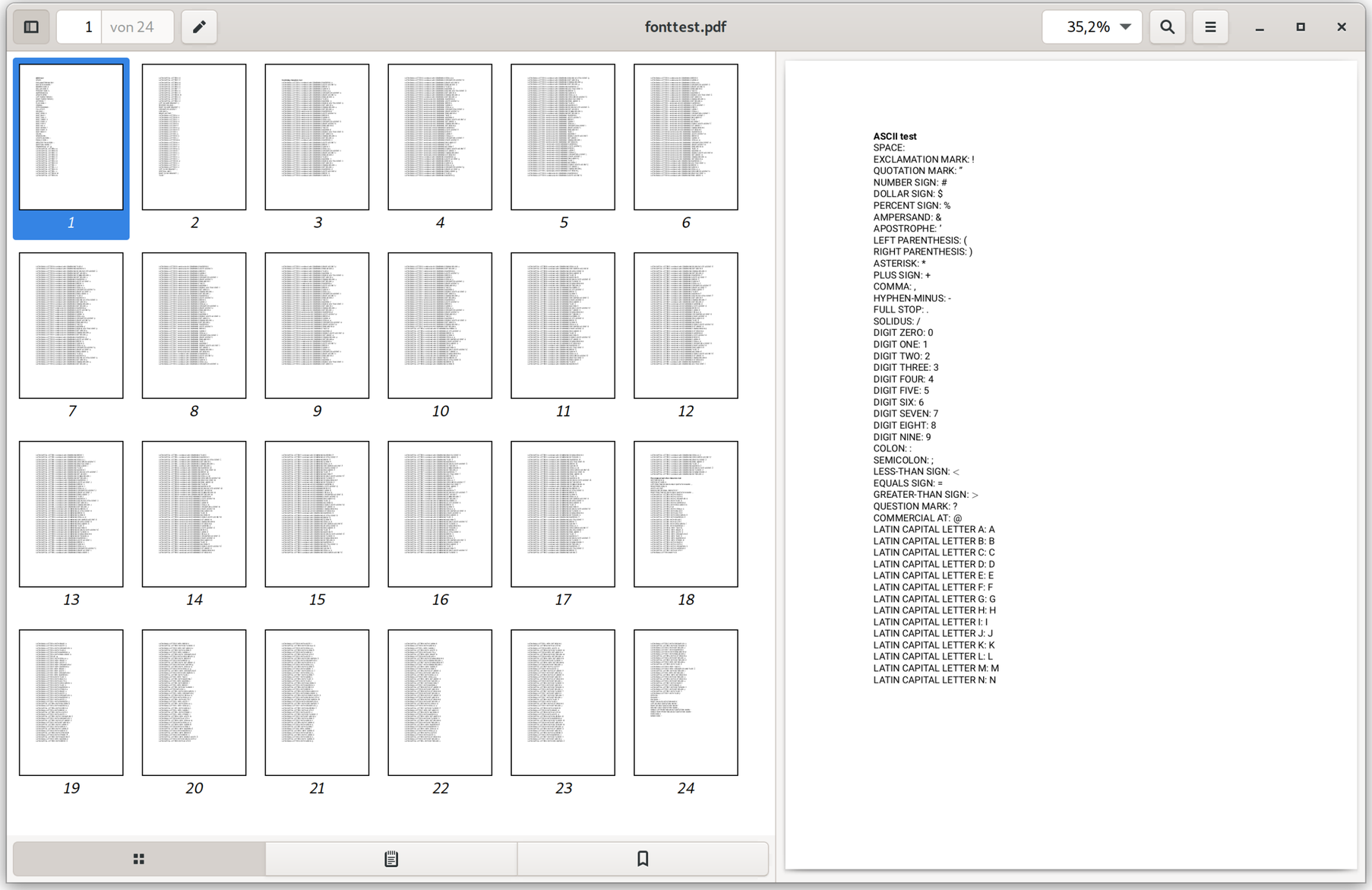
Best results (max. 100):

Name	Participating Pupils	Participating Pupils Ratio	Pupils Points Ratio	Sum Ratio	Action
Jagsttalgymnasium Möckmühl	103	0.343	0.830	1.173	view
Städtisches Gymnasium Riesa	135	0.241	0.872	1.113	view
Gymnasium der Benediktiner	159	0.289	0.805	1.094	view
Hocheifelschule	117	0.279	0.602	0.880	view
Schleusen-Gemeinschaftsschule	100	0.260	0.612	0.872	view
Bertolt-Brecht-Realschule	196	0.272	0.594	0.866	view
Staatliches Gymnasium "Johann Wolfgang von Goethe"	192	0.274	0.554	0.828	view
Wirsberg-Gymnasium	175	0.250	0.548	0.798	view
Johannes Kepler Gymnasium Chemnitz	110	0.220	0.555	0.775	view
Heinrich-Hertz-Gymnasium	131	0.247	0.519	0.766	view
Albrecht-Ernst-Gymnasium	176	0.202	0.539	0.741	view
Saarpfalz-Gymnasium	181	0.266	0.471	0.737	view

Text output using LaTeX

- Attendee certificates, class codes, prize letters, font test
- Escape all LaTeX control characters
- Output all acceptable characters
- Output a question mark for everything else (and log and review it)
- Example LaTeX input:

```
\documentclass[english]{pia_certificate}
\begin{document}
\begin{piaCertificate}
\piaYear{2021}
\piaType{enumType.person}
\piaGender{enumGender.male}
\piaFirstName{Andr\'{e}}
\piaSurname{Wobst}
\piaPoints{24}
\end{piaCertificate}
\end{document}
```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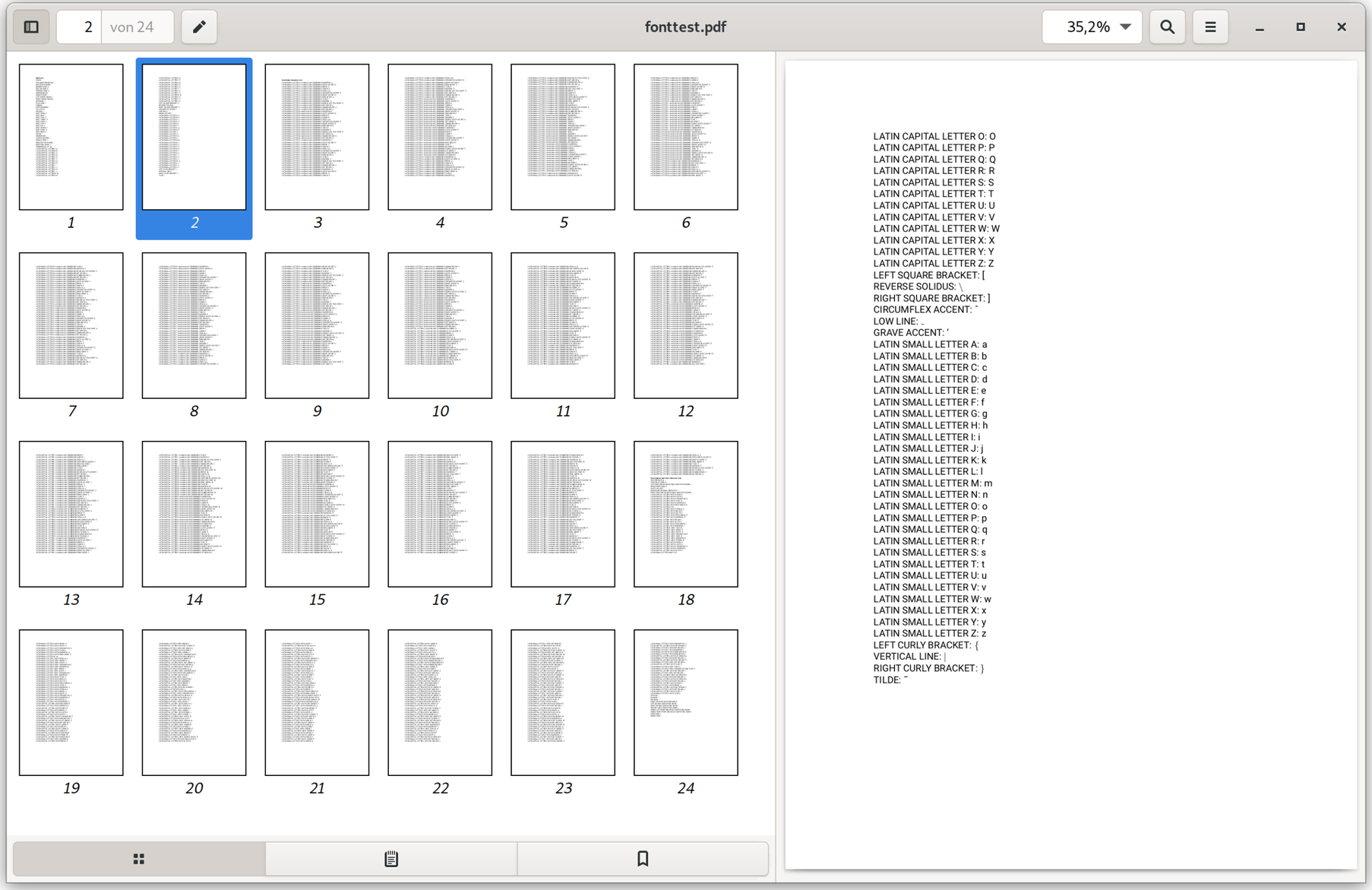
ASCII test
SPACE:
EXCLAMATION MARK: !
QUOTATION MARK: "
NUMBER SIGN: #
DOLLAR SIGN: $
PERCENT SIGN: %
AMPERSAND: &
APOSTROPHE: '
LEFT PARENTHESIS: (
RIGHT PARENTHESIS:)
ASTERISK: *
PLUS SIGN: +
COMMA: ,
HYPHEN-MINUS: -
FULL STOP: .
SOLIDUS: /
DIGIT ZERO: 0
DIGIT ONE: 1
DIGIT TWO: 2
DIGIT THREE: 3
DIGIT FOUR: 4
DIGIT FIVE: 5
DIGIT SIX: 6
DIGIT SEVEN: 7
DIGIT EIGHT: 8
DIGIT NINE: 9
COLON: :
SEMICOLON: ;
LESS-THAN SIGN: <
EQUALS SIGN: =
GREATER-THAN SIGN: >
QUESTION MARK: ?
COMMERCIAL AT: @
LATIN CAPITAL LETTER A: A
LATIN CAPITAL LETTER B: B
LATIN CAPITAL LETTER C: C
LATIN CAPITAL LETTER D: D
LATIN CAPITAL LETTER E: E
LATIN CAPITAL LETTER F: F
LATIN CAPITAL LETTER G: G
LATIN CAPITAL LETTER H: H
LATIN CAPITAL LETTER I: I
LATIN CAPITAL LETTER J: J
LATIN CAPITAL LETTER K: K
LATIN CAPITAL LETTER L: L
LATIN CAPITAL LETTER M: M
LATIN CAPITAL LETTER N: N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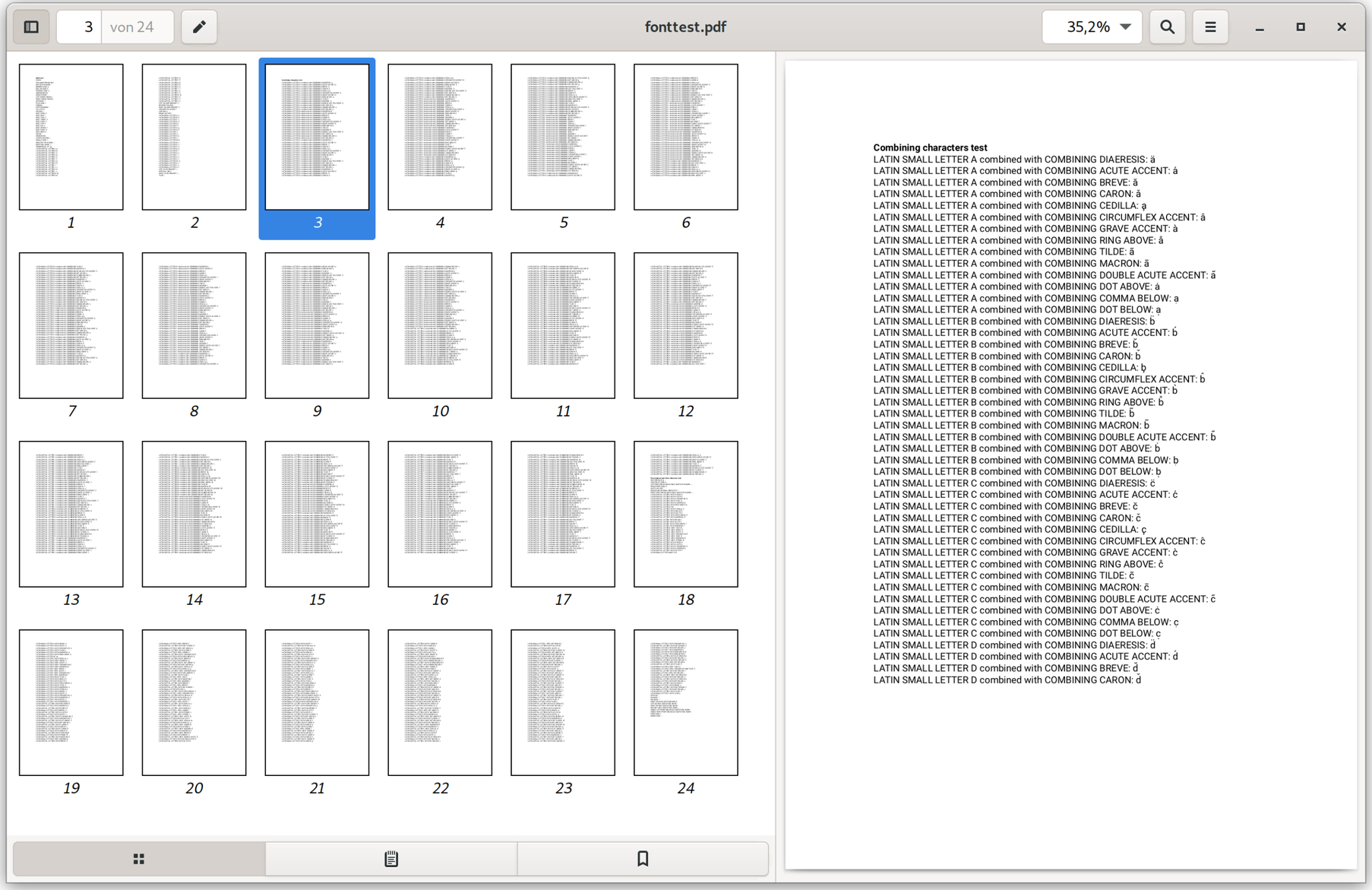
LATIN CAPITAL LETTER O: O
LATIN CAPITAL LETTER P: P
LATIN CAPITAL LETTER Q: Q
LATIN CAPITAL LETTER R: R
LATIN CAPITAL LETTER S: S
LATIN CAPITAL LETTER T: T
LATIN CAPITAL LETTER U: U
LATIN CAPITAL LETTER V: V
LATIN CAPITAL LETTER W: W
LATIN CAPITAL LETTER X: X
LATIN CAPITAL LETTER Y: Y
LATIN CAPITAL LETTER Z: Z
LEFT SQUARE BRACKET: [
REVERSE SOLIDUS: \
RIGHT SQUARE BRACKET:]
CIRCUMFLEX ACCENT: ^
LOW LINE: _
GRAVE ACCENT: ‘
LATIN SMALL LETTER A: a
LATIN SMALL LETTER B: b
LATIN SMALL LETTER C: c
LATIN SMALL LETTER D: d
LATIN SMALL LETTER E: e
LATIN SMALL LETTER F: f
LATIN SMALL LETTER G: g
LATIN SMALL LETTER H: h
LATIN SMALL LETTER I: i
LATIN SMALL LETTER J: j
LATIN SMALL LETTER K: k
LATIN SMALL LETTER L: l
LATIN SMALL LETTER M: m
LATIN SMALL LETTER N: n
LATIN SMALL LETTER O: o
LATIN SMALL LETTER P: p
LATIN SMALL LETTER Q: q
LATIN SMALL LETTER R: r
LATIN SMALL LETTER S: s
LATIN SMALL LETTER T: t
LATIN SMALL LETTER U: u
LATIN SMALL LETTER V: v
LATIN SMALL LETTER W: w
LATIN SMALL LETTER X: x
LATIN SMALL LETTER Y: y
LATIN SMALL LETTER Z: z
LEFT CURLY BRACKET: {
VERTICAL LINE: |
RIGHT CURLY BRACKET: }
TILDE: ~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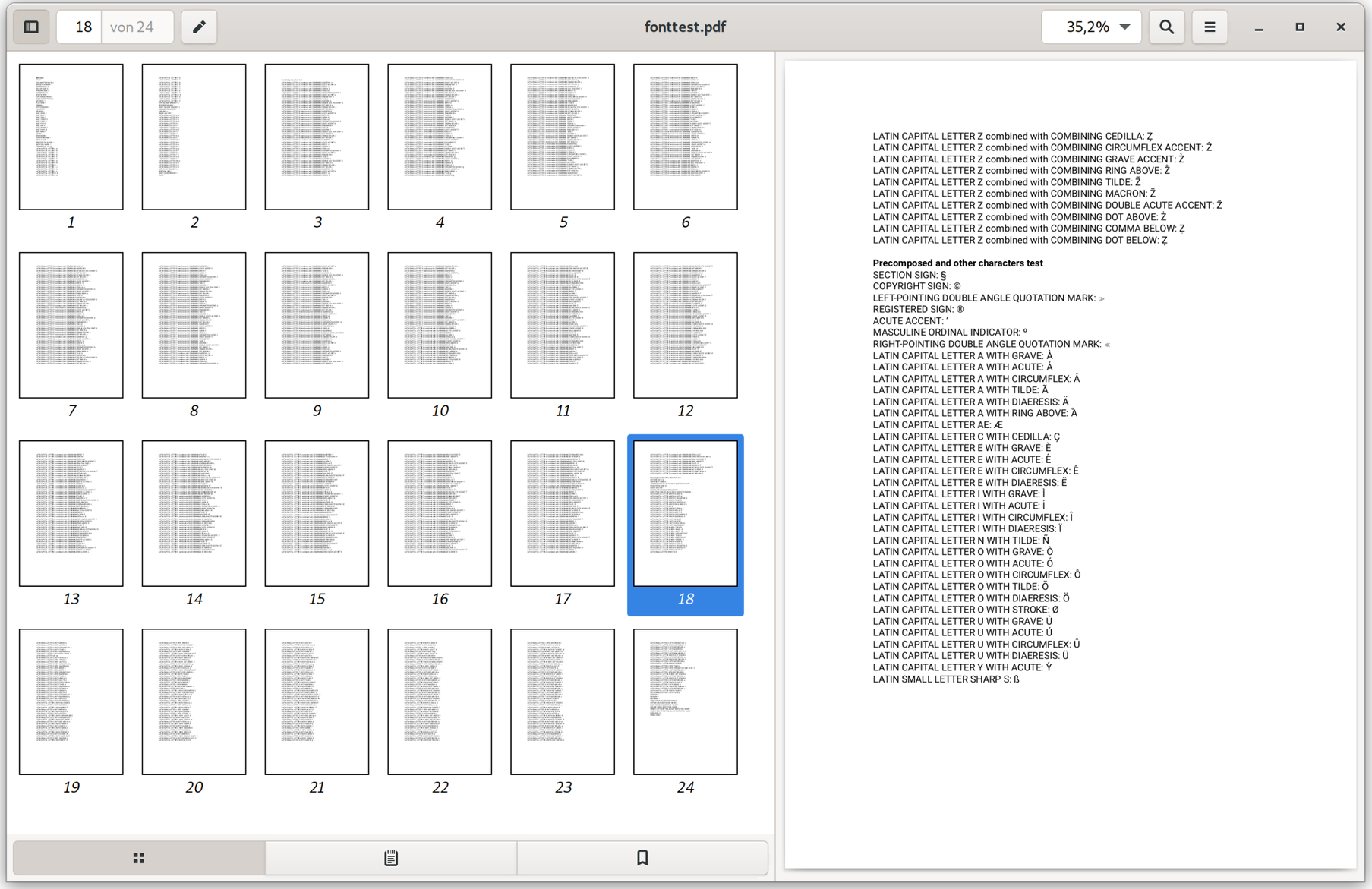
Combining characters test
LATIN SMALL LETTER A combined with COMBINING DIAERESIS: ä
LATIN SMALL LETTER A combined with COMBINING ACUTE ACCENT: á
LATIN SMALL LETTER A combined with COMBINING BREVE: ă
LATIN SMALL LETTER A combined with COMBINING CARON: ǎ
LATIN SMALL LETTER A combined with COMBINING CEDILLA: ą
LATIN SMALL LETTER A combined with COMBINING CIRCUMFLEX ACCENT: â
LATIN SMALL LETTER A combined with COMBINING GRAVE ACCENT: à
LATIN SMALL LETTER A combined with COMBINING RING ABOVE: å
LATIN SMALL LETTER A combined with COMBINING TILDE: ã
LATIN SMALL LETTER A combined with COMBINING MACRON: ā
LATIN SMALL LETTER A combined with COMBINING DOUBLE ACUTE ACCENT: a̋
LATIN SMALL LETTER A combined with COMBINING DOT ABOVE: ȧ
LATIN SMALL LETTER A combined with COMBINING COMMA BELOW: a̦
LATIN SMALL LETTER A combined with COMBINING DOT BELOW: ạ
LATIN SMALL LETTER B combined with COMBINING DIAERESIS: b̈
LATIN SMALL LETTER B combined with COMBINING ACUTE ACCENT: b́
LATIN SMALL LETTER B combined with COMBINING BREVE: b̆
LATIN SMALL LETTER B combined with COMBINING CARON: b̌
LATIN SMALL LETTER B combined with COMBINING CEDILLA: ḇ
LATIN SMALL LETTER B combined with COMBINING CIRCUMFLEX ACCENT: b̂
LATIN SMALL LETTER B combined with COMBINING GRAVE ACCENT: b̀
LATIN SMALL LETTER B combined with COMBINING RING ABOVE: b̊
LATIN SMALL LETTER B combined with COMBINING TILDE: b̃
LATIN SMALL LETTER B combined with COMBINING MACRON: b̄
LATIN SMALL LETTER B combined with COMBINING DOUBLE ACUTE ACCENT: b̋
LATIN SMALL LETTER B combined with COMBINING DOT ABOVE: ḃ
LATIN SMALL LETTER B combined with COMBINING COMMA BELOW: b̦
LATIN SMALL LETTER B combined with COMBINING DOT BELOW: ḅ
LATIN SMALL LETTER C combined with COMBINING DIAERESIS: c̈
LATIN SMALL LETTER C combined with COMBINING ACUTE ACCENT: ć
LATIN SMALL LETTER C combined with COMBINING BREVE: c̆
LATIN SMALL LETTER C combined with COMBINING CARON: č
LATIN SMALL LETTER C combined with COMBINING CEDILLA: ç
LATIN SMALL LETTER C combined with COMBINING CIRCUMFLEX ACCENT: ĉ
LATIN SMALL LETTER C combined with COMBINING GRAVE ACCENT: c̀
LATIN SMALL LETTER C combined with COMBINING RING ABOVE: c̊
LATIN SMALL LETTER C combined with COMBINING TILDE: c̃
LATIN SMALL LETTER C combined with COMBINING MACRON: c̄
LATIN SMALL LETTER C combined with COMBINING DOUBLE ACUTE ACCENT: c̋
LATIN SMALL LETTER C combined with COMBINING DOT ABOVE: ċ
LATIN SMALL LETTER C combined with COMBINING COMMA BELOW: c̦
LATIN SMALL LETTER C combined with COMBINING DOT BELOW: c̣
LATIN SMALL LETTER D combined with COMBINING DIAERESIS: d̈
LATIN SMALL LETTER D combined with COMBINING ACUTE ACCENT: d́
LATIN SMALL LETTER D combined with COMBINING BREVE: d̆
LATIN SMALL LETTER D combined with COMBINING CARON: ď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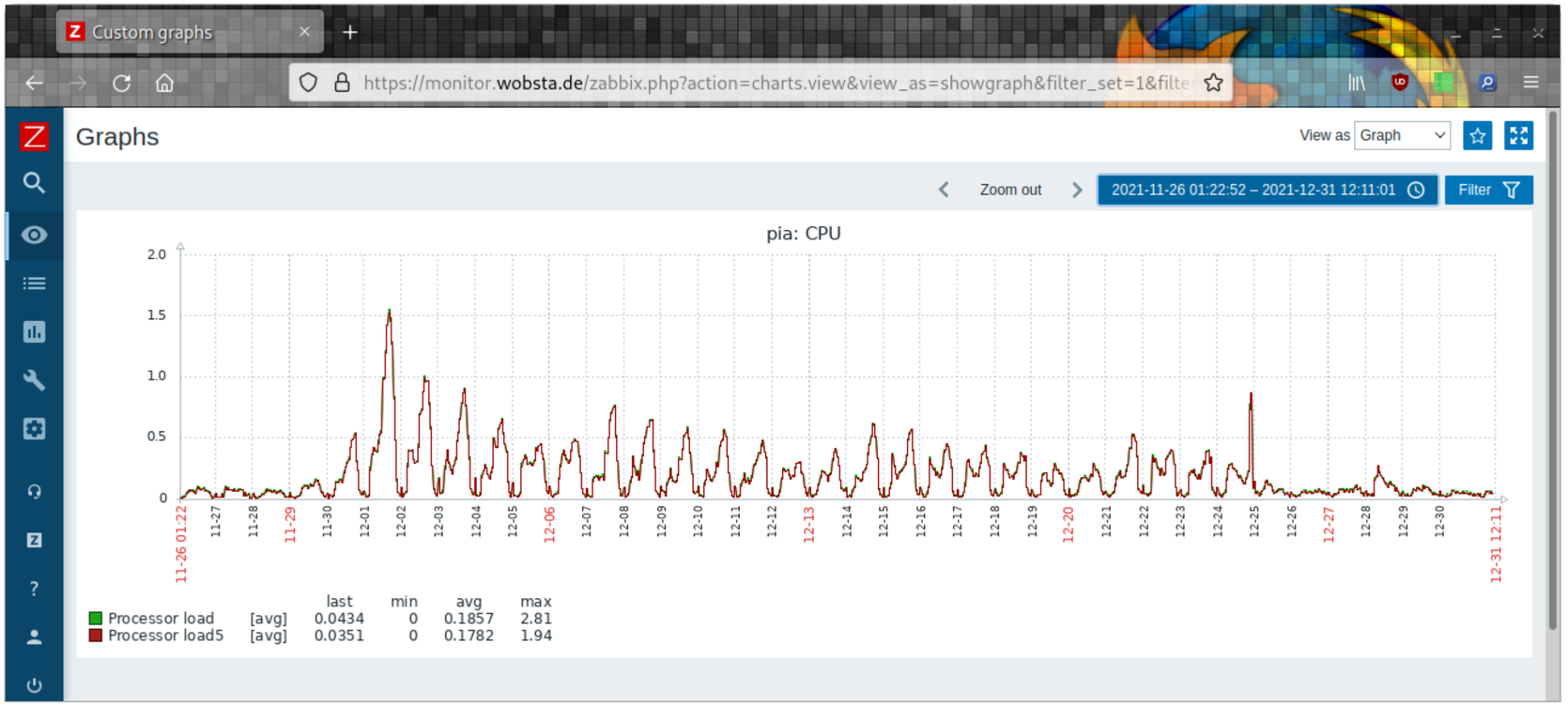
LATIN CAPITAL LETTER Z combined with COMBINING CEDILLA: Ȝ
LATIN CAPITAL LETTER Z combined with COMBINING CIRCUMFLEX ACCENT: Ẑ
LATIN CAPITAL LETTER Z combined with COMBINING GRAVE ACCENT: Ż
LATIN CAPITAL LETTER Z combined with COMBINING RING ABOVE: Ẑ
LATIN CAPITAL LETTER Z combined with COMBINING TILDE: Ẑ
LATIN CAPITAL LETTER Z combined with COMBINING MACRON: Ẑ
LATIN CAPITAL LETTER Z combined with COMBINING DOUBLE ACUTE ACCENT: Ẑ
LATIN CAPITAL LETTER Z combined with COMBINING DOT ABOVE: Ż
LATIN CAPITAL LETTER Z combined with COMBINING COMMA BELOW: Z
LATIN CAPITAL LETTER Z combined with COMBINING DOT BELOW: Ẓ
Precomposed and other characters test
SECTION SIGN: §
COPYRIGHT SIGN: ©
LEFT-POINTING DOUBLE ANGLE QUOTATION MARK: »
REGISTERED SIGN: ®
ACUTE ACCENT: ´
MASCULINE ORDINAL INDICATOR: º
RIGHT-POINTING DOUBLE ANGLE QUOTATION MARK: «
LATIN CAPITAL LETTER A WITH GRAVE: À
LATIN CAPITAL LETTER A WITH ACUTE: Á
LATIN CAPITAL LETTER A WITH CIRCUMFLEX: Â
LATIN CAPITAL LETTER A WITH TILDE: Ã
LATIN CAPITAL LETTER A WITH DIAERESIS: Ä
LATIN CAPITAL LETTER A WITH RING ABOVE: Å
LATIN CAPITAL LETTER AE: Æ
LATIN CAPITAL LETTER C WITH CEDILLA: Ç
LATIN CAPITAL LETTER E WITH GRAVE: È
LATIN CAPITAL LETTER E WITH ACUTE: É
LATIN CAPITAL LETTER E WITH CIRCUMFLEX: Ê
LATIN CAPITAL LETTER E WITH DIAERESIS: Ë
LATIN CAPITAL LETTER I WITH GRAVE: Ì
LATIN CAPITAL LETTER I WITH ACUTE: Í
LATIN CAPITAL LETTER I WITH CIRCUMFLEX: Î
LATIN CAPITAL LETTER I WITH DIAERESIS: Ï
LATIN CAPITAL LETTER N WITH TILDE: Ñ
LATIN CAPITAL LETTER O WITH GRAVE: Ò
LATIN CAPITAL LETTER O WITH ACUTE: Ó
LATIN CAPITAL LETTER O WITH CIRCUMFLEX: Ô
LATIN CAPITAL LETTER O WITH TILDE: Õ
LATIN CAPITAL LETTER O WITH DIAERESIS: Ö
LATIN CAPITAL LETTER O WITH STROKE: Ø
LATIN CAPITAL LETTER U WITH GRAVE: Ù
LATIN CAPITAL LETTER U WITH ACUTE: Ú
LATIN CAPITAL LETTER U WITH CIRCUMFLEX: Û
LATIN CAPITAL LETTER U WITH DIAERESIS: Ü
LATIN CAPITAL LETTER Y WITH ACUTE: Ý
LATIN SMALL LETTER SHARP S: ß

Monitoring

- Measure
- Report issues by triggers (email)
- Special events like Christmas mailing and download of certificates
- Monitoring has nothing to do with web statistics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Graphs
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2021-11-26 01:22:52 – 2021-12-31 12:11:01
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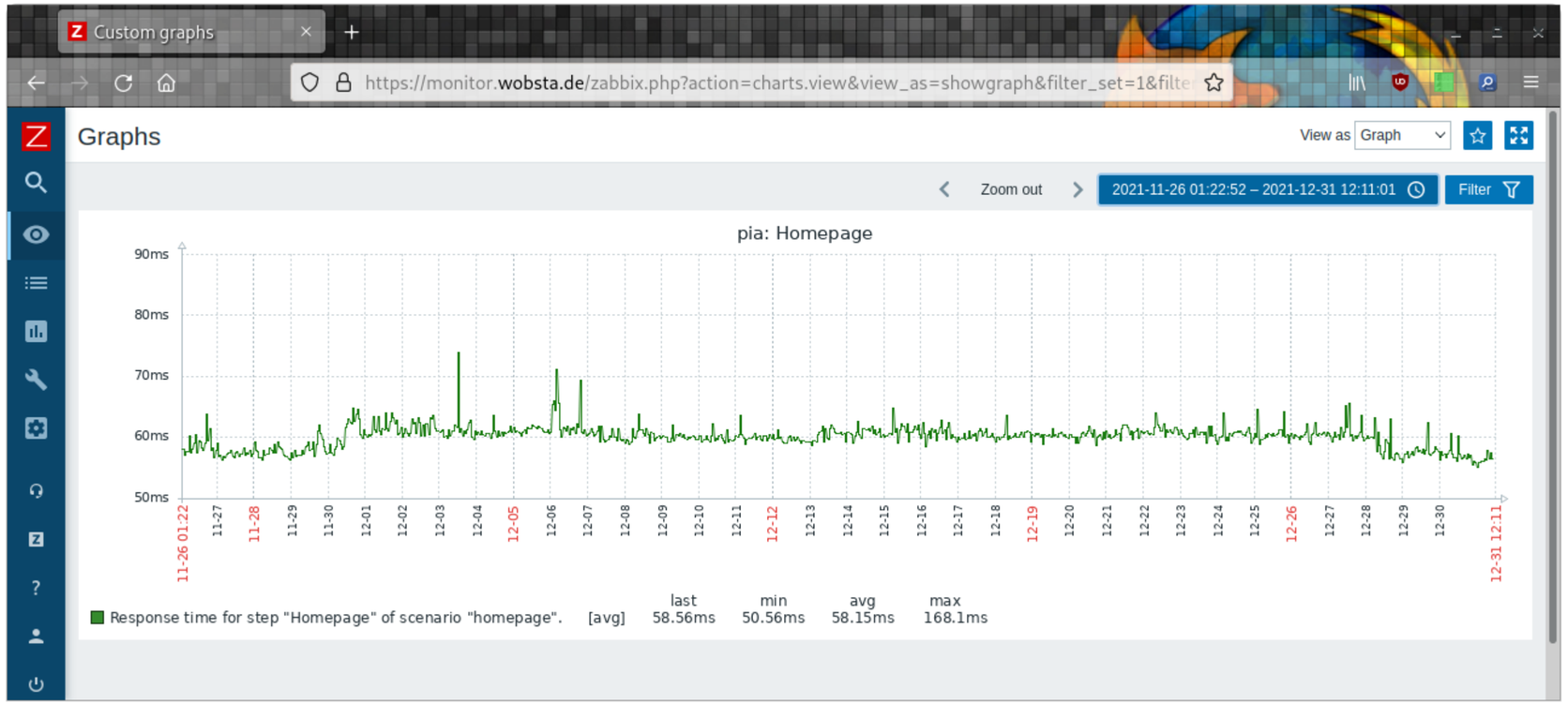
last min avg max
Processor load [avg] 0.0434 0 0.1857 2.81
Processor load5 [avg] 0.0351 0 0.1782 1.94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Graphs
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pia: Homepage
90ms
80ms
70ms
60ms
50ms
11-26 01:22
11-27
11-28
11-29
11-30
12-01
12-02
12-03
12-04
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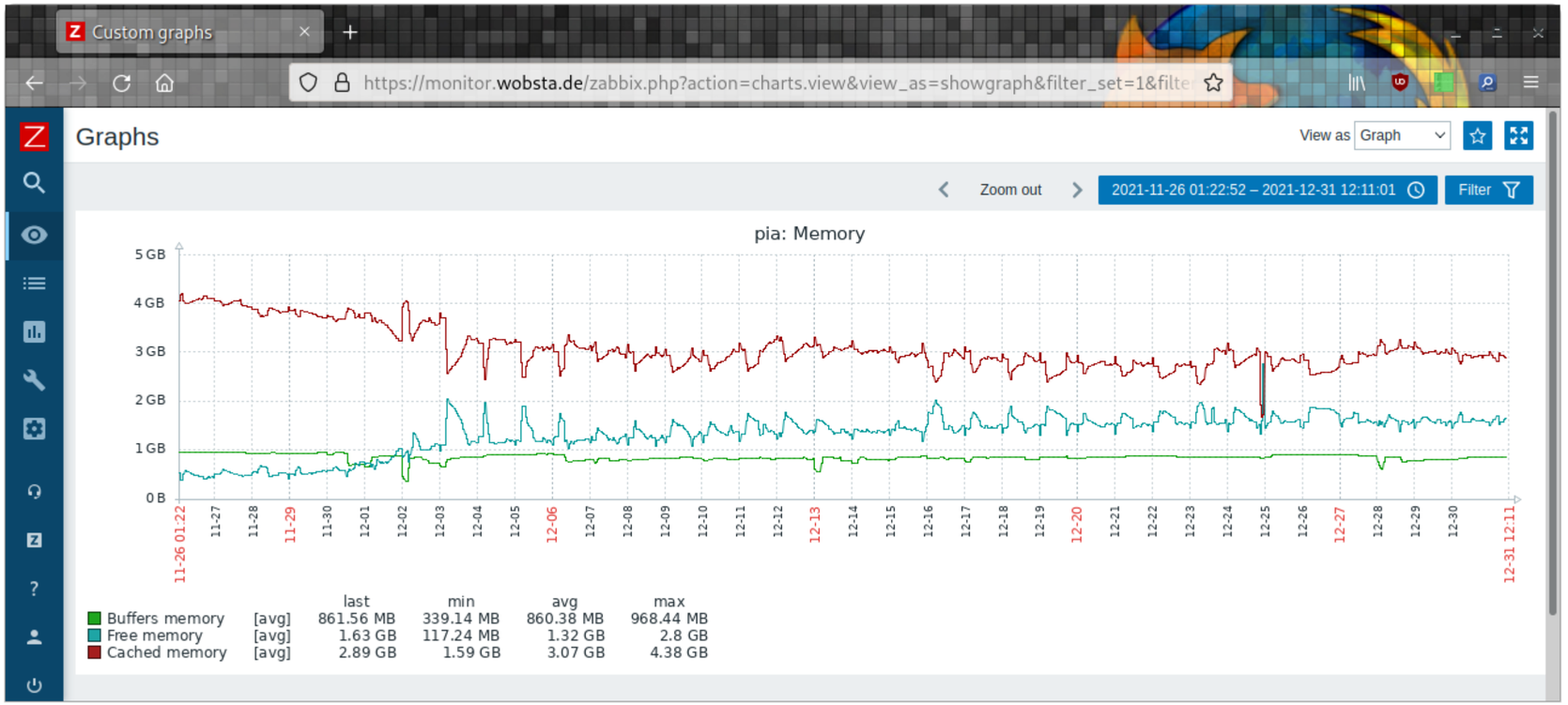
12-31 12:11
last
min
avg
max
Response time for step "Homepage" of scenario "homepage". [avg] 58.56ms 50.56ms 58.15ms 168.1ms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Graphs
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pia: Memory
5 GB
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3 GB
2 GB
1 GB
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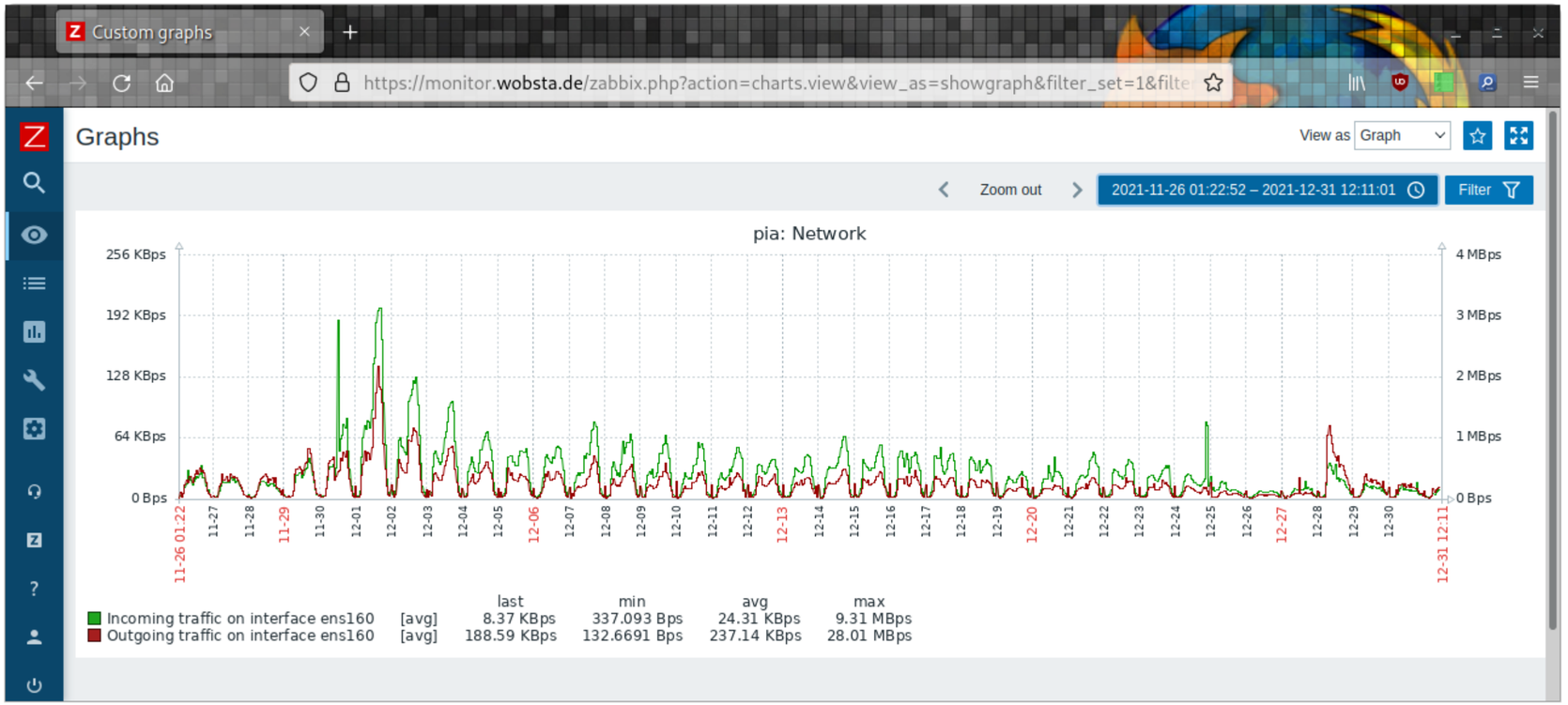
12-25
12-26
12-27
12-28
12-29
12-30
12-31 12:11
last min avg max
Buffers memory [avg] 861.56 MB 339.14 MB 860.38 MB 968.44 MB
Free memory [avg] 1.63 GB 117.24 MB 1.32 GB 2.8 GB
Cached memory [avg] 2.89 GB 1.59 GB 3.07 GB 4.38 GB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Graphs
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Filter
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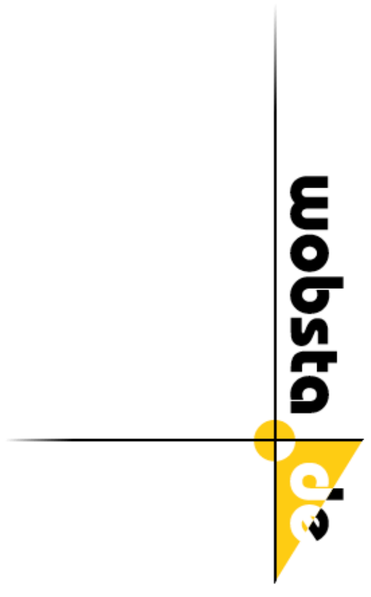
12-30
12-31 12:11
last
min
avg
max
Incoming traffic on interface ens160 [avg] 8.37 KBps 337.093 Bps 24.31 KBps 9.31 MBps
Outgoing traffic on interface ens160 [avg] 188.59 KBps 132.6691 Bps 237.14 KBps 28.01 MBps

Lessons learned

- Be fast, use real data or heavy test data
- High search engine rank without any SEO
- E-mail is troublesome
- There are always people having issues, complains etc.
- Form misuse by bots here and elsewhere (URLs as or in names etc.)
- Real people submit wired input, too (emoijs in names, mathematical double-struck digits in postcodes “𝟙𝟚𝟛𝟜𝟝”, etc.)
- Maybe be more strict on accepting input?
- Asynchronous tasks may still harm (overload machine or block via the DB)
- Levenshtein (fuzzy match) fails on large strings (>100 characters)
- There are always new ideas



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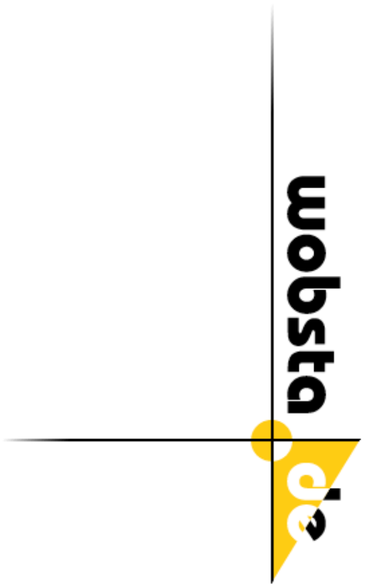
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