Algorithm for on-line calendar text generation in public transport

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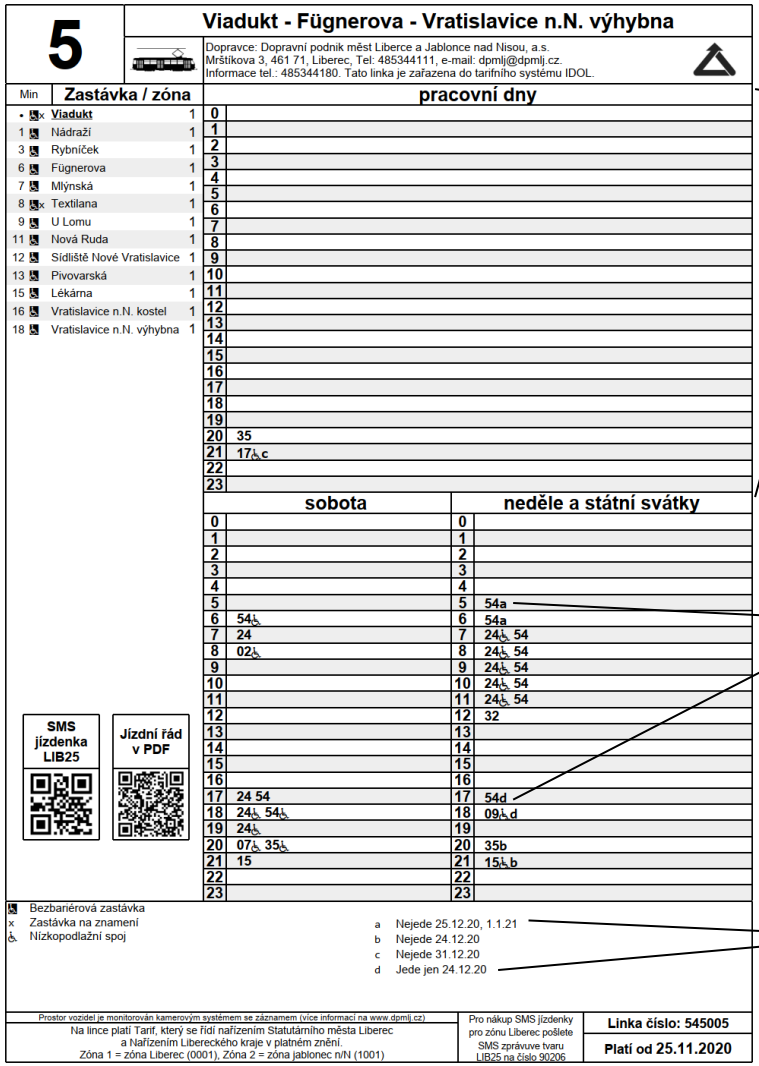
Introduction



5 — **Viadukt - Fügnerova - Vratislavice n.N. výhybna**

Dopravce: Dopravní podnik měst Liberce a Jablonce nad Nisou, a.s.
Mrštíkova 3, 461 71, Liberec, Tel: 485344111, e-mail: dpmlj@dpmlj.cz.
Informace tel.: 485344180. Tato linka je zařazena do tarifního systému IDOL.

Min	Zastávka / zóna		pracovní dny	sobota	neděle a státní svátky
•	Viadukt	1	0		
1	Nádraží	1	1		
3	Rybníček	1	2		
6	Fügnerova	1	3		
7	Mlýnská	1	4		
8	Textilana	1	5		5 54a
9	U Lomu	1	6	54	6 54a
11	Nová Ruda	1	7	24	7 24 54
12	Sídliště Nové Vratislavice	1	8	02	8 24 54
13	Pivovarská	1	9		9 24 54
15	Lékárna	1	10		10 24 54
16	Vratislavice n.N. kostel	1	11		11 24 54
18	Vratislavice n.N. výhybna	1	12		12 32
			13		13
			14		14
			15		15
			16		16
			17	24 54	17 54d
			18	24 54	18 09 d
			19	24	19
			20	07 35	20 35b
			21	15	21 15 b
			22		22
			23		23
			20	35	
			21	17 c	
			22		
			23		

SMS jízdenka LIB25

Jízdní řád v PDF

Bezbariérová zastávka
x Zastávka na znamení
Nízkopodlažní spoj

a Nejede 25.12.20, 1.1.21
b Nejede 24.12.20
c Nejede 31.12.20
d Jede jen 24.12.20

Prostor vozidel je monitorován kamerovým systémem se záznamem (více informací na www.dpmlj.cz)

Na lince platí Tarif, který se řídí nařízením Statutárního města Liberec a Nařízením Libereckého kraje v platném znění.
Zóna 1 = zóna Liberec (0001), Zóna 2 = zóna jablonec n/N (1001)

Pro nákup SMS jízdenky pro zónu Liberec pošlete SMS zprávuve tvaru LIB25 na číslo 90206

Linka číslo: 545005

Platí od 25.11.2020

System symbol

Trip with different validity

Calendar text

Introduction

- CZE/SVK
  - Trips in public transport have many validity exceptions
  - Lot of calendar text needs to be generated

- Existing heuristic algorithm for train calendar text
  - Different requirements and environment compared to public transport
  - Unsuitable

- Existing set covering problem formulation
  - Can be solved to optimality
  - Very slow

- Design new heuristic for public transport
  - Handle more complicated exceptions, which are frequent
  - Handles user defined *published symbols*

System symbols

SYSTEM SYMBOLS IN CALENDAR TEXTS

Symbol	Meaning
1	Mondays except holidays
2	Tuesdays except holidays
⋮	⋮
7	Sundays except holidays
x	Monday to Friday except holidays
+	Holidays

- Below we show expected calendar text for a set of two *published symbols*
  - "workdays"
  - "weekends + holidays"

- Situation: Trip validity is 5 without 31.12.
- Timetable: Trip is included in "workdays" only
- Calendar text: Operates 5, no service 31.12.

User defined symbols

EXAMPLES OF USER DEFINED SYMBOLS

Symbol	Meaning	Published title
1-5	Workdays	Workdays
1-4	Monday to Thursday	Monday to Thursday
6,7,+	Saturdays, Sundays, Holidays	Non-workdays
5-6*	Days before Saturdays, Sundays and Holidays	Before non-workdays
s	Serviced only in school days	School days
o	Serviced only in odd weeks	Odd weeks
e	Serviced only in even weeks	Even weeks

- Below we show expected calendar text for a set of two *published symbols*
  - "workdays"
  - "weekends + holidays"

- Situation: Trip validity is 1-4 with two additional Fridays, 20.4. and 18.5.
- Timetable: Trip is included in "workdays" only
- Calendar text: Operates only 1-4 and 20.4., 18.5.

Requirements

- Fast algorithm for on-line calendar text generation
- Calendar text does not usually contain a simple list of days, rather variations of shorter and more meaningful texts relevant to published symbols
- Calendar text convenience and user experience
- Possibility for user defined symbols and published symbols

Algorithm description

- For each *published symbol* and each trip within given time interval:

1. Use weekly mask
2. Do not consider days which are irrelevant considering *published symbol*
3. Identify patterns within rows
4. Identify patterns within columns
5. While possible, join patterns together
6. Create calendar text based on patterns
7. Create calendar text for exceptions not included within patterns

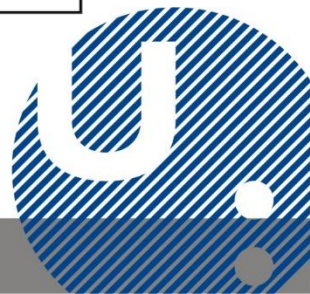
Algorithm description

- The algorithm is used for both
  - Positive text
    = correspondence to *published symbol*, “operates on…”
  - Negative text
    = exceptions against *published symbol*, “no service on…”
- Out of which is selected the shorter one and published

Results of calendar text generation

Indicator	Value
The number of unique trips in all lines and all variants in the year	45,260
The number of times a unique trip was presented (as one trip is valid for multiple paternal symbols)	63,045
The number of different calendar texts	426
The number of generated calendar texts into stop timetable	11,218
The number of generated calendar texts for other consumers of data	37,581
The average time of generating a calendar text	7 ms
The maximum time of generating a calendar text	17 ms

City of Liberec, 2019



Conclusion

- Fast heuristic algorithm for on-line calendar text generation
- Tested on real data within Czech republic
- Implemented in few information systems for passengers, journey planners, and as component of system MAGNUS, which is a complex software for planning and evaluation of public transport services