

FORENZIČKA ANALIZA GOOGLE CHROME WEB PREGLEDNIKA

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Projekt iz predmeta *Računalna forenzika*

2022./2023.

Uvod

- 75 % Windows OS
- 66 % Google Chrome
- OS samo *bootloader* za web preglednik

Google Chrome direktoriji

(1) *C:\Program Files\Google\Chrome*

(2) *C:\Users\<win_user_name>\AppData\Local\Google\Chrome\
User Data\<chrome_user_profile>*

(2.1) – **SQLite baze podatak** (iznimka: *cache*, *add-ons*)

- povijest pretraživanja interneta (i preuzimanja),
- kolačići,
- proširenja (eng. *add-ons*),
- privremeni (eng. *cache*) podaci,
- podaci za automatsko popunjavanje obrazaca
(ime, prezime, adresa, e-mail, ...),
- lozinke,
- podaci bankovnih kartica.

Povijest pretraživanja interneta (i povijest preuzimanja) - *History*

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\History

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Save Project Attach Database Close Database

Database Structure Browse Data Edit Pragmas Execute SQL

Table: urls

Filter in any column

	id	url	title	visit_count	typed_count	last_visit_time
	Filter	Filter	Filter	Filter	Filter	Filter
1	1	https://accounts.google.com/signin/chrome/sync...	Prijava – Google računi	2	0	1331782364779642
2	2	https://accounts.google.com/signin/chrome/sync...	Prijava – Google računi	1	0	1331782364798077
3	3	https://accounts.google.com/signin/v2/challenge...	Prijava – Google računi	1	0	1331782367945797
4	4	https://www.google.com/search?...	random credit card generator - Google ...	2	0	1331782381576077
5	5	https://www.creditcardvalidator.org/generator	Fake Credit Card Generator CreditCardValidator	1	0	1331782381779064
6	6	https://www.youtube.com/	YouTube	4	2	1331792224944900
7	7	http://fer.hr/	Fakultet elektrotehnike i računarstva	2	2	1331792201519452
8	8	https://www.fer.unizg.hr/	Fakultet elektrotehnike i računarstva	5	0	1331792225223106
9	9	https://www.fer.unizg.hr/#	Fakultet elektrotehnike i računarstva	1	0	1331782419658234
10	10	https://www.fer.unizg.hr/login/?...	Prijava	3	0	1331792205025769
11	11	https://www.youtube.com/results?...	litt - YouTube	1	0	1331782421378503
12	12	https://www.youtube.com/watch?v=nXt8bj0cN4k	LTT Nerf War : SEAL X Warriors Nerf Guns Fight ...	1	0	1331782423426819
13	13	https://www.fer.unizg.hr/login/Compound?...	Prijava	1	0	1331792204165627
14	14	https://www.google.com/search?...	chrome extensions - Google pretraživanje	2	0	1331792219049995

Kolačići - <chrome_dir>\netowk\Cookies

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Network\Cookies

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Save Project Attach Database Close Database

Database Structure Browse Data Edit Pragma Execute SQL

Table: cookies Filter in any column

	creation_utc	host_key	top_frame_site_key	name	value	encrypted_value	path	expires_utc	is_secure	is_httponly	last_access_
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	13317823648233526	.google.com		CONSENT		BLOB	/	13352383648233526	1	0	133179222398
2	13317823686235825	accounts.google.com		__Host-GAPS		BLOB	/	13352383686235825	1	1	133179221789
3	13317823815608449	.google.com		SOCS		BLOB	/	13351951815779242	1	0	133179222398
4	13317823817781200	www.creditcardvalidator.org		XSRF-TOKEN		BLOB	/	13317831017781200	0	0	133178241816
5	13317823818919814	.creditcardvalidator.org		__gads		BLOB	/	13351519819000000	0	0	133178241816
6	13317823818920106	.creditcardvalidator.org		__gpi		BLOB	/	13351519819000000	0	0	133178241816
7	13317823818775721	.creditcardvalidator.org		_ga		BLOB	/	13352383818775659	0	0	133178241816
8	13317823818589910	.creditcardvalidator.org		_gid		BLOB	/	13317910218000000	0	0	133178241816
9	13317823817781237	www.creditcardvalidator.org		laravel_session		BLOB	/	13317831017781237	0	1	133178238177
10	13317824189380122	youtube.com		CONSENT		BLOB	/	13352384189380122	1	0	133179222493

Kolačići - <chrome_dir>\netowk\Cookies - ChromeCookiesView

ChromeCookiesView: C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Network\Cookies

File Edit View Options Help

Host Name	Path	Name	Value	Secure	HTTP Only	Last Accessed	Created On	Expires
.chrome.google.com	/	__utmt	1	No	No	1/11/2023 3:49:5...	1/11/2023 3:49:5...	1/11/2023 3:59:5...
.chrome.google.com	/	__utma	73091649.1267416735.16...	No	No	1/11/2023 3:50:4...	1/11/2023 3:49:5...	2/15/2024 3:50:4...
.chrome.google.com	/	__utmb	73091649.49.0.167344863...	No	No	1/11/2023 3:50:4...	1/11/2023 3:50:4...	1/11/2023 4:20:4...
.chrome.google.com	/	__utmz	73091649.1673448593.1.1...	No	No	1/11/2023 3:50:4...	1/11/2023 3:49:5...	7/13/2023 4:50:4...
.creditcardvalidator.org	/	__gads	ID=005e7dda07f33cdf-2...	No	No	1/10/2023 12:36:...	1/10/2023 12:30:...	2/4/2024 12:30:1...
.creditcardvalidator.org	/	__gpi	UID=00000ba0afc5e087:...	No	No	1/10/2023 12:36:...	1/10/2023 12:30:...	2/4/2024 12:30:1...
.creditcardvalidator.org	/	_ga	GA1.1.649899585.167335...	No	No	1/10/2023 12:36:...	1/10/2023 12:30:...	2/14/2024 12:30:...
.creditcardvalidator.org	/	_gid	GA1.2.1155933257.16733...	No	No	1/10/2023 12:36:...	1/10/2023 12:30:...	1/11/2023 12:30:...
.creditcardvalidator.org	/	_ga_Y6ZWYLVYDP	GS1.1.1673350218.1.1.16...	No	No	1/10/2023 12:36:...	1/10/2023 12:36:...	2/14/2024 12:36:...
.google.com	/	CONSENT	PENDING 821	Yes	No	1/11/2023 3:50:3...	1/10/2023 12:27:...	2/14/2024 12:27:...
.google.com	/	SOCS	CAESHAgCEhJnd3NfMj...	Yes	No	1/11/2023 3:50:3...	1/10/2023 12:30:...	2/9/2024 12:30:1...
.google.com	/	AEC	ARSKqsl_4uJwSC74LXBO...	Yes	Yes	1/11/2023 3:50:4...	1/11/2023 3:49:4...	7/9/2023 1:30:12 ...
.google.com	/	NID	511=AjuppHmAVWkUfv...	Yes	Yes	1/11/2023 3:50:5...	1/11/2023 3:49:5...	7/13/2023 4:49:5...
.google.com	/	__Secure-ENID	9.SE=aoPZ3HoiAw36db...	Yes	Yes	1/11/2023 3:50:4...	1/11/2023 3:49:4...	2/10/2024 4:48:3...
.unizg.hr	/	_ga	GA1.2.1593868936.16733...	No	No	1/11/2023 3:50:5...	1/10/2023 12:36:...	2/15/2024 3:50:5...

Proširenja (eng. add-ons) - $\langle chrome_dir \rangle \backslash Extensions$

Data > Local > Google > Chrome > User Data > Default > Extensions >

Name

- aapbdbdomjkkjkaonfhkkikfgjllcleb
- ghbmnnjooekpmoecnninlnbdlolhkhi
- nmmhkkegccagdldgiimedpiccmgmieda
- Temp

Chrome > User Data > Default > Extensions > aapbdbdomjkkjkaonfhkkikfgjllcleb > 2.0.12_0

<input type="checkbox"/> Name	Date modified	Type	Size
_locales	1/11/2023 3:50 PM	File folder	
_metadata	1/11/2023 3:50 PM	File folder	
icons	1/11/2023 3:50 PM	File folder	
bubble_compiled.js	3/9/2022 1:00 PM	JavaScript File	130 KB
bubble_gss.css	3/9/2022 1:00 PM	Cascading Style S...	5 KB
injection.js	3/9/2022 12:56 PM	JavaScript File	2 KB
main_compiled.js	3/9/2022 1:00 PM	JavaScript File	20 KB
manifest.json	1/11/2023 3:50 PM	JSON File	2 KB
options.html	3/9/2022 12:56 PM	Chrome HTML Do...	2 KB
options_compiled.js	3/9/2022 1:00 PM	JavaScript File	83 KB
options_css_compiled.css	3/9/2022 1:00 PM	Cascading Style S...	25 KB
popup.html	3/9/2022 12:56 PM	Chrome HTML Do...	2 KB
popup_compiled.js	3/9/2022 1:00 PM	JavaScript File	115 KB
popup_css_compiled.css	3/9/2022 1:00 PM	Cascading Style S...	22 KB

Cache podaci - <chrome_dir>\Cache\Cache_data - ChromeCacheView

ChromeCacheView: C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Cache\Cache_Data

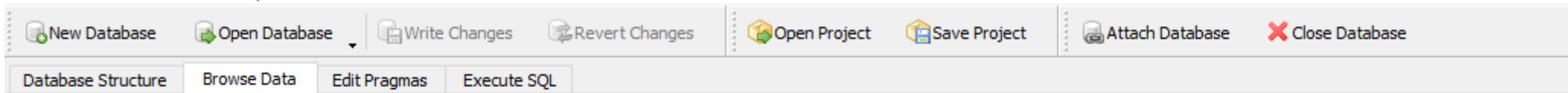
File Edit View Options Help



Filename	URL	Content Type	File Size	Last Accessed	Server Time	S
site-v2.webmanifest.json	https://unsplash.com/site-v2.webmanifest	application/json	806	1/12/2023 1:34:06 ...	1/12/2023 1:34:07 ...	1
skeleton.gif	https://static.adsafeprotected.com/skeleton.gif	image/gif	43	1/12/2023 1:34:07 ...	12/3/2022 4:22:46 ...	8
skyline-7622147_640.jpg	https://cdn.pixabay.com/photo/2022/11/28/14/07/skyline-762...	image/jpeg	36,707	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
snow-2.18.1.js	https://unsplash.com/a/third-party/snow-2.18.1.js	application/java...	26,673	1/12/2023 1:34:04 ...	1/12/2023 1:34:05 ...	1
spring-7705996_340.jpg	https://cdn.pixabay.com/photo/2023/01/08/19/48/spring-770...	image/jpeg	15,003	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
ss.json	https://unsplash.com/nautocomplete/ss	application/json	188	1/12/2023 1:34:11 ...	1/12/2023 1:34:12 ...	1
street-7690119_340.jpg	https://cdn.pixabay.com/photo/2023/01/01/13/47/street-7690...	image/jpeg	16,619	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
street-7690347_340.jpg	https://cdn.pixabay.com/photo/2023/01/01/16/35/street-7690...	image/jpeg	51,075	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
tbn_ANd9GcQpW1covLtEXFEv4ueXqVDkKhtLT7p9mMOB0Uxh...	https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQ...	image/jpeg	3,262	1/12/2023 1:34:03 ...	1/12/2023 10:33:44...	3
tbn_ANd9GcR23k0mGgX4Hg8obJ5yTGCHfg787FpPjmVocdRBB...	https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcR2...	image/jpeg	4,854	1/12/2023 1:34:03 ...	1/12/2023 10:40:31...	2
tbn_ANd9GcRAjnJI-jmGEATQITdfzvsYNdQNwKXJ9kAX-3gP3A...	https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcR...	image/jpeg	4,804	1/12/2023 1:34:03 ...	1/12/2023 9:28:52 ...	1
tbn_ANd9GcStm-whXn21HuxnmFF8FJSlzZF0SkOMZmliU9DO...	https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSt...	image/jpeg	7,324	1/12/2023 1:34:03 ...	1/12/2023 1:34:04 ...	1
tea-1040653_340.jpg	https://cdn.pixabay.com/photo/2015/11/12/17/20/tea-104065...	binary/octet-stre...	25,719	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
temple-7692729_340.png	https://cdn.pixabay.com/photo/2023/01/02/18/35/temple-76...	image/png	73,475	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
tia.png	https://www.google.com/tia/tia.png	image/png	258	1/12/2023 1:34:00 ...	1/10/2023 6:00:17 ...	9
tia.png	https://www.gstatic.com/inputtools/images/tia.png	image/png	151	1/12/2023 1:34:00 ...	1/10/2023 6:22:40 ...	3
unsplash.com.htm	https://unsplash.com	text/html	47,797	1/12/2023 1:34:04 ...	1/12/2023 1:34:05 ...	1
vSdyTd,gJjRYc,sbC4bb	https://www.gstatic.com/_mss/boq-search/_js/k=boq-searc...	text/javascript	5,554	1/12/2023 1:34:03 ...	1/11/2023 10:14:09...	1
w92-h92-n-k-no.jpg	https://lh5.googleusercontent.com/p/AF1QipOtZG2q8eCmY1...	image/jpeg	2,978	1/12/2023 1:33:57 ...	1/12/2023 11:36:53...	1
wedding-7550227_340.jpg	https://cdn.pixabay.com/photo/2022/10/27/07/13/wedding-7...	image/jpeg	52,250	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
windmill-7367963_640.jpg	https://cdn.pixabay.com/photo/2022/08/06/06/03/windmill-7...	binary/octet-stre...	58,001	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
woman-7633843_640.jpg	https://cdn.pixabay.com/photo/2022/12/04/07/03/woman-76...	image/jpeg	51,011	1/12/2023 1:34:01 ...	1/12/2023 1:34:02 ...	1
ws9Tlc,n73qwf,IZT63,UUJqVe,O1Gjze,xUdipf,OTA3Ae,COQbmf,f...	https://www.gstatic.com/_mss/boq-search/_js/k=boq-searc...	text/javascript	334,574	1/12/2023 1:34:03 ...	1/11/2023 10:14:07...	1
Wt6vjf,hhhU8,FCpbqb,WJhNk	https://www.gstatic.com/_mss/boq-search/_js/k=boq-searc...	text/javascript	2,720	1/12/2023 1:34:04 ...	1/11/2023 10:14:10...	1

276 item(s), 1 Selected (46.68 KB)

NirSoft Freeware. <https://www.nirsoft.net>



Database Structure Browse Data Edit Pragmas Execute SQL

Table autofill

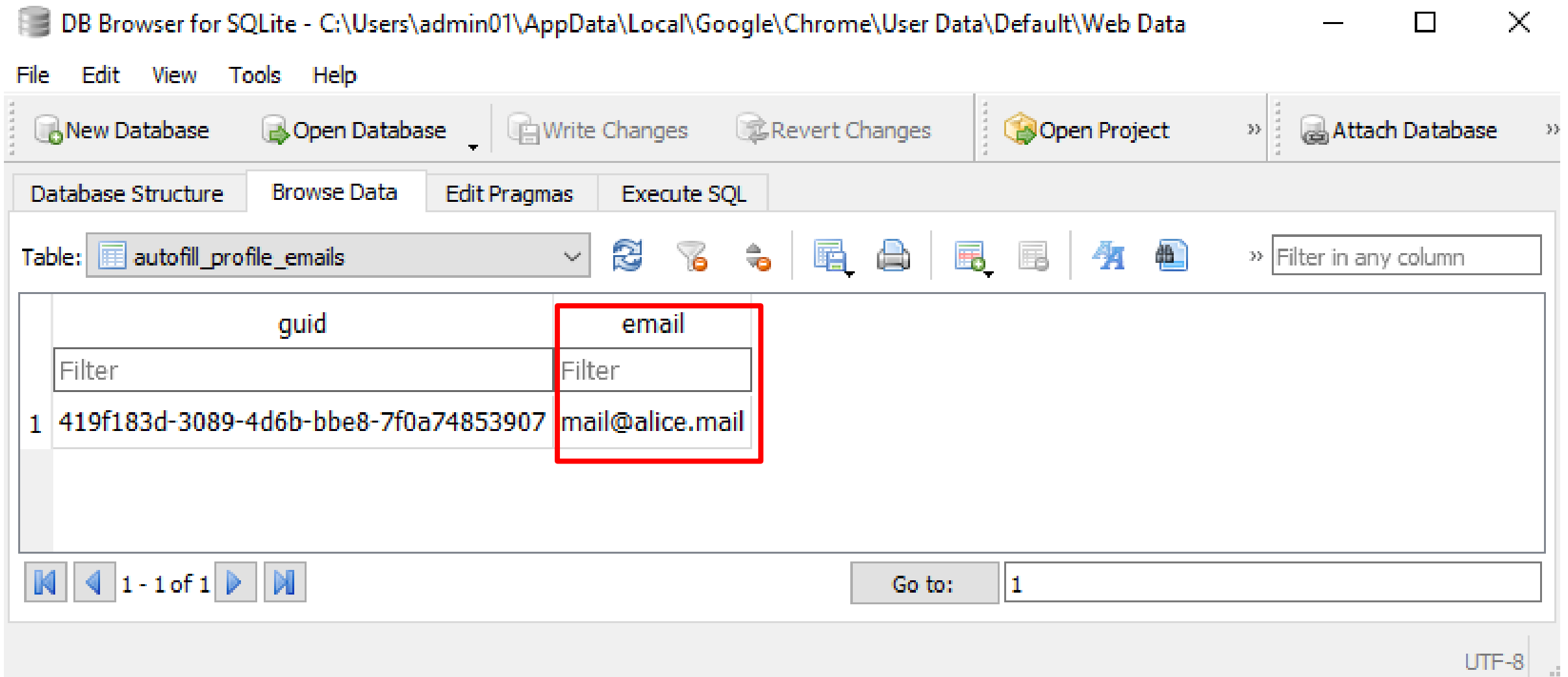
value_lower	date_created	date_last_used	count
	Filter	Filter	Filter
mson@gmail.com	1673350079	1673350079	1

1 autofill

- autofill
- autofill_model_type_state
- autofill_profile_addresses
- autofill_profile_birthdates
- autofill_profile_emails
- autofill_profile_names
- autofill_profile_phones
- autofill_profiles
- autofill_sync_metadata
- credit_cards
- ibans
- keywords
- masked_credit_cards
- meta
- offer_data
- offer_eligible_instrument
- offer_merchant_domain
- payment_method_manifest
- payments_customer_data
- payments_upi_vpa
- secure_payment_confirmation_instrument
- server_address_metadata
- server_addresses
- server_card_cloud_token_data
- server_card_metadata
- token_service
- unmasked_credit_cards
- web_app_manifest_section

Popunjavanje web obrazaca
(eng. autofill data)
- *<chrome_dir>\Web Data*

Popunjavanje web obrazaca (eng. autofill data) - *<chrome_dir>\Web Data*



The screenshot shows the DB Browser for SQLite application window. The title bar reads "DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Web Data". The menu bar includes "File", "Edit", "View", "Tools", and "Help". The toolbar contains buttons for "New Database", "Open Database", "Write Changes", "Revert Changes", "Open Project", and "Attach Database". The main interface has tabs for "Database Structure", "Browse Data", "Edit Pragmas", and "Execute SQL". The "Browse Data" tab is active, showing a table named "autofill_profile_emails". The table has two columns: "guid" and "email". The "email" column is highlighted with a red box. The first row of data shows a GUID of "419f183d-3089-4d6b-bbe8-7f0a74853907" and an email of "mail@alice.mail". The status bar at the bottom indicates "UTF-8" encoding.

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Web Data

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Attach Database

Database Structure Browse Data Edit Pragmas Execute SQL

Table: autofill_profile_emails Filter in any column

	guid	email
Filter	Filter	Filter
1	419f183d-3089-4d6b-bbe8-7f0a74853907	mail@alice.mail

1 - 1 of 1 Go to: 1 UTF-8

Popunjavanje web obrazaca (eng. autofill data) - `<chrome_dir>\Web Data`

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Dat... — □ ×

File Edit View Tools Help

New Database

Open Database

Open Project

Attach Database

Database Structure

Browse Data

Edit Pragmas

Execute SQL

Table: autofill_profile_names

	guid	first_name	middle_name	last_name	full_name
	Filter	Filter	Filter	Filter	Filter
1	419f183d-3089-4d6b-bbe8-7f0a74853907	Alice		Adamson	Alice Adamson

1 - 0 of 1

Go to:

1

UTF-8

Lozinke - <chrome_dir>\Login Data

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default>Login Data

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Save Project Attach Database Close Database

Database Structure Browse Data Edit Pragas Execute SQL

Table: logins

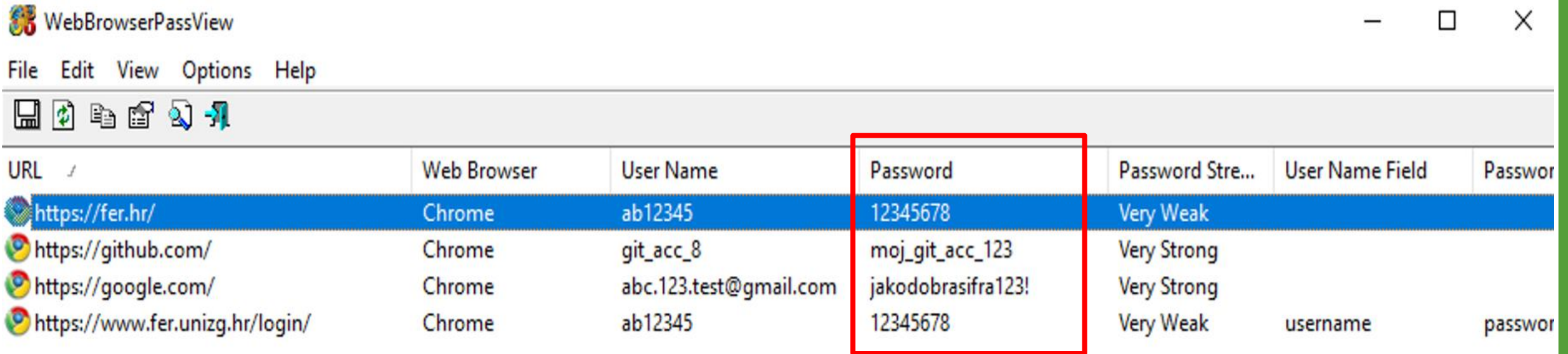
Filter in any column

	origin_url	action_url	username_element	username_value	password_element	password_value
	Filter	Filter	Filter	Filter	Filter	Filter
1	https://fer.hr/			ab12345		BLOB
2	https://google.com/			abc.123.test@gmail.com		BLOB
3	https://github.com/			git_acc_8		BLOB
4	https://www.fer.unizg.hr/login/	https://www.fer.unizg.hr/login/Compound	username	ab12345	password	BLOB



Lozinke - <chrome_dir>\Login Data

- **WebBrowserPassView**



The screenshot shows the WebBrowserPassView application window. The title bar reads "WebBrowserPassView" and the menu bar includes "File", "Edit", "View", "Options", and "Help". Below the menu bar is a toolbar with icons for file operations. The main area contains a table with the following columns: "URL", "Web Browser", "User Name", "Password", "Password Stre...", "User Name Field", and "Passwor". The table lists four entries, with the first entry highlighted in blue and the "Password" column highlighted in red.

URL	Web Browser	User Name	Password	Password Stre...	User Name Field	Passwor
https://fer.hr/	Chrome	ab12345	12345678	Very Weak		
https://github.com/	Chrome	git_acc_8	moj_git_acc_123	Very Strong		
https://google.com/	Chrome	abc.123.test@gmail.com	jakodobrasifra123!	Very Strong		
https://www.fer.unizg.hr/login/	Chrome	ab12345	12345678	Very Weak	username	passwor

DB Browser for SQLite - C:\Users\admin01\AppData\Local\Google\Chrome\User Data\Default\Web Data

File Edit View Tools Help

New Database Open Database Write Changes Revert Changes Open Project Save Project Attach Database Close Database

Database Structure Browse Data Edit Pragas Execute SQL

Table: credit_cards Filter in any column

	guid ↕ ¹	me_on_ca	expiration_month	expiration_year	card_number_encrypted	date_modified	origin	use_count	use_date	ing_address	nickname
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	9f800c08-...	John Doe	10	2026	BLOB	1673350292	Chrome settings	1	1673350266		Moja kartica za put

1 - 1 of 1 Go to: 1

UTF-8







Brojevi bankovnih kartica
- *<chrome_dir>\Web Data*
(tablica *credit_cards*)

Hack browser data - <chrome_dir>\Web Data (tablica credit_cards)









PC > Downloads > hack_browser_data >



<input type="checkbox"/>	Name	Date modified	Type	Size
<input checked="" type="checkbox"/>	 results	1/12/2023 6:16 PM	File folder	
<input checked="" type="checkbox"/>	 chromiumKey	1/12/2023 6:20 PM	File	73 KB
<input checked="" type="checkbox"/>	 firefoxKey4	1/12/2023 6:15 PM	File	288 KB
<input type="checkbox"/>	 hack-browser-data-windows-32bit.exe	8/16/2022 1:52 PM	Application	7,261 KB

Hack browser data - <chrome_dir>\Web Data (tablica credit_cards)

PC > Downloads > hack_browser_data > results

<input type="checkbox"/> Name	Date modified	Type	Size
<input checked="" type="checkbox"/>  chrome_default_bookmark.csv	1/12/2023 6:15 PM	CSV File	1 KB
<input checked="" type="checkbox"/>  chrome_default_cookie.csv	1/12/2023 6:15 PM	CSV File	10 KB
<input checked="" type="checkbox"/>  chrome_default_creditcard.csv	1/12/2023 6:15 PM	CSV File	1 KB
<input checked="" type="checkbox"/>  chrome_default_download.csv	1/12/2023 6:15 PM	CSV File	1 KB
<input checked="" type="checkbox"/>  chrome_default_extension.csv	1/12/2023 6:15 PM	CSV File	1 KB
<input checked="" type="checkbox"/>  chrome_default_history.csv	1/12/2023 6:15 PM	CSV File	4 KB
<input checked="" type="checkbox"/>  chrome_default_localstorage.csv	1/12/2023 6:15 PM	CSV File	6 KB
<input checked="" type="checkbox"/>  chrome_default_password.csv	1/12/2023 6:15 PM	CSV File	1 KB

Hack browser data - <chrome_dir>\Web Data (tablica credit_cards)

C:\Users\admin01\Downloads\hack_browser_data\results\chrome_default_creditcard.csv - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?



chrome_default_creditcard.csv

```
1 GUID,Name,ExpirationYear,ExpirationMonth,CardNumber,Address,NickName
2 9f800c08-fdc3-4729-962f-5011d7b74af1,John Doe,2026,10,4024007171190605,,Moja kartica za put
3
```



Zaključak

- Uspješno obavljena forenzička analiza
 - Bitnih artefakata Google Chrome web preglednika
- Forenzički alati olakšavaju dekriptiranje
 - Automatiziraju analiz
- Daljnji rad:
 - Istražiti (de)kriptiranje
 - lozinka, kolačića i brojeva bankovnih kartica
 - na razini programskog koda Google Chrome preglednika
 - AES GCM, funkcija *CryptProtectData* unutar Data Protection Application Programming Interface (DPAPI) (na Win OS-u)
 - pokušati obaviti ručno dekriptiranje navedenog

Računalna forenzika
– projekt/seminar

*Forenzička analiza
Google Chrome
web preglednika*

2022./2023.

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