

CSE310 Fall2020

PROJECT 2 REPORT

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The experiments were performed on the “big-sample.txt” dataset provided by the instructor, with an additional category named “India” with no apps.

CONCLUSIONS:

The below conclusion were drawn from the data obtained from the experiments performed and the characteristics of the data structure.

1. The hash function does closely resemble the assumption of simple uniform hashing as most of the of the chain had a length of one, meaning that most keys were hashed uniformly.
2. Some of the Binary Search Tree does appear balanced such as Category: Games subtree with height of both left subtree and right subtree being 6 where as, many binary search trees were unbalanced such Category: Entertainment (left subtree:0 and right-subtree:8) and Category: Medical (left subtree:0 and right-subtree:4). Balanced binary tree had lesser average search time than the unbalanced binary search trees.
3. The hashtable data structure best supports the find app command, as the the search time is significantly lower in hashtable than the binary search tree. In most cases the search time for the find app in BST is 2-3 times longer than the search time in hastable.

1. Characteristics of the Binary Tree Data Structure:

The below reports the height of the binary tree in each category, the number of nodes, the height of the left-subtree from root and the height of the righ-subtree from the root.

Category: Books
Number of Nodes: 8
Height of the Binary Tree: 5
Height of the Left Sub Tree: 3
Height of the Right Sub Tree: 1

Category: Business
Number of Nodes: 11
Height of the Binary Tree: 7
Height of the Left Sub Tree: 1
Height of the Right Sub Tree: 5

Category: Catalogs
Number of Nodes: 7
Height of the Binary Tree: 5
Height of the Left Sub Tree: 4
Height of the Right Sub Tree: 0

Category: Education
Number of Nodes: 9
Height of the Binary Tree: 6
Height of the Left Sub Tree: 2
Height of the Right Sub Tree: 3

Category: Entertainment
Number of Nodes: 13
Height of the Binary Tree: 9
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 8

Category: Finance
Number of Nodes: 7
Height of the Binary Tree: 4
Height of the Left Sub Tree: 2
Height of the Right Sub Tree: 1

Category: Food & Drink
Number of Nodes: 12
Height of the Binary Tree: 8
Height of the Left Sub Tree: 2
Height of the Right Sub Tree: 5

Category: Games
Number of Nodes: 20
Height of the Binary Tree: 13
Height of the Left Sub Tree: 6
Height of the Right Sub Tree: 6

Category: Health & Fitness
Number of Nodes: 10
Height of the Binary Tree: 6
Height of the Left Sub Tree: 3
Height of the Right Sub Tree: 2

Category: India
Number of Nodes: 0
Height of the Binary Tree: 0
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 0

Category: Kids
Number of Nodes: 7
Height of the Binary Tree: 4
Height of the Left Sub Tree: 3
Height of the Right Sub Tree: 0

Category: Lifestyle
Number of Nodes: 7
Height of the Binary Tree: 4
Height of the Left Sub Tree: 1
Height of the Right Sub Tree: 2

Category: Magazines & Newspapers
Number of Nodes: 6
Height of the Binary Tree: 4
Height of the Left Sub Tree: 3
Height of the Right Sub Tree: 0

Category: Medical
Number of Nodes: 7
Height of the Binary Tree: 5
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 4

Category: Music
Number of Nodes: 11
Height of the Binary Tree: 7
Height of the Left Sub Tree: 6
Height of the Right Sub Tree: 0

Category: Navigation
Number of Nodes: 11
Height of the Binary Tree: 6
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 5

Category: News
Number of Nodes: 10
Height of the Binary Tree: 7
Height of the Left Sub Tree: 1
Height of the Right Sub Tree: 5

Category: Photo & Video
Number of Nodes: 7
Height of the Binary Tree: 4
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 3

Category: Productivity
Number of Nodes: 11
Height of the Binary Tree: 7
Height of the Left Sub Tree: 4
Height of the Right Sub Tree: 2

Category: Reference
Number of Nodes: 5
Height of the Binary Tree: 3
Height of the Left Sub Tree: 1
Height of the Right Sub Tree: 1

Category: Social Networking
Number of Nodes: 8
Height of the Binary Tree: 5
Height of the Left Sub Tree: 3
Height of the Right Sub Tree: 1

Category: Sports
Number of Nodes: 12
Height of the Binary Tree: 7
Height of the Left Sub Tree: 4
Height of the Right Sub Tree: 2

Category: Travel
Number of Nodes: 3
Height of the Binary Tree: 2
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 1

Category: Utilities
Number of Nodes: 11
Height of the Binary Tree: 7
Height of the Left Sub Tree: 5
Height of the Right Sub Tree: 1

Category: Weather
Number of Nodes: 4
Height of the Binary Tree: 2
Height of the Left Sub Tree: 0
Height of the Right Sub Tree: 1

2. Characteristics of the Binary Tree Data Structure:

The data below reports the lists the number of chains of length for each chain length and the load factor in the hashtable.

Number of Chains of length 0 :265
Number of Chains of length 1 :135
Number of Chains of length 2 :36
Number of Chains of length 3 :2
Number of Chains of length 4 :1
Load Factor: 0.494305

3. Time comparison between “findapp” search between HashTable and Binary Search Tree:

The below data reports the time comparison between HashTable and Binary Search Tree while searching each app. The time is in 1/1000000 of a minute:

Dunkin' Donuts found in HASHTABLE in time: 0.499
Dunkin' Donuts found in BINARY TREE in time: 1.333

The Weather Channel found in HASHTABLE in time: 0.343
The Weather Channel found in BINARY TREE in time: 0.849

Fantastical 2 for iPhone found in HASHTABLE in time: 0.271
Fantastical 2 for iPhone found in BINARY TREE in time: 1.085

ClassDojo found in HASHTABLE in time: 0.182
ClassDojo found in BINARY TREE in time: 0.643

BTN2Go found in HASHTABLE in time: 0.152
BTN2Go found in BINARY TREE in time: 1.012

WhatsApp Messenger found in HASHTABLE in time: 0.313
WhatsApp Messenger found in BINARY TREE in time: 0.83

Essential Anatomy 5 found in HASHTABLE in time: 0.248
Essential Anatomy 5 found in BINARY TREE in time: 0.772

Gmail - email from Google found in HASHTABLE in time: 0.365
Gmail - email from Google found in BINARY TREE in time: 0.794

Bank of America found in HASHTABLE in time: 0.223
Bank of America found in BINARY TREE in time: 0.496

QR Reader for iPhone found in HASHTABLE in time: 0.238
QR Reader for iPhone found in BINARY TREE in time: 0.769

PhotoMath found in HASHTABLE in time: 0.21
PhotoMath found in BINARY TREE in time: 0.461

FanDuel: One Day Fantasy Sports Leagues found in HASHTABLE in time: 0.409
FanDuel: One Day Fantasy Sports Leagues found in BINARY TREE in time: 0.749

iCatcher! Podcast Player found in HASHTABLE in time: 0.27
iCatcher! Podcast Player found in BINARY TREE in time: 0.774

Star Walk 2 found in HASHTABLE in time: 0.165
Star Walk 2 found in BINARY TREE in time: 0.398

Elmo Calls found in HASHTABLE in time: 0.215
Elmo Calls found in BINARY TREE in time: 0.614

McDonald's found in HASHTABLE in time: 0.248
McDonald's found in BINARY TREE in time: 0.709

Pocket God found in HASHTABLE in time: 0.168
Pocket God found in BINARY TREE in time: 0.859

SoundCloud - Music & Audio found in HASHTABLE in time: 0.346
SoundCloud - Music & Audio found in BINARY TREE in time: 0.832

Yahoo Mail found in HASHTABLE in time: 0.145
Yahoo Mail found in BINARY TREE in time: 0.682

HBO NOW found in HASHTABLE in time: 0.145
HBO NOW found in BINARY TREE in time: 0.689

Police Scanner+ Free found in HASHTABLE in time: 0.258
Police Scanner+ Free found in BINARY TREE in time: 0.762

Instagram found in HASHTABLE in time: 0.245
Instagram found in BINARY TREE in time: 0.544

Messenger found in HASHTABLE in time: 0.155
Messenger found in BINARY TREE in time: 0.692

Purify Blocker found in HASHTABLE in time: 0.201
Purify Blocker found in BINARY TREE in time: 0.608

iTunes Connect found in HASHTABLE in time: 0.201
iTunes Connect found in BINARY TREE in time: 0.714

myAT&T found in HASHTABLE in time: 0.141
myAT&T found in BINARY TREE in time: 0.669

Starbucks found in HASHTABLE in time: 0.176

Starbucks found in BINARY TREE in time: 0.574

Jo-Ann found in HASHTABLE in time: 0.136
Jo-Ann found in BINARY TREE in time: 0.581

Univision Deportes found in HASHTABLE in time: 0.243
Univision Deportes found in BINARY TREE in time: 0.765

Stylebook found in HASHTABLE in time: 0.25
Stylebook found in BINARY TREE in time: 0.588

Adobe Acrobat Reader found in HASHTABLE in time: 0.32
Adobe Acrobat Reader found in BINARY TREE in time: 0.589

Pinterest found in HASHTABLE in time: 0.181
Pinterest found in BINARY TREE in time: 0.616

Sleep Pillow Sounds found in HASHTABLE in time: 0.283
Sleep Pillow Sounds found in BINARY TREE in time: 0.591

National Geographic Magazine found in HASHTABLE in time: 0.285
National Geographic Magazine found in BINARY TREE in time: 0.581

xTube found in HASHTABLE in time: 0.152
xTube found in BINARY TREE in time: 0.611

Shazam - Discover music, artists, videos & lyrics found in HASHTABLE in time: 0.496
Shazam - Discover music, artists, videos & lyrics found in BINARY TREE in time: 0.789

Tollsmart found in HASHTABLE in time: 0.185
Tollsmart found in BINARY TREE in time: 0.501

Plague Inc. found in HASHTABLE in time: 0.188
Plague Inc. found in BINARY TREE in time: 1.238

MotionX GPC found in HASHTABLE in time: 0.191
MotionX GPC found in BINARY TREE in time: 0.84

Snap Upload for snapchat found in HASHTABLE in time: 0.253
Snap Upload for snapchat found in BINARY TREE in time: 0.667

Boating USA found in HASHTABLE in time: 0.166
Boating USA found in BINARY TREE in time: 0.701

TeamSpeak 3 found in HASHTABLE in time: 0.165
TeamSpeak 3 found in BINARY TREE in time: 0.576

Geekbench 3 found in HASHTABLE in time: 0.162
Geekbench 3 found in BINARY TREE in time: 0.634

Swype found in HASHTABLE in time: 0.19
Swype found in BINARY TREE in time: 0.504

Transit Directions by Moovit found in HASHTABLE in time: 0.311
Transit Directions by Moovit found in BINARY TREE in time: 0.583

Overcast: Podcast Player found in HASHTABLE in time: 0.253
Overcast: Podcast Player found in BINARY TREE in time: 0.664

Psych! found in HASHTABLE in time: 0.168
Psych! found in BINARY TREE in time: 0.856

BillMinder found in HASHTABLE in time: 0.194
BillMinder found in BINARY TREE in time: 0.549

Toca Hair Salon 2 found in HASHTABLE in time: 0.219
Toca Hair Salon 2 found in BINARY TREE in time: 0.511

Sago Mini Babies found in HASHTABLE in time: 0.251
Sago Mini Babies found in BINARY TREE in time: 0.33

Touch Surgery, Surgical Simulator found in HASHTABLE in time: 0.335
Touch Surgery, Surgical Simulator found in BINARY TREE in time: 0.677

Cosmopolitan Magazine US found in HASHTABLE in time: 0.313
Cosmopolitan Magazine US found in BINARY TREE in time: 0.537

Geocaching found in HASHTABLE in time: 0.163
Geocaching found in BINARY TREE in time: 0.542

PAW Patrol Rescue Run found in HASHTABLE in time: 0.346
PAW Patrol Rescue Run found in BINARY TREE in time: 0.486

Candy Crush Soda Saga found in HASHTABLE in time: 0.228
Candy Crush Soda Saga found in BINARY TREE in time: 0.944

Wake Alarm Clock found in HASHTABLE in time: 0.221
Wake Alarm Clock found in BINARY TREE in time: 0.501

Baby Heartbeats found in HASHTABLE in time: 0.185
Baby Heartbeats found in BINARY TREE in time: 0.491

City Maps 2Go Pro found in HASHTABLE in time: 0.221
City Maps 2Go Pro found in BINARY TREE in time: 0.539

EWallpaper found in HASHTABLE in time: 0.163
EWallpaper found in BINARY TREE in time: 0.591

Sonic Dash 2 found in HASHTABLE in time: 0.196
Sonic Dash 2 found in BINARY TREE in time: 0.661

ThemeLocks found in HASHTABLE in time: 0.143
ThemeLocks found in BINARY TREE in time: 0.446

YL Oils & Young Living Oils found in HASHTABLE in time: 0.343
YL Oils & Young Living Oils found in BINARY TREE in time: 0.478

Forbes Magazine found in HASHTABLE in time: 0.208
Forbes Magazine found in BINARY TREE in time: 0.509

DailyMVP: Daily Fantasy Sports found in HASHTABLE in time: 0.381
DailyMVP: Daily Fantasy Sports found in BINARY TREE in time: 0.722

PayPal found in HASHTABLE in time: 0.14
PayPal found in BINARY TREE in time: 0.451

Pandora - Free Music & Radio found in HASHTABLE in time: 0.293
Pandora - Free Music & Radio found in BINARY TREE in time: 0.639

Flashlight found in HASHTABLE in time: 0.163
Flashlight found in BINARY TREE in time: 0.654

Google Docs found in HASHTABLE in time: 0.223
Google Docs found in BINARY TREE in time: 0.506

hocus. found in HASHTABLE in time: 0.138
hocus. found in BINARY TREE in time: 0.614

Scribblenauts Remix found in HASHTABLE in time: 0.247
Scribblenauts Remix found in BINARY TREE in time: 0.516

doTERRA found in HASHTABLE in time: 0.157
doTERRA found in BINARY TREE in time: 0.535

Afterlight found in HASHTABLE in time: 0.181
Afterlight found in BINARY TREE in time: 0.521

GoodRx found in HASHTABLE in time: 0.181
GoodRx found in BINARY TREE in time: 0.517

Ultimate Guitar Tabs found in HASHTABLE in time: 0.233
Ultimate Guitar Tabs found in BINARY TREE in time: 0.581

Google Maps found in HASHTABLE in time: 0.163
Google Maps found in BINARY TREE in time: 0.674

Fit Men Cook found in HASHTABLE in time: 0.223
Fit Men Cook found in BINARY TREE in time: 0.724

HomeBudget with Sync found in HASHTABLE in time: 0.222
HomeBudget with Sync found in BINARY TREE in time: 0.368

Google found in HASHTABLE in time: 0.138
Google found in BINARY TREE in time: 0.606

Chrome found in HASHTABLE in time: 0.143
Chrome found in BINARY TREE in time: 0.599

Medium found in HASHTABLE in time: 0.14
Medium found in BINARY TREE in time: 0.589

The Wonder Weeks found in HASHTABLE in time: 0.229
The Wonder Weeks found in BINARY TREE in time: 0.559

Fitbit found in HASHTABLE in time: 0.14
Fitbit found in BINARY TREE in time: 0.487

Project Color by The Home Depot found in HASHTABLE in time: 0.303
Project Color by The Home Depot found in BINARY TREE in time: 0.464

Tinder found in HASHTABLE in time: 0.145
Tinder found in BINARY TREE in time: 0.414

Phone Tracker for iPhones found in HASHTABLE in time: 0.233
Phone Tracker for iPhones found in BINARY TREE in time: 0.702

Square Register found in HASHTABLE in time: 0.184
Square Register found in BINARY TREE in time: 0.504

Minecraft: Pocket Edition found in HASHTABLE in time: 0.318
Minecraft: Pocket Edition found in BINARY TREE in time: 0.627

Rainbow Loom Pro found in HASHTABLE in time: 0.255
Rainbow Loom Pro found in BINARY TREE in time: 0.459

GIF Keyboard found in HASHTABLE in time: 0.215
GIF Keyboard found in BINARY TREE in time: 0.648

Tiny Scanner Pro found in HASHTABLE in time: 0.215
Tiny Scanner Pro found in BINARY TREE in time: 0.429

Follow Boss found in HASHTABLE in time: 0.165
Follow Boss found in BINARY TREE in time: 0.433

djay 2 for iPhone found in HASHTABLE in time: 0.228
djay 2 for iPhone found in BINARY TREE in time: 0.544

Mixologist found in HASHTABLE in time: 0.158
Mixologist found in BINARY TREE in time: 0.456

College Football Radio & Live Scores! found in HASHTABLE in time: 0.299
College Football Radio & Live Scores! found in BINARY TREE in time: 0.744

Stack the States found in HASHTABLE in time: 0.193
Stack the States found in BINARY TREE in time: 0.366

Printer Pro found in HASHTABLE in time: 0.145
Printer Pro found in BINARY TREE in time: 0.596

Abby Lee Dance Secrets found in HASHTABLE in time: 0.237
Abby Lee Dance Secrets found in BINARY TREE in time: 0.661

Sing! Karaoke by Smule found in HASHTABLE in time: 0.326
Sing! Karaoke by Smule found in BINARY TREE in time: 0.591

Indeed Job Search found in HASHTABLE in time: 0.25
Indeed Job Search found in BINARY TREE in time: 0.466

PBS KIDS Video found in HASHTABLE in time: 0.231
PBS KIDS Video found in BINARY TREE in time: 0.597

Balloons TD 5 found in HASHTABLE in time: 0.198
Balloons TD 5 found in BINARY TREE in time: 0.874

AccuWeather found in HASHTABLE in time: 0.161
AccuWeather found in BINARY TREE in time: 0.616

FOX Sports GO found in HASHTABLE in time: 0.201
FOX Sports GO found in BINARY TREE in time: 0.594

Premium Music for Spotify found in HASHTABLE in time: 0.238
Premium Music for Spotify found in BINARY TREE in time: 0.447

1010! found in HASHTABLE in time: 0.135
1010! found in BINARY TREE in time: 0.649

CNN App for iPhone found in HASHTABLE in time: 0.23

CNN App for iPhone found in BINARY TREE in time: 0.676

MLB.com At Bat found in HASHTABLE in time: 0.248
MLB.com At Bat found in BINARY TREE in time: 0.596

7-Eleven, Inc. found in HASHTABLE in time: 0.178
7-Eleven, Inc. found in BINARY TREE in time: 0.534

Chase Mobile found in HASHTABLE in time: 0.167
Chase Mobile found in BINARY TREE in time: 0.483

Monogram it! found in HASHTABLE in time: 0.171
Monogram it! found in BINARY TREE in time: 0.449

iTrans NYC Subway found in HASHTABLE in time: 0.227
iTrans NYC Subway found in BINARY TREE in time: 0.539

Reeder 2 found in HASHTABLE in time: 0.15
Reeder 2 found in BINARY TREE in time: 0.621

NYTimes found in HASHTABLE in time: 0.196
NYTimes found in BINARY TREE in time: 0.493

7 Minute Workout Challenge found in HASHTABLE in time: 0.235
7 Minute Workout Challenge found in BINARY TREE in time: 0.581

GrubHub found in HASHTABLE in time: 0.199
GrubHub found in BINARY TREE in time: 0.461

Plane Finder found in HASHTABLE in time: 0.17
Plane Finder found in BINARY TREE in time: 0.481

Hype Machine found in HASHTABLE in time: 0.23
Hype Machine found in BINARY TREE in time: 0.626

MyChart found in HASHTABLE in time: 0.148
MyChart found in BINARY TREE in time: 0.468

DC Comics: Batman #1 found in HASHTABLE in time: 0.258
DC Comics: Batman #1 found in BINARY TREE in time: 0.549

SkyDroid - Golf GPS found in HASHTABLE in time: 0.23
SkyDroid - Golf GPS found in BINARY TREE in time: 0.549

IronMobile - Ironman Athlete Tracker found in HASHTABLE in time: 0.323
IronMobile - Ironman Athlete Tracker found in BINARY TREE in time: 0.478

Mad Libs found in HASHTABLE in time: 0.153
Mad Libs found in BINARY TREE in time: 0.434

Google Translate found in HASHTABLE in time: 0.195
Google Translate found in BINARY TREE in time: 0.423

Ocarina found in HASHTABLE in time: 0.185
Ocarina found in BINARY TREE in time: 0.524

Dataman Next found in HASHTABLE in time: 0.172
Dataman Next found in BINARY TREE in time: 0.443

Loopy HD found in HASHTABLE in time: 0.15
Loopy HD found in BINARY TREE in time: 0.534

Google Drive found in HASHTABLE in time: 0.183
Google Drive found in BINARY TREE in time: 0.597

YouTube Kids found in HASHTABLE in time: 0.251
YouTube Kids found in BINARY TREE in time: 0.446

TapeACallPro found in HASHTABLE in time: 0.233
TapeACallPro found in BINARY TREE in time: 0.386

Google Classroom found in HASHTABLE in time: 0.271
Google Classroom found in BINARY TREE in time: 0.431

Scanner Pro by Readdle found in HASHTABLE in time: 0.314
Scanner Pro by Readdle found in BINARY TREE in time: 0.401

NOAA Radar Pro found in HASHTABLE in time: 0.181
NOAA Radar Pro found in BINARY TREE in time: 0.616

Zombies, Run! found in HASHTABLE in time: 0.175
Zombies, Run! found in BINARY TREE in time: 0.539

Bowling King found in HASHTABLE in time: 0.221
Bowling King found in BINARY TREE in time: 0.794

Finished Results Live found in HASHTABLE in time: 0.241
Finished Results Live found in BINARY TREE in time: 0.544

Weather Live found in HASHTABLE in time: 0.171
Weather Live found in BINARY TREE in time: 0.477

Domino's Pizza USA found in HASHTABLE in time: 0.274
Domino's Pizza USA found in BINARY TREE in time: 0.491

YouTube found in HASHTABLE in time: 0.15
YouTube found in BINARY TREE in time: 0.496

Pocket Casts found in HASHTABLE in time: 0.208
Pocket Casts found in BINARY TREE in time: 0.586

IntelliDrink PRO - Blood Alcohol Content Calculator found in HASHTABLE in time: 0.383
IntelliDrink PRO - Blood Alcohol Content Calculator found in BINARY TREE in time: 0.384

iHandy Translator Pro found in HASHTABLE in time: 0.216
iHandy Translator Pro found in BINARY TREE in time: 0.416

Color Splash found in HASHTABLE in time: 0.203
Color Splash found in BINARY TREE in time: 0.507

Full Fitness found in HASHTABLE in time: 0.195
Full Fitness found in BINARY TREE in time: 0.459

Netflix found in HASHTABLE in time: 0.145
Netflix found in BINARY TREE in time: 0.494

My Verizon Mobile found in HASHTABLE in time: 0.193
My Verizon Mobile found in BINARY TREE in time: 0.659

Dropbox found in HASHTABLE in time: 0.148
Dropbox found in BINARY TREE in time: 0.641

Colorfy found in HASHTABLE in time: 0.185
Colorfy found in BINARY TREE in time: 0.549

Facebook Pages Manager found in HASHTABLE in time: 0.243
Facebook Pages Manager found in BINARY TREE in time: 0.466

Billionaire. found in HASHTABLE in time: 0.168
Billionaire. found in BINARY TREE in time: 0.83

Crystal found in HASHTABLE in time: 0.147
Crystal found in BINARY TREE in time: 0.531

Forks Over Knives found in HASHTABLE in time: 0.192
Forks Over Knives found in BINARY TREE in time: 0.499

Superimpose found in HASHTABLE in time: 0.239
Superimpose found in BINARY TREE in time: 0.461

Fox News found in HASHTABLE in time: 0.156
Fox News found in BINARY TREE in time: 0.511

Heads Up! found in HASHTABLE in time: 0.158
Heads Up! found in BINARY TREE in time: 0.689

Sherlock: Interactive Adventure found in HASHTABLE in time: 0.313
Sherlock: Interactive Adventure found in BINARY TREE in time: 0.564

ESPN found in HASHTABLE in time: 0.178
ESPN found in BINARY TREE in time: 0.544

iTunes U found in HASHTABLE in time: 0.246
iTunes U found in BINARY TREE in time: 0.328

Tattoo Fonts found in HASHTABLE in time: 0.236
Tattoo Fonts found in BINARY TREE in time: 0.481

Twitter found in HASHTABLE in time: 0.148
Twitter found in BINARY TREE in time: 0.679

Paprika Recipe Manager found in HASHTABLE in time: 0.225
Paprika Recipe Manager found in BINARY TREE in time: 0.441

Tweetbot 4 for Twitter found in HASHTABLE in time: 0.223
Tweetbot 4 for Twitter found in BINARY TREE in time: 0.639

Where's my MBTA Bus? found in HASHTABLE in time: 0.233
Where's my MBTA Bus? found in BINARY TREE in time: 0.493

TED Books found in HASHTABLE in time: 0.155
TED Books found in BINARY TREE in time: 0.426

Nike+ Running found in HASHTABLE in time: 0.208
Nike+ Running found in BINARY TREE in time: 0.533

Stride & Prejudice found in HASHTABLE in time: 0.231
Stride & Prejudice found in BINARY TREE in time: 0.351

Game of Life Classic Edition found in HASHTABLE in time: 0.27
Game of Life Classic Edition found in BINARY TREE in time: 0.701

WolframAlpha found in HASHTABLE in time: 0.176
WolframAlpha found in BINARY TREE in time: 0.391

Toca Kitchen 2 found in HASHTABLE in time: 0.178
Toca Kitchen 2 found in BINARY TREE in time: 0.323

Wish - Shopping Made Fun found in HASHTABLE in time: 0.251
Wish - Shopping Made Fun found in BINARY TREE in time: 0.381

HotSchedules found in HASHTABLE in time: 0.168
HotSchedules found in BINARY TREE in time: 0.394

Daily Craigslist Unlimited found in HASHTABLE in time: 0.238
Daily Craigslist Unlimited found in BINARY TREE in time: 0.481

Facebook found in HASHTABLE in time: 0.153
Facebook found in BINARY TREE in time: 0.634

BuzzFeed found in HASHTABLE in time: 0.153
BuzzFeed found in BINARY TREE in time: 0.539

VIP Pool Party found in HASHTABLE in time: 0.178
VIP Pool Party found in BINARY TREE in time: 0.531

Snagajob found in HASHTABLE in time: 0.151
Snagajob found in BINARY TREE in time: 0.361

Scout GPS Navigation, ETA, Maps & Traffic found in HASHTABLE in time: 0.316
Scout GPS Navigation, ETA, Maps & Traffic found in BINARY TREE in time: 0.529

Facetune found in HASHTABLE in time: 0.153
Facetune found in BINARY TREE in time: 0.413

WatchESPN found in HASHTABLE in time: 0.16
WatchESPN found in BINARY TREE in time: 0.489

Badoo Premium found in HASHTABLE in time: 0.215
Badoo Premium found in BINARY TREE in time: 0.522

Sky Guide: View Stars Night or Day found in HASHTABLE in time: 0.383
Sky Guide: View Stars Night or Day found in BINARY TREE in time: 0.395

Shopkins Magazine found in HASHTABLE in time: 0.349
Shopkins Magazine found in BINARY TREE in time: 0.454

Hair Color Dye found in HASHTABLE in time: 0.181
Hair Color Dye found in BINARY TREE in time: 0.454

Snapchat found in HASHTABLE in time: 0.216
Snapchat found in BINARY TREE in time: 0.396

Akinator the Genie found in HASHTABLE in time: 0.218
Akinator the Genie found in BINARY TREE in time: 0.611

PAUSE found in HASHTABLE in time: 0.143

PAUSE found in BINARY TREE in time: 0.491

Geometry Dash found in HASHTABLE in time: 0.24
Geometry Dash found in BINARY TREE in time: 0.601

Dubsmash found in HASHTABLE in time: 0.148
Dubsmash found in BINARY TREE in time: 0.483

eBay found in HASHTABLE in time: 0.133
eBay found in BINARY TREE in time: 0.388

FIFA 16 Ultimate Team found in HASHTABLE in time: 0.213
FIFA 16 Ultimate Team found in BINARY TREE in time: 0.654

Fitness Buddy found in HASHTABLE in time: 0.193
Fitness Buddy found in BINARY TREE in time: 0.461

Sleep Cycle alarm clock found in HASHTABLE in time: 0.24
Sleep Cycle alarm clock found in BINARY TREE in time: 0.444

Need for Speed found in HASHTABLE in time: 0.271
Need for Speed found in BINARY TREE in time: 0.624

The Wall Street Journal found in HASHTABLE in time: 0.248
The Wall Street Journal found in BINARY TREE in time: 0.526

Photo Plastic found in HASHTABLE in time: 0.183
Photo Plastic found in BINARY TREE in time: 0.391

Uber found in HASHTABLE in time: 0.135
Uber found in BINARY TREE in time: 0.511

Sky Whale found in HASHTABLE in time: 0.208
Sky Whale found in BINARY TREE in time: 0.454

Vine found in HASHTABLE in time: 0.136
Vine found in BINARY TREE in time: 0.429

What's On? found in HASHTABLE in time: 0.158
What's On? found in BINARY TREE in time: 0.366

iDownloads PLUS FREE found in HASHTABLE in time: 0.233
iDownloads PLUS FREE found in BINARY TREE in time: 0.579

The Walking Dead: No Man's Land found in HASHTABLE in time: 0.306
The Walking Dead: No Man's Land found in BINARY TREE in time: 0.536

Weird But True found in HASHTABLE in time: 0.178
Weird But True found in BINARY TREE in time: 0.301

Yelp found in HASHTABLE in time: 0.118
Yelp found in BINARY TREE in time: 0.419

Microsoft Outlook found in HASHTABLE in time: 0.201
Microsoft Outlook found in BINARY TREE in time: 0.583

Hulu found in HASHTABLE in time: 0.205
Hulu found in BINARY TREE in time: 0.487

Skeletal Anatomy 3D found in HASHTABLE in time: 0.233
Skeletal Anatomy 3D found in BINARY TREE in time: 0.466

Spotify Music found in HASHTABLE in time: 0.21
Spotify Music found in BINARY TREE in time: 0.669

Emoji 3 PRO found in HASHTABLE in time: 0.206
Emoji 3 PRO found in BINARY TREE in time: 0.373

PewDiePie found in HASHTABLE in time: 0.153
PewDiePie found in BINARY TREE in time: 0.672

Poems by Heart found in HASHTABLE in time: 0.219
Poems by Heart found in BINARY TREE in time: 0.338

Dude, your car! found in HASHTABLE in time: 0.205
Dude, your car! found in BINARY TREE in time: 0.423

Jubitrone the Girl Robot found in HASHTABLE in time: 0.237
Jubitrone the Girl Robot found in BINARY TREE in time: 0.331

Pizza Hut found in HASHTABLE in time: 0.211
Pizza Hut found in BINARY TREE in time: 0.496

MapQuest: Free Navigation, GPC, Maps & Traffic found in HASHTABLE in time: 0.333
MapQuest: Free Navigation, GPC, Maps & Traffic found in BINARY TREE in time: 0.684

Toca Life: City found in HASHTABLE in time: 0.215
Toca Life: City found in BINARY TREE in time: 0.393

Al Gore -- Our Choice: A Plan to Solve the Climate Crisis found in HASHTABLE in time: 0.383
Al Gore -- Our Choice: A Plan to Solve the Climate Crisis found in BINARY TREE in time: 0.416

MealBoard found in HASHTABLE in time: 0.158
MealBoard found in BINARY TREE in time: 0.463

Smashy Road: Wanted found in HASHTABLE in time: 0.234
Smashy Road: Wanted found in BINARY TREE in time: 0.554

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