

If found, please return to:

Record of Important Things



Simply, people can no longer remember passwords good enough to reliably defend against dictionary attacks, and are much more secure if they choose a password too complicated to remember and then write it down. We're all good at securing small pieces of paper. I recommend that people write their passwords down on a small piece of paper, and keep it with their other valuable small pieces of paper: in their wallet.

Bruce Schneier CTO, Resilient

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Login or E-mail address

Passwords used

Date

Notes

Web site

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Passwords used

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Notes

Secure passphrases with Diceware

<p>UNCOMMON (NON-GIBBERISH) BASE WORD</p> <p>ORDER UNKNOWN</p> <p>Tr0ub4dor &3</p> <p>CAPS? COMMON SUBSTITUTIONS NUMERAL PUNCTUATION</p> <p>(YOU CAN ADD A FEW MORE BITS TO ACCOUNT FOR THE FACT THAT THIS IS ONLY ONE OF A FEW COMMON FORMATS.)</p>	<p>~28 BITS OF ENTROPY</p> <p>$2^{28} = 3 \text{ DAYS AT } 1000 \text{ GUESSES/SEC}$</p> <p>(PLAUSIBLE ATTACK ON A WEAK REMOTE WEB SERVICE: YES, CRACKING A STOLEN HASH IS FASTER, BUT IT'S NOT WHAT THE AVERAGE USER SHOULD WORRY ABOUT.)</p> <p>DIFFICULTY TO GUESS: EASY</p>	<p>WAS IT TROMBONE? NO, TROUBADOR. AND ONE OF THE 0s WAS A ZERO?</p> <p>AND THERE WAS SOME SYMBOL...</p> <p>DIFFICULTY TO REMEMBER: HARD</p>
<p>correct horse battery staple</p> <p>FOUR RANDOM COMMON WORDS</p>	<p>~44 BITS OF ENTROPY</p> <p>$2^{44} = 530 \text{ YEARS AT } 1000 \text{ GUESSES/SEC}$</p> <p>DIFFICULTY TO GUESS: HARD</p>	<p>THAT'S A BATTERY STAPLE.</p> <p>CORRECT!</p> <p>DIFFICULTY TO REMEMBER: YOU'VE ALREADY MEMORIZED IT</p>

THROUGH 20 YEARS OF EFFORT, WE'VE SUCCESSFULLY TRAINED EVERYONE TO USE PASSWORDS THAT ARE HARD FOR HUMANS TO REMEMBER, BUT EASY FOR COMPUTERS TO GUESS.

Comic by <https://xkcd.com/> © ⓘ ♻

What is a Diceware passphrase?

A passphrase is a bunch of words and characters that you type in to your computer to let it know for sure that *the person typing is you*. Passphrases differ from passwords only in length.

Diceware is a method for picking passphrases which uses dice to select words at random from a special list. Each word in the list is preceded by a four digit number. All the digits are between one and six, allowing you to use the outcomes of four dice rolls to select a word from the list.

Directions

- 1 Decide how many words you want in your passphrase. A five-word passphrase provides a level of security *much* higher than the passwords most people use. For NSA-proof security, use seven words.
- 2 Roll all four dice at once and write the results down, reading from left to right, on a scrap paper. Make as many of these four-digit groups as you want words in your passphrase.
- 3 Flip to the word list and look up the corresponding word next to each four-digit number.
- 4 The words you have found are your new passphrase!
- 5 Come up with a way to remember your phrase. It might be a story, mental picture, or sentence that can remind you of the phrase you generated.

Example

Suppose you want a five-word passphrase. You will need 5×4 or 20 dice rolls. Let's say they come out as:

1, 6, 6, 6, 5, 1, 5, 6, 5, 3, 5, 6, 3, 2, 2, 3, 5, 6, 2, 6.

Write the results on a scrap of paper in groups of four:

1 6 6 6

5 1 5 6

5 3 5 6

3 2 2 3

5 6 2 6

You then look up each group of five rolls in the Diceware word list by finding the number in the list and writing down the word next to the number:

1666 cognitive

5156 poetic

5356 ribbon

3223 garlic

5626 smelliness

Your passphrase would then be:

cognitive poetic ribbon garlic smelliness

This passphrase is one of the 3,656,158,440,062,976 (about 2^{51}) alternatives that could have been chosen by this method.

1111 aardvark	1253 anagram	1435 axially	1621 cedar
1112 abandoned	1254 anchor	1436 azalea	1622 celery
1113 abbreviate	1255 android	1441 babbling	1623 cement
1114 abdomen	1256 anesthesia	1442 backpack	1624 census
1115 abhorrence	1261 angelfish	1443 badass	1625 ceramics
1116 abiding	1262 animal	1444 bagpipe	1626 cesspool
1121 abnormal	1263 anklet	1445 bakery	1631 chalkboard
1122 abrasion	1264 announcer	1446 balancing	1632 cheesecake
1123 absorbing	1265 anonymous	1451 bamboo	1633 chimney
1124 abundant	1266 answer	1452 banana	1634 chlorine
1125 abyss	1311 antelope	1453 barracuda	1635 chopsticks
1126 academy	1312 anxiety	1454 basket	1636 chrome
1131 accountant	1313 anyplace	1455 bathrobe	1641 chute
1132 acetone	1314 aorta	1456 bazooka	1642 cilantro
1133 achiness	1315 apartment	1461 blade	1643 cinnamon
1134 acid	1316 apnea	1462 blender	1644 circle
1135 acoustics	1321 apostrophe	1463 blimp	1645 cityscape
1136 acquire	1322 apple	1464 blouse	1646 civilian
1141 acrobat	1323 apricot	1465 blurred	1651 clay
1142 actress	1324 aquamarine	1466 boatyard	1652 clergyman
1143 acuteness	1325 arachnid	1511 bobcat	1653 clipboard
1144 aerosol	1326 arbitrate	1512 body	1654 clock
1145 aesthetic	1331 ardently	1513 bogusness	1655 clubhouse
1146 affidavit	1332 arena	1514 bohemian	1656 coathanger
1151 afloat	1333 argument	1515 boiler	1661 cobweb
1152 afraid	1334 aristocrat	1516 bonnet	1662 coconut
1153 aftershave	1335 armchair	1521 boots	1663 codeword
1154 again	1336 aromatic	1522 borough	1664 coexistent
1155 agency	1341 arrowhead	1523 bossiness	1665 coffeecake
1156 aggressor	1342 arsonist	1524 bottle	1666 cognitive
1161 aghast	1343 artichoke	1525 bouquet	2111 cohabitate
1162 agitate	1344 asbestos	1526 boxlike	2112 collarbone
1163 agnostic	1345 ascend	1531 breath	2113 computer
1164 agonizing	1346 aseptic	1532 briefcase	2114 confetti
1165 agreeing	1351 ashamed	1533 broom	2115 copier
1166 aidless	1352 asinine	1534 brushes	2116 cornea
1211 aimlessly	1353 asleep	1535 bubblegum	2121 cosmetics
1212 ajar	1354 asocial	1536 buckle	2122 cotton
1213 alarmclock	1355 asparagus	1541 buddhist	2123 couch
1214 albatross	1356 astronaut	1542 buffalo	2124 coverless
1215 alchemy	1361 asymmetric	1543 bullfrog	2125 coyote
1216 alfalfa	1362 atlas	1544 bunny	2126 coziness
1221 algae	1363 atmosphere	1545 busboy	2131 crawfish
1222 aliens	1364 atom	1546 buzzard	2132 crewmember
1223 alkaline	1365 atrocious	1551 cabin	2133 crib
1224 almanac	1366 attic	1552 cactus	2134 croissant
1225 alongside	1411 atypical	1553 cadillac	2135 crumble
1226 alphabet	1412 auctioneer	1554 cafeteria	2136 crystal
1231 already	1413 auditorium	1555 cage	2141 cubical
1232 also	1414 augmented	1556 cahoots	2142 cucumber
1233 altitude	1415 auspicious	1561 cajoling	2143 cuddly
1234 aluminum	1416 automobile	1562 cakewalk	2144 cufflink
1235 always	1421 auxiliary	1563 calculator	2145 cuisine
1236 amazingly	1422 avalanche	1564 camera	2146 culprit
1241 ambulance	1423 avenue	1565 canister	2151 cup
1242 amendment	1424 aviator	1566 capsule	2152 curry
1243 amiable	1425 avocado	1611 carrot	2153 cushion
1244 ammunition	1426 awareness	1612 cashew	2154 cuticle
1245 amnesty	1431 awhile	1613 cathedral	2155 cybernetic
1246 amoeba	1432 awkward	1614 caucasian	2156 cyclist
1251 amplifier	1433 awning	1615 caviar	2161 cylinder
1252 amuser	1434 awake	1616 ceasefire	2162 cymbal

2163 cynicism	2345 droppings	2531 engine	3113 feigned
2164 cypress	2346 drum	2532 enhance	3114 feline
2165 cytoplasm	2351 dryer	2533 enigmatic	3115 femur
2166 dachshund	2352 dubiously	2534 enjoyably	3116 fence
2211 daffodil	2353 duckling	2535 enlarged	3121 ferret
2212 dagger	2354 duffel	2536 enormous	3122 festival
2213 dairy	2355 dugout	2541 enquirer	3123 fettuccine
2214 dalmatian	2356 dumpster	2542 enrollment	3124 feudalist
2215 dandelion	2361 duplex	2543 ensemble	3125 feverish
2216 dartboard	2362 durable	2544 entryway	3126 fiberglass
2221 dastardly	2363 dustpan	2545 enunciate	3131 fictitious
2222 datebook	2364 dutiful	2546 envoy	3132 fiddle
2223 daughter	2365 duvet	2551 enzyme	3133 figurine
2224 dawn	2366 dwarfism	2552 epidemic	3134 fillet
2225 daytime	2411 dwelling	2553 equipment	3135 finalist
2226 dazzler	2412 dwindling	2554 erasable	3136 fiscally
2231 dealer	2413 dynamite	2555 ergonomic	3141 fixture
2232 debris	2414 dyslexia	2556 erratic	3142 flashlight
2233 decal	2415 eagerness	2561 eruption	3143 fleshiness
2234 dedicate	2416 earlobe	2562 escalator	3144 flight
2235 deepness	2421 easel	2563 eskimo	3145 florist
2236 defrost	2422 eavesdrop	2564 esophagus	3146 flypaper
2241 degree	2423 ebook	2565 espresso	3151 foamless
2242 dehydrator	2424 eccentric	2566 essay	3152 focus
2243 deliverer	2425 echoless	2611 estrogen	3153 foggy
2244 democrat	2426 eclipse	2612 etching	3154 folksong
2245 dentist	2431 ecosystem	2613 eternal	3155 fondue
2246 deodorant	2432 ecstasy	2614 ethics	3156 footpath
2251 depot	2433 edged	2615 etiquette	3161 fossil
2252 deranged	2434 editor	2616 eucalyptus	3162 fountain
2253 desktop	2435 educator	2621 eulogy	3163 fox
2254 detergent	2436 eelworm	2622 euphemism	3164 fragment
2255 device	2441 eerie	2623 euthanize	3165 freeway
2256 dexterity	2442 effects	2624 evacuation	3166 fridge
2261 diamond	2443 eggnog	2625 evergreen	3211 frosting
2262 dibs	2444 egomaniac	2626 evidence	3212 fruit
2263 dictionary	2445 ejection	2631 evolution	3213 fryingpan
2264 diffuser	2446 elastic	2632 exam	3214 gadget
2265 digit	2451 elbow	2633 excerpt	3215 gainfully
2266 dilated	2452 elderly	2634 exerciser	3216 gallstone
2311 dimple	2453 elephant	2635 exfoliate	3221 gamekeeper
2312 dinnerware	2454 elfishly	2636 exhale	3222 gangway
2313 dioxide	2455 eliminator	2641 exist	3223 garlic
2314 diploma	2456 elk	2642 exorcist	3224 gaslight
2315 directory	2461 elliptical	2643 explode	3225 gathering
2316 dishcloth	2462 elongated	2644 exquisite	3226 gauntlet
2321 ditto	2463 elsewhere	2645 exterior	3231 gearbox
2322 dividers	2464 elusive	2646 exuberant	3232 gecko
2323 dizziness	2465 elves	2651 fabric	3233 gem
2324 doctor	2466 emancipate	2652 factory	3234 generator
2325 dodge	2511 embroidery	2653 faded	3235 geographer
2326 doll	2512 emcee	2654 failsafe	3236 gerbil
2331 dominoes	2513 emerald	2655 falcon	3241 gesture
2332 donut	2514 emission	2656 family	3242 getaway
2333 doorstep	2515 emoticon	2661 fanfare	3243 geyser
2334 dorsal	2516 emperor	2662 fasten	3244 ghoulishly
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5515 sculpture	5661 steamboat	6243 tryout	6425 usher
5516 scythe	5662 stingray	6244 tubeless	6426 utensil
5521 secretary	5663 stopwatch	6245 tuesday	6431 utility
5522 sedative	5664 strawberry	6246 tugboat	6432 utmost
5523 segregator	5665 student	6251 tulip	6433 utopia
5524 seismology	5666 stylus	6252 tumbleweed	6434 utterance
5525 selected	6111 suave	6253 tupperware	6435 vacuum
5526 semicolon	6112 subway	6254 turtle	6436 vagrancy
5531 senator	6113 suction	6255 tusk	6441 valuables
5532 septum	6114 suds	6256 tutorial	6442 vanquished
5533 sequence	6115 suffocate	6261 tuxedo	6443 vaporizer
5534 serpent	6116 sugar	6262 tweezers	6444 varied
5535 sesame	6121 suitcase	6263 twins	6445 vaseline
5536 settler	6122 sulphur	6264 tyrannical	6446 vegetable
5541 severely	6123 superstore	6265 ultrasound	6451 vehicle
5542 shack	6124 surfer	6266 umbrella	6452 velcro
5543 shelf	6125 sushi	6311 umber	6453 vendor
5544 shirt	6126 swan	6312 unarmored	6454 vertebrae
5545 shovel	6131 sweatshirt	6313 unbuttoned	6455 vestibule
5546 shrimp	6132 swimwear	6314 uncle	6456 veteran
5551 shuttle	6133 sword	6315 underwear	6461 vexingly
5552 shyness	6134 sycamore	6316 unevenness	6462 vicinity
5553 siamese	6135 syllable	6321 unflavored	6463 videogame
5554 sibling	6136 symphony	6322 ungloved	6464 viewfinder
5555 siesta	6141 synagogue	6323 unhinge	6465 vigilante
5556 silicon	6142 syringes	6324 unicycle	6466 village
5561 simmering	6143 systemize	6325 unjustly	6511 vinegar
5562 singles	6144 tablespoon	6326 unknown	6512 violin
5563 sisterhood	6145 taco	6331 unlocking	6513 viperfish
5564 sitcom	6146 tadpole	6332 unmarked	6514 virus
5565 sixfold	6151 taekwondo	6333 unnoticed	6515 visor
5566 sizable	6152 tagalong	6334 unopened	6516 vitamins
5611 skateboard	6153 takeout	6335 unpaved	6521 vivacious
5612 skeleton	6154 tallness	6336 unquenched	6522 vixen
5613 skies	6155 tamale	6341 unroll	6523 vocalist
5614 skulk	6156 tanned	6342 unscrewing	6524 vogue
5615 skylight	6161 tapestry	6343 untied	6525 voicemail
5616 slapping	6162 tarantula	6344 unusual	6526 volleyball
5621 sled	6163 tastebud	6345 unveiled	6531 voucher
5622 slingshot	6164 tattoo	6346 unwrinkled	6532 voyage
5623 sloth	6165 tavern	6351 unyielding	6533 vulnerable
5624 slumbering	6166 thaw	6352 unzip	6534 waffle

6535 wagon	6562 wildcat	6625 wrongdoing	6652 zebra
6536 wakeup	6563 windmill	6626 xerox	6653 zeppelin
6541 walrus	6564 wipeout	6631 xylophone	6654 zestfully
6542 wanderer	6565 wired	6632 yacht	6655 zigzagged
6543 wasp	6566 wishbone	6633 yahoo	6656 zillion
6544 water	6611 wizardry	6634 yard	6661 zipping
6545 waving	6612 wobbliness	6635 yearbook	6662 zirconium
6546 wheat	6613 wolverine	6636 yesterday	6663 zodiac
6551 whisper	6614 womb	6641 yiddish	6664 zombie
6552 wholesaler	6615 woolworker	6642 yield	6665 zookeeper
6553 wick	6616 workbasket	6643 yoyo	6666 zucchini
6554 widow	6621 wound	6644 yodel	
6555 wielder	6622 wrangle	6645 yogurt	
6556 wifeless	6623 wreckage	6646 yuppie	
6561 wikipedia	6624 wristwatch	6651 zealot	

Security Questions

Shouldn't I never write my password down?

In today's world, major corporations are hacked every week, and distributed cracking networks can break complex passwords in record time. It's safest to use a strong, unique password for each account you hold, but this makes memorization impractical.

Once, people were told not to write passwords down, ever, but the consensus among security professionals has evolved. You're better at protecting this book than corporations are at securing their password databases.

Can I just pick my own words from the list?

No. Humans are terrible at being unpredictable, and hackers are great at exploiting predictability. The primary reason that Diceware creates secure passwords is that you have no agency in the process.

Should I leave spaces between the words?

Yes. It makes your passphrase more secure, and easier to type.

How many words should I use in my passphrase?

The most important accounts, such as email, e-commerce and financial sites, should use at least five words.

Encrypted drives storing sensitive personal and financial documents should use seven words.

Less critical accounts, like social media, can use three words provided the passwords are unique.

My passphrase was rejected because it is too long, or because it lacks capitalization and numbers.

You may shorten words to no less than three letters without affecting the security of your passphrase. You may also replace words with their associated 4 digit number. You may *not* choose different words.

Capitalization adds a very small amount of security; if required, pick a memorable word to capitalize.

What if I lose this book?

The real purpose of this book is to provide you with the tools to generate strong, memorable passwords that are unbreakable by the world's most powerful computers. It need not be the only place that you record them.

Are password managers like 1Password safe?

Yes, as long as the master password is strong & secure. For example, if Google Chrome is configured to store your password, make sure that you have a strong Google password, and don't leave your account logged in on computers or mobile devices that are not physically secure. The same is true of Safari and iCloud, Internet Explorer and Windows Live, etc.

Who invented Diceware?

Diceware was invented by Arnold G. Reinhold, a computer scientist in Cambridge, MA. It was first published to Usenet's *sci.crypt.research* on August 1st, 1995. For lots more information, see <https://google.com/search?q=xobzeV>.

This book implements a simplified version developed by the Electronic Frontier Foundation (EFF) in 2016.

What is the danger in reusing a password?

Imagine that you used the same password for an online clothing store, and your email provider. Months later, the clothing store is hacked and your password is stolen. The hackers login to your email and find correspondence from your bank. They use the bank website to reset your online banking password, and intercept the confirmation email. Next, they use the bank website to order checks in your name, initiate transfers, etc.

This story illustrates why the security of your email ranks above others in importance: for hackers, it is the gateway to all your accounts.

How can I find out if my password has been stolen?

Visit haveibeenpwned.com, and type in your email address. This helpful site tracks the data leaks released by hackers, and can identify which email addresses were hacked and how much data was released.

If your email tests positive, immediately change the password for the sites listed *and* any sites that might have used the same password.

What is two-factor authentication?

Two-factor authentication enhances your password by sending a code to your phone or another device, which you must supply in order to be authorized. This ensures that even if someone has your password, they also need to have your phone.

It's a good idea to set up two-factor authentication on any account linked to your bank account or credit cards.

The US Government no longer recommends SMS for two-factor authentication, due to the ease with which text messages can be intercepted. Mobile apps such as Google Authenticator are more secure.

What is phishing?

Phishing is when a hacker sends you an email that appears to be from an organization you have a relationship with, but is actually a

trap to cause you to give up your password.

Phishing emails typically warn you that something is wrong with your account, and urge you to log in via a link. They can be very realistic and insidious.

Always check the URL in any emailed links you click, and be sure that they take you to the site you expect.

What is social engineering?

Social engineering is when a hacker contacts a company you do business with and pretends to be you. Often this means telling customer service that you have lost your password, and trying to convince the representative to change it or otherwise unlock your account.

The best protection against social engineering is to avoid easily-guessed security questions, such as your mother's maiden name. When asked for such information, generate a Diceware password instead.

How can I stay safe online?

Above all, practice good operational security (*opsec*). Be suspicious and careful online.

Minimize the number of accounts you open, and always choose the best account security available. Keep track of the accounts you open, close unused accounts, and change passwords on active accounts regularly. Prefer to shop with businesses that have strong online safeguards, and take advantage of identity protection and online shopping protection services offered by reputable financial institutions.

What to do if I've been hacked?

The resources at crashoverridenetwork.com and staysafeonline.org are a good starting point. They provide tools that help determine whether you have been hacked and can help regain control over your online accounts.

Record of Important Things

Compiled & edited by Wade Brainerd

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XKCD comic from:

<https://xkcd.com/936/>

Diceware by Arnold G. Reinhold from:

<http://world.std.com/~reinhold/diceware.html>

Diceware word list from:

<https://www.eff.org/deeplinks/2016/07/new-wordlists-random-passphrases>

https://www.eff.org/files/2016/09/08/eff_short_wordlist_2_0.txt

The L^AT_EX source code for this book is located at:

<https://github.com/wadetb/dicebook>