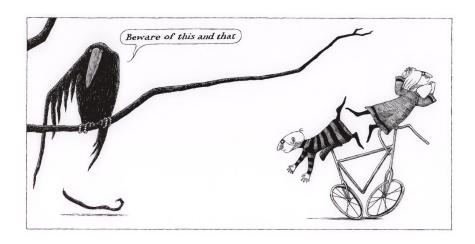


## Record of Important Things



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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Cryptographically-secure passphrases with Diceware

Questions & answers regarding online security

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Notes	

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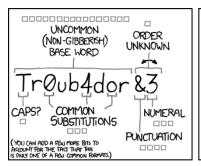
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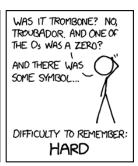
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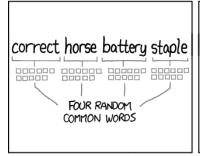
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# Secure passphrases with Diceware



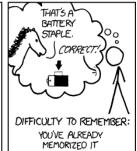








DIFFICULTY TO GUESS: HARD



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 fiveword 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  $5 \times 4$  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:

- 1666
- 5 1 5 6
- 5 3 5 6
- 3 2 2 3
- 5626

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 1124 abundant	1265 anonymous 1266 answer	1451 bamboo 1452 banana	1633 chimney 1634 chlorine
1124 abundant 1125 abyss	1311 antelope	1452 banana 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 1531 breath	2112 collarbone
1163 agnostic 1164 agonizing	1345 ascend 1346 aseptic	1531 breath 1532 briefcase	2113 computer 2114 confetti
1165 agreeing	1351 ashamed	1532 briefcase 1533 broom	2114 confecti 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 1422 avalanche	1563 calculator	2145 cuisine
1236 amazingly		1564 camera	2146 culprit
1241 ambulance 1242 amendment	1423 avenue 1424 aviator	1565 canister 1566 capsule	2151 cup 2152 curry
1242 amendment 1243 amiable	1424 aviator 1425 avocado	1611 carrot	2152 curry 2153 cushion
1244 ammunition	1426 awareness	1612 cashew	2154 cuticle
1245 amnesty	1431 awhile	1613 cathedral	2154 cuticle 2155 cybernetic
1246 amoeba	1432 awkward	1614 caucasian	2156 cyclist
1251 amplifier	1433 awning	1615 caviar	2161 cylinder
1252 amuser	1434 awoke	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 3161 fossil
2251 depot	2433 edged 2434 editor	2615 etiquette	3162 fountain
2252 deranged 2253 desktop	2434 educator	2616 eucalyptus 2621 eulogy	3162 fountain 3163 fox
2254 detergent	2436 eelworm	2622 euphemism	3164 fragment
2255 device	2441 eerie	2623 euthanize	3165 freeway
2256 device 2256 dexterity	2441 eeffects	2624 evacuation	3166 fridge
2261 diamond	2442 enects 2443 eggnog	2625 evergreen	3211 frosting
2262 dibs	2444 egomaniac	2626 evidence	3211 frosting 3212 fruit
2263 dictionary	2445 ejection	2631 evolution	3212 fruit 3213 fryingpan
2264 diffuser	2446 elastic	2632 exam	3214 gadget
2265 digit	2451 elbow	2633 excerpt	3214 gauget 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
2335 double	2521 emulate	2663 faucet	3245 gibberish
2336 downstairs	2522 enactment	2664 favorite	3246 giddiness
2341 dozed	2523 enchilada	2665 feasibly	3251 giftshop
2342 drainpipe	2524 endorphin	2666 february	3252 gigabyte
2343 dresser	2525 energy	3111 federal	3253 gimmick
2344 driftwood	2526 enforcer	3112 feedback	3254 giraffe

3255 giveaway	3441 hugeness	3623 jezebel	4165 leisure
3256 gizmo	3442 hullabaloo	3624 jiffy	4166 lemon
3261 glasses	3443 human	3625 jigsaw	4211 length
3262 gleeful	3444 hunter	3626 jingling	4212 leopard
3263 glisten	3445 hurricane	3631 jobholder	4213 leprechaun
3264 glove	3446 hushing	3632 jockstrap	4214 lettuce
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3266 glycerin	3452 hybrid 3453 hydrant	3634 john	4216 levers
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3322 gorgeous	3464 identical	3646 juggle	4232 lilac
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3324 gothic	3466 idly	3652 jujitsu	4234 lint
3325 gourmet	3511 igloo	3653 jukebox	4235 lioness
3326 governor	3512 ignition	3654 jumpiness	4236 lipstick
3331 grape	3513 iguana	3655 junkyard	4241 liquid
3332 greyhound	3514 illuminate	3656 juror	4242 listless
3333 grill	3515 imaging	3661 justifying	4243 litter
3334 groundhog	3516 imbecile	3662 juvenile	4244 liverwurst
3335 grumbling	3521 imitator	3663 kabob	4245 lizard
3336 guacamole	3522 immigrant	3664 kamikaze	4246 llama
3341 guerrilla	3523 imprint	3665 kangaroo	4251 luau
3342 guitar	3524 iodine	3666 karate	4252 lubricant
3343 gullible	3525 ionosphere 3526 ipad	4111 kayak 4112 keepsake	4253 lucidity 4254 ludicrous
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3351 gutless	3533 irksome	4114 kerosene 4115 ketchup	4261 lullaby
3352 gymnast	3534 iron	4116 khaki	4262 lumberjack
3353 gynecology	3535 irrigation	4121 kickstand	4263 lunchbox
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3355 habitat	3541 isotope	4123 kimono	4265 luscious
3356 hacking	3542 issueless	4124 kingdom	4266 luxurious
3361 haggard	3543 italicize	4125 kiosk	4311 lyrics
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3363 halogen	3545 itinerary	4131 kite	4313 maestro
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3421 hedgehog	3563 jarring	4145 lantern	4331 marbles
3422 hefty	3564 jasmine	4146 laptop	4332 massager
3423 heinously	3565 jaundice	4151 laryngitis	4333 matchstick
3424 helmet	3566 jawbreaker	4152 lasagna	4334 maverick
3425 hemoglobin	3611 jaywalker	4153 latch	4335 maximum
3426 henceforth	3612 jazz	4154 laundry	4336 mayonnaise
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3432 hesitation	3614 jeep	4156 laxative	4342 mobilize
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3434 hubcap	3616 jeopardize	4162 lecturer	4344 modify
3435 huddling	3621 jersey	4163 leftover	4345 moisture
3436 huff	3622 jetski	4164 leggings	4346 molecule

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4364 mozzarella	4546 occupation	5132 peroxide	5314 rebuilt
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4424 myspace	4566 oncoming	5152 plug	5334 reopen
4425 myth	4611 onion	5153 plywood	5335 reporter
4426 nail	4612 onlooker	5154 pneumonia	5336 request
4431 namesake	4613 onstage	5155 podiatrist	5341 rerun
4432 nanosecond	4614 onward	5156 poetic	5342 reservoir
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4434 narrator	4616 oomph	5162 poison	5344 reunion
4435 nastiness	4621 opaquely	5163 poking	5345 revolver
4436 natives	4622 opera	5164 policeman	5346 rewrite
4441 nautically	4623 opium	5165 poncho	5351 rhapsody
4442 navigate	4624 opossum	5166 popcorn	5352 rhetoric
4443 nearest	4625 opponent	5211 porcupine	5353 rhino
4444 nebula	4626 optical	5212 postcard	5354 rhubarb
4445 nectar	4631 opulently	5213 poultry	5355 rhyme
4446 nefarious	4632 oscillator	5214 powerboat	5356 ribbon
4451 negotiator	4633 osmosis	5215 prairie	5361 riches
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4455 nephew 4456 nervously	4642 ovation	5224 pry	5366 riskily
4461 nest	4643 oven	5225 pseudo	5411 ritzy
4462 netting	4644 owlish	5226 psychopath	5411 litzy 5412 riverboat
4463 neuron	4645 oxford	5231 publisher	5413 roamer
4464 nevermore	4646 oxidize	5232 pucker	5414 robe
4465 nextdoor	4651 oxygen	5233 pueblo	5415 rocket
4466 nicotine	4652 oyster	5234 pulley	5416 romancer
4511 niece	4653 ozone	5235 pumpkin	5421 ropelike
4512 nimbleness	4654 pacemaker	5236 punchbowl	5422 rotisserie
4513 nintendo	4655 padlock	5241 puppy	5423 roundtable
4514 nirvana	4656 pageant	5242 purse	5424 royal
4515 nuclear	4661 pajamas	5243 pushup	5425 rubber
4516 nugget	4662 palm	5244 putt	5426 rudderless
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4532 oasis	5114 pavement	5256 racoon	5442 sabotage

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5444 saddlebag	5626 smelliness	6212 thimble	6354 upcountry
5445 saffron	5631 smitten	6213 thorn	6355 update
5446 sainthood	5632 smokestack	6214 throat	6356 upfront
5451 saltshaker	5633 smudge	6215 thumb	6361 upgrade
5452 samurai	5634 snapshot	6216 thwarting	6362 upholstery
5453 sandworm	5635 sneezing	6221 tiara	6363 upkeep
5454 sapphire	5636 sniff	6222 tidbit	6364 upload
5455 sardine	5641 snowsuit	6223 tiebreaker	6365 uppercut
5456 sassy	5642 snugness	6224 tiger	6366 upright
5461 satchel	5643 speakers	6225 timid	6411 upstairs
5462 sauna	5644 sphinx	6226 tinsel	6412 uptown
5463 savage	5645 spider	6231 tiptoeing	6413 upwind
5464 saxophone	5646 splashing	6232 tirade	6414 uranium
5465 scarf	5651 sponge	6233 tissue	6415 urban
5466 scenario	5652 sprout	6234 tractor	6416 urchin
5511 schoolbook	5653 spur	6235 tree	6421 urethane
5512 scientist	5654 spyglass	6236 tripod	6422 urgent
5513 scooter	5655 squirrel	6241 trousers	6423 urologist
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5515 sculpture	5661 steamboat	6243 tryout	6425 usher
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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 umpire	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
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6535 wagon	
6536 wakeup	
6541 walrus	
6542 wanderer	
6543  wasp	
6544 water	
6545 waving	
6546 wheat	
6551 whisper	
6552 wholesale	er
6553 wick	
6554  widow	
6555 wielder	
6556 wifeless	
6561 wikipedia	a

6562 wildcat
6563 windmill
6564 wipeout
6565 wired
6566 wishbone
6611 wizardry
6612 wobbliness
6613 wolverine
6614  womb
6615 woolworker
6616 workbasket
6621 wound
6622 wrangle
6623 wreckage
6624 wristwatch

6625	wrongdoing
6626	xerox
6631	xylophone
6632	yacht
6633	yahoo
6634	yard
6635	yearbook
6636	yesterday
6641	yiddish
6642	yield
6643	yoyo
6644	yodel
6645	yogurt
6646	yuppie
6651	zealot

6652 zebra
6653 zeppelin
6654 zestfully
6655 zigzagged
6656 zillion
6661 zipping
6662 zirconium
6663 zodiac
6664 zombie
6665 zookeeper
6666 zucchini

# 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 1<sup>st</sup>, 1995. For lots more information, see https://goo.gl/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 ©()(\$

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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 LATEX source code for this book is located at:

https://github.com/wadetb/dicebook