SEQUENTIAL SNAKES AND LADDERS

REX GOOCHE
Letchworth, Herts, England

In a private communication I recently received an example and a challenge. The example was to change COLD to BARE by changing each letter in turn (all words to be valid), then to return to COLD in the same fashion: COLD BOLD BALD BARD BARE CARE CORE COLE COLD. I have previously called such sequences of there-and-back (regardless of the order of change) Snakes and Ladders, so I term these sequences Sequential Snakes and Ladders, or SSLs for short. Notice that it makes no difference whether you start from COLD or BARE: you will get the same words. Moreover, the two terminal words completely define all the intermediate words, so I shall merely give the terminal words. The challenge was to do this with five-letter words.

In my article "Statistics of Word Neighbours" in the Nov 1997 Word Ways, Graph 6 showed how rapidly the number of neighbours (words with one changed letter) decreases as the word length increases. This was the basis for a discussion in my article "Snakes and Ladders" in the May 1998 issue on how easy it was to create word ladders with four- and five-letter words, and how difficult for those with eight- and nine-letter words. Drawing upon ladders from past issues of Word Ways, the article exhibited 41 of length seven, over 31 of length eight (though many were related), and just two of length nine. Though there are undoubtedly many more ordinary ladders, the work for this article attempted to count all Sequential Snakes and Ladders for lengths of four or more. It is no surprise that the added restriction of sequential change and there-and-back has a very dramatic effect on the number possible. Indeed, though I found a few million ladders using four-letter words, I found merely 47 from the much larger number of words of length six, and none from words of length seven.

In "Modular Ladders" in the May 1996 Word Ways, Leonard Gordon and Ross Eckler defined a module as a ladder in which all letters are changed in turn (as in this article). The Sequential Snakes and Ladders in this article are special cases of their modular ladders, and could be termed modular two-cycles, the second module returning to the first. Their article also pointed out the high connectivity of four-letter words.

75 percent of all four-letter words start SSLs, each word on the average generating 213 different ones. The most popular starting words for SSLs are BARE 1833, SALE 1785, HARE 1767, MARE 1735, HALE 1731, SARE 1729 and PERE 1712. Note that all end in -E, and that -ARE and -ALE are popular. Despite the fact that there are a few million SSLs with words of length four, finding eight linked words free of hyphens and apostrophes, commonly known, not plurals, and with their terminal words related in

Copyright Rex Gooch 2000
meaning is difficult, so the example originally given to me is not so common. Note that it
does in fact belong to the largest group of SSLs, those starting with BARE. Other SSLs
starting with BARE include CODS, CONK, CUPS, COTS, CUTS, DENT, DICK, DINS,
DOGS, DOSS, DUCK, DUNK, FICK, FIND, FINK, HIND, HOLD, HONK, MEND, MESS,
MICK, MILK, MIND, MINK, MUSK, PETS, PINK, POND, PUCK, TINK, TINS, TINT,
TONK, TOPS, TOPS, WIND, and WINK. All intermediate words can be found in
medium dictionaries, by which I mean Pulliam and Carruth’s Word Game Dictionary,
The American Heritage Dictionary and the Concise Oxford Dictionary; I also allow com-
mon given names like FRED or BART. All eight words in the following are common:

BONK TONK TANK TALK TALE BALE BOLE BONE
BUST MUST MIST MILT MILK BULK BUSK
CLAW SLAW SHAW SHOW SHOP CLOP CLAP
CLIT SLIT SHIT SHOT SHOP CLOP CLIP
DARE WARE WINE WINK DINK DANK DARK
DIED TIED TEED TEND TENT DENT DINT DIET
DINE FINE FANE FARE FART DART DIRT DINT
FIND HIND HANE HARD HARE FARE FIRE FINE
HEAT MEAT MOAT MOLT MOLD HOLD HELD HEAD
HOST MOST MAST MALT MALE HALE HOLE HOSE
LACE PACE PICE PINE PINK LINK LACK
MILE PILLE POLE POSE POST MOST MIST MILT
MINE SINE SANE SALE SALT MALT MILT MINT
MINE VINE VANE VASE VAST MAST MIST MINT
MOLE VOLE VALE VAPE VAST MAST MOST MOLT
PINK RINK RANK RACK RACE PACE PICE PINE

Next I have tried to pick a selection of word-pairs which are apt, amusing, or perhaps
surreal, such as BEES GRIN or VAST MOLE. Some pairs are related by associated
meanings such as BALM HEAL, BUST MILK, BANE LUCK, VAST HOLE and MILK
WEAN, or the frequently-encountered LOUD YAWN, SALT MINE, DIRE LUCK, MINE
HOST, TIRE WALL (in motor racing), BUSH HATS, FIND WORK, HATE FUSS, MARK
WELL (my words), LOSE PATH, PALE TINT, PEAR TART, RUST HOLE or WEAR
THIN. One pair, TAKE LIFT, has two synonyms for theing. MARK WEAL and MARK
WELT are more or less synonyms. The ultimate association is where two words join
into one: MILEPOST, PEATMOSS, SLIPKNOT, FAREWELL, RAILHEAD, or the
accidental MISSPENT! There are also antonyms such as FORE HIND. Sometimes the
link is by appropriate imagery such as BANK MOSS or WINE SACK (sherry). Some are
consequences, like BEND PAIN, BINT DOSE, BEER SHAT, DINE FART, LICE RASH.

Often one word of the pair is the same as a word in another pair, and this can extend
further, as in the following story which you might call a SICK TALE: The small dog had
been bought at a RUNT SALE (next to the CLIT SALE in the CLIT SHOP, behind the
CLAW SHOP and by the DOLL MART). The MUTT looked PALE: PORE MUTT! The
RUNT had eaten the PATE (I did FEED the RUNT, and saw him BOLT the PATE), and
was now a PALE RUNT. Ill RUNT did make a PILE, a VAST PILE, and did PISS on the
BEST SEAT. Its French-American father (PERE) was called WALT. Though PERE
could manage a WINK, you could see PERE WILT, so PERE was also SICK. Their
master, who was a TINY POLE of the PINK RACE, was upset, and did PINE for WALT after his sad end... More odd connections are given in the list below.

| BABY—GONE | BAKE—FETA | BAND—FOLK | BARD—SOLO | BASH—DICK | BATH—LUST |
| BATH—MUST | BEAN—MILL | BEAR—HARM | BEAT—MONK | BENT—DICK | BENT—POLE |
| BEST—COLA | BINT—MALE! | BITE—POLO (brand of mint) | | BITS—LOST | BOIL—MAUD |
| BOLD—WINK | BOLT—MEND | BONK—HARD | BONK—MULE | BONK—TALE (bodice ripper) | |
| BORE—CAST | BOSS—HATE | BOSS—LATE | BOSS—PINK | BRAT—FLED | BREW—THAT |
| BRUT (fragrance)—POOH | | BULL—GOAT | BULL—HARE | BULL—MARE | BURN—TEAT |
| BURT—JILL | BUSH—RATS | BUST—MALE | CALL—HERE | CANE—WORN | CARE—MOST |
| CASH—HUNT | CAST—HOLE | CAST—WORK | CHAT—GRIN | CHAT—SLOW | |
| CHOP—SLAW (coleslaw) | | CITY—PARK | CLAM—GRIP | CLAM—GROW | COLA—SAME |
| COLA—TANK | COLD—HERE | COLD—WARE | COLT—DARK | COLT—DUCK | COLT—HARE |
| COLT—MANE | COLT—MARE | CONK—HARD | COON—PAUL | COPE—RATS | |
| CORD—SADE (but no whips) | | COSH—TACO (Mexican weapon) | | COST—HATS | COTS—LIST |
| CROW—FLAP (not just cats!) | | CROW—PLAY | CULL—HART | CURD—WANT | CURE—DOLL |
| CURE—MOLL | CURT—HATE | CUTE—MOSS (Kate, supermodel) | | CUTE—TOPS (other models) | |
| DAMP—TERN | DARE—WINK | DARK—LUCE (opposites) | | DARK—LUST | DATE—TODO |
| DEAL—GAIN | DEAR—PAIN | DEMO—MADE | DEMO—MORE | DENT—WARE | DICK—LASH |
| DICK—RENT | DIED—TENT | DINE—PERK | DIRT—JUNK | DISH—HUNK (desirable people) | |
| DOGE—LAZY | DOGS—LATE | DOLL—PURE | DOLL—HATE | DOME—HAZY | DONE—LAST |
| DONE—PAST | DONT—FUSE | DORY—PIKE (fish) | | DOTE—LASS | DOTH—MUSE |
| DOTS—LINE | DUCE—LAST (Mussolini) | | DUCK—FEET | DUCK—RENT | DUET—SELL |
| DULL—FEET | DUNK—FACE | DUNK—MICE | FACE—PINK | FAIL—SOON | |
| FARE—MIND (Word Ways) | | FART—WELL | FATE—WISH | FEAR—HAIL | FEEL—MOOD |
| FENS—SOLD | FETA—MARE | FILL—HERS | FILM—MERE | FILO—MADE | FIND—HARE |
| FINE—LUCK | FINE—WACK | FINO—MADE | FOIL—MARE | FONT—WELD | |
| FORE—TALK (before foreplay) | | FOUL—MAIN | FOUL—MAIN (sewer) | FOUL—PAIN | |
| GAIL—SOUR | GAIN—MEAL | GAIN—REAL | GOOD—PRAM | GEAR—PAIN | GIRO—HELME |
| GITE—POSHE | GOLD—MEAL | GOLD—WARE | GOOD—PER | GOON—PIER | GORE—PULP |
| GORY—TIDE | GOWN—TAUT | GRIN—THAT | GYRO—TALE | HAKE—MESH | |
| HALE—MISS (& Mr Hearty) | | HALE—SICK | HALO—KINK | HARD—SOLE | HARE—MIN |
| HARK—WELL | HART—MOLE | HATE—KILT | HATE—MINT | HATE—POST | HATE—RUST |
| HATH (KATH)—KISS | | HATH—LUST | HATS—LINT | HEAL—PALM | HEAT—MOLD |
| HELD—MIRO | HENS—SOLD | HIND—RUDE | HOLD—MINE | HOLY—PAKE | HOLY—PUKE |
| HOMO—MALE | HONE—PICK | HOST—MALE | HUNK—MART | HUNT—PACK | KATE—TINA |
| KEPT—SORE | LACE—PINK | LACK—TUNE | LANE—WORD | LANK—MICE | LASS—SENT |
| LAST (PAST POST)—POTS | | LAST—WIFE | LATE—MISS | LATE—RUSE | LEND—TIES |
| LENT—MASS | LENT—MORE | LIFT—TATE | LILY—POKE | LILY—PUKE | LINE—MESS |
| LINE—RUST | LINT—MASK | LION—PEES | LOCO—MAMA | LORE—WITS | LOSS—TATE |
| LURE—SONG (The Sirens) | | LURK—MICE | MAKE—SILO | MALE—TINA | |
| MARE—PONY | MART—PONY | MARY—WINO | MEAL—SILD (herring) | MELT—SAND | |
| MEND—WARE | MERE—WILD | MESA—PATH | MESS—SORE | MIND—WARY | |
| MINE—SALT | MINE—VAST | MINT—PACK | MILD—SORE | MOIN—TINY | |
| MOLE—WART | MOLE—WENT | MONK—TALE | MOLD—WANT | MOLE—TINY | |
| MOTH—WISE | MULE—PACK | MUTE—PAST | MOPS—TATE (Gallery) | MORE—TOLL | |
| PACK—WINE | PAID—SELL | PAY—REAL | NARY—WINE | NOSH—SAME | |
| PETE—SAGA | PICK—SEAT | PICK—TEAT (twin’s dilemma) | PAY—REAR | PEST—VANS | |
| PILE (big house)—TORY | | PILE—WANT | PILE—WENT | PICK—TUNA | PICK—TERN |
| PISS—SENT (opposite of take piss?) | | POKE—TINY | POKE—WILY | PINT—VALE | |
| POOR—SHIT | PORE—TINY | PORN—TAUT (good writing?) | PORN—WEAK | POND—WARE | POOL—SILT |
| POOR—TASE | RACK—WINE | RAIN—SEND | RASH—SITE | PORT—TAKE | |
| REAR—SOUP | RENT—SUED | RODE—WIND | RASH—SITE | REAL—SOUP | |
| SALT—WIFE (of Lott?) | | SAME—TOGA | SASH—WINE | SALE—TOGA | |
| SEGA (games console)—VILE | | SELL—TIRE | SEEM—THAT | SEEN—THAT | |
| SILT—TOOL | SITE—WASH | SOLD—TENS | SOLD—WAF | SHAM—WEED (bad trip!) | TORY—WAVE |
| SPICE | TRAP—WHIG |
For words of length five, about 20 percent begin SSLs, and each one generates nearly nine ladders on the average. Popular starting words are COLES 166, HOLES 137, MARES 136, PERES 131, WALES 116, SALES 115, BARDE 111, WARES 105. In the following list, all words can be found in medium dictionaries.

BANDY PANDY PONDY PODDY PODGY PODGE BUDGE BADGE BANGE BANDE
BARDY PARDY PURDY PUDDY PUDGY PUDGE BUDGE BADGE BARGE BARDE
CHINE SHINE SLINE SLONE SLOPE SLOPS CLOPS CHOPS CHIPS CHINS
CLARE SLARE SHARE SHIRE SHICE SHICK CHICK CLICK CLARK
CLONE SLONE SHONE SHINE SHICK CHICK CLICK CLOCK CLONK
CLOTS SLOTS SHOTS SHITS SHINS SHINE CHINE CLINE CLONE CLOTE
DOLLY POLLY PALLY PARTY PARTS DARTS DORTS DOLTS DOLLS
FLAKY SLAKY SOAKY SOOKY SOTY SOOTS FOOTS FLOTS FLATS FLAKS
MILLY WILLY WALLY WANYL WANLY WANEY WANEYS MANES MINES MILES MILLS

The following ladders are nearly as good, only one word (asterisked) not being found in medium dictionaries.

ALICK*SLICK STICK STOCK STONK STONE ATONE ALONE ALINE ALICE
ALACK SLACK STACK STOCK STONK STONE ATONE ALONE ALANE ALACE*
BARDY GARDY GURDY GUNDY GUNKY GUNKS*BUNKS BANKS BARKS BARDS
BARKS MARKS MIRKS*MILKS MILLS MILLY BILLY BALLY BARY BARKY
BARRY LARRY LORRY LOURY LOUSY LOUSE BOUSE*BARSE BARRE
BALLY WALLY WILLY WINLY WINDY WINDS BINDS BANDS BALDS*BALLS
BINGE TINGE TANE TANDE TARDE TARDY BARDY BIRDY BINDY*BINGY
BRINE CRINE CLINE CLONE CLOCE*CLOCK BLOCk BROCK BRICK BRINK
BUNTY PUNTY PANTY PARTY PARKS BARKS BURKS*BUNKS BUNTS
BURRA SURRA SERRA SELRA*SILLA SELLY BELLY BULLY BURLY BURRY
CARRY LARRY LORRY LOURY LOUSY COUSE*CAUSE CASE CARRE
CHART SHART*SLART SLIRT SLIPT SLITS CLIPS CHIPS CHAPS CHARS
CHINE SHINE SLING SLANE SLATE SLATS CLATS*CHATS CHITS CHINS
CHINE THINE TRINE TRANE*TRACE TRACK CRACK CHACK CHICK CHINK
CHINE THINE TRINE TRUNE*TRUCE TRUCK CRUCK CHUCK CHICK CHINK
CHIVE SHIVE SLIVE SLAVE SLATE SLATS CLATS*CHATS CHITS CHIVS
CLARE SLARE SHARE SHORE SHOU*SHOUT CHOUT CLOUT CLAUT CLART
CLASS GLASS GRASS GROW GROUS*GROUT CLOUT CLAST
CLONE PLONE*PRONE PRINE PRICE PRICK CRICK CLICK CLOCK CLONK
CORKY PORKY PERKY PEAKY PEASY PEASE CEASE COASE CORSE CORKE
DEMON LEMON LIMON LINON LINEN LINES DINES DENES DEMES*DEMOS
GLOCK SLOCK SNOCK SNAK SNAPE SNARE GNARE GLARE GLORE GLOCE*
GUNGE TUNGE*TANGE TARE TARDE TARDE GARDY GURDY GUNGY
LOUSE POUSE PAUSE PARSSE PARRE*PARRY LARRY LORRY LOURY LOUSY
LOUSE POUSE PAUSE PASE PASTE PASTY LASY**LOSTY*LOUTY LOUSY
LUNGE MUNG MANGE MARGE MAREE*MARES MARES LARES LURES LUNGS
MARES TARES TIERES TINES TINGS TINGE MINGE MANGE MARGE MAREE*
MARTY PARTY PUNTY PUNGY PUNGE MUNG MANG MANGE MARTE*
MINGE PINGE PUNGE PUDGE PUDDE*PUDDY MUDDY MIDDY MINDY MINGY
POUCH WOUCH*WAUCH WARCH WARTH WARTY PARTY PORTY PORTY POUCHY
SLATE WLATE WHATE WHITE WHIRE*WHIPS SHIPS SLIPS SLAPS SLATS
WARES WARES WIRER WINES WINGS WINGE TINGE TANGE TARGE TAREE*
For words of length six, about 0.1 percent (one in a thousand) begin SSLs. The best SSLs now have a far larger proportion of unusual words in them. For example, all but three words in the following are in medium dictionaries: BATTER MATTER METTER(obs. meter) MELTER MELLER MELLOR(placename) MELLON BELLON (OED) BALLON BATLON BATTON BATHEN. All but four words can be found in medium dictionaries:

BURNER TURNER TERNER TENTER TENTOR TEN-TON(WW86-153)
BENTON(Chambers) BUNTON BURTON BURNON(OED var)
BURNEN(OED var)
MANTIE(OED) PANTIE PONTIE(Chambers) POSTIE(Chambers) POSSIE
POSSEE(Chambers) POSSES MOSSES MASSES MANSSES MANTES MANTIS

And all but five words can be found in medium dictionaries:

BURIAN SURIAN(obs. Syrian) SIRIAN SILIAN(placename) SILLAN(OED var)
SILLER BILLER BULLER BURLER BURIER BURIAR(OED var)
PANDAN SANDAN SENDAN(Chambers) SELDAN(Chambers)
SELTAN(OED var) SELTEN(Chambers) SELTER(seltzer, Web3) PELTER
PALTER PANTER PANDER PANDAR

Here are a few six-letter SSLs with half the words in smaller dictionaries:

BURION CURION(OED) CARION(OED var) CALION(OED) CALLON(Chambers)
CALLEN(OED var) CALLER BALLER BULLER BURLER BURIER BURIOR(OED)
BURION CURION(OED) CORION(OED) COLION(OED var) COLLON(OED)
COLLEN COLLER(OED var) BOLLER BULLER BURLER BURIER BURIOR(OED)
BURION MURIION(OED var) MERION(OED) MELION(OED) MELTON
MELTEN(OED var) MELTER BELTER BULTER BURTER(OED) BURIER
BURIOR(OED)
CASTER MASTER MESTER(Web2) MELTER MELLER MELLOR(placename)
MELLON CELLON(OED) CALLON(Chambers) CASLON(Chambers)
CAST ON(Chambers) CASTEN
CAST ON(Chambers) TASTON(placename) TESTON TEN-TON(WW86-153)
TENSON(OED) TENSEN TENSER CENSER CANSER(OED var)
CASSER(Chambers) CASTER CASTOR
HARDER WARDER WERDER(OED) WELDER WELLER WELLAR(OED var)
WELLAN(OED var) HELLAN(Chambers) HALLAN HARRAN(UKAdvancedCryptics)
HARDAN(OED var) HARDEN
POTTER TOTTER TETTER TERTER(OED var) TERRER(OED var) TERROR
TERRON PERRON PORRON(OED) POTRON(OED) POTTON(placename)
POTTEN(OED var)

The remainder of the 47 six-letter SSLs that I found are summarized below.

BASSES LENTON (BANTON is a place)
BELLED MOTTON (BETTON is a place)
BILLED MOTTON (BITTON and BILTON are places)
BINDER FARMAN
BINDER FERMAN
BRUSHY FLECKE
BURIAN SINGER (SINIAN is in UK Advanced Cryptics Dictionary)
BURIAN SINGES (SINIAN as above, BUNGES is medical)
BURION MESSER
CALLED MOTTON (CATTON and CALTON are places)
CARPAL PENTER
CASSER PORTON (PORTON and CORTON are places, CORTON also OED)
COLIAN PUTTER (PULIAN is in UK Advanced Cryptics Dictionary)
COLLIE WARDEN (CARDEN is in UK Advanced Cryptics Dictionary)
CURION MESSES
DORSUM MENNER (MENNEM in English Dialect Dictionary)
FARMAN WENDER (WENDER is medical)
GESTON SINNER (SISTON and SINTON are places)
GILLAN SETTER (GILLAN is a place)
HARKER MILTON (HILTON, HALTON and HARTON are places, HARK ON is OED)
HEATER SANDON (SANDOR?, SANDON, HENDON, HEATON are places, HAND ON IS OED)
HENDER MILTON (HILTON, HELTON, HENTON and HENDON are places)
HOLLIE WARDEN
LENTON PASSES (PASTON is a place in Norfolk, PASS ON is OED)
LESSES MARCHE (MARCHES is in UK Advanced Cryptics Dictionary)
LONGES MARCHE (MONGES is medical, MARCHES as above)
MALTER WIND-ON (MIND ON is OED, MALDON and MALTON are places)
MANDAN SELTER (Selter Web 3 under seltzer)
MANNEL TORTIS (MANNEL is a place)
MARTIS PENDER (PENDES is medical, PENDER is UK Advanced Cryptics Dict)
MARTIS PETRON (PETTIS is UK Advanced Cryptics Dictionary, PETRI'S as in Petri's dish)
MELDAN WINNER
MOTTON PULLED (POTTON and PUTTON are places)
REWERE SOLAND
REWERS SOLAND

Number of Sequential Snakes and Ladders

Number of SSLs (log scale)

100000000
10000000
1000000
100000
10000
1000
100
10

Word Length

4 5 6 7