

The Digrams of Webster's Unabridged Dictionary

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For many years word buffs at these laboratories have made a game out of finding words which contain strange digrams (pairs of letters side-by-side). The problem, as originally posed by M. D. McIlroy, was to complete a table with 26 rows and 26 columns, labeled by the letters A, B, . . . , Z. The space where row L crossed column L' was to be filled by a word containing the digram LL'. Of the 626 ($= 26 \times 26$) words needed, about 80% are easy to find. Each of the others presents a difficult puzzle and some must be impossible under any reasonable rules for deciding what words are allowable. The rules adopted here accept only words from the second edition of Webster's unabridged dictionary, spelled without a capital letter, without a hyphen, and without the sign || by which Webster denotes words in foreign languages. The word may be listed as an archaic form (below the line at the bottom of the page), as a recent word (in the addendum), or as an alternate spelling.

A. Ross Eckler and Faith W. Eckler used different rules for their trigram table, now being serialized in *Word Ways*. Our rules are more permissive in using a larger dictionary but also less permissive in rejecting hyphenated words and neologisms. Although our rules are natural ones they dictate peculiar choices for certain digrams. Thus, for the digram ZB, the rules reject buzz bomb (two words) and whizz-bang (hyphenated) but allow ezba and blitzbuggy. For the digram LJ, aljoba is acceptable (although it is below the line) but aljama is rejected as a foreign word; kill-joy (hyphenated) is also rejected. For the digram MZ, Zemzem (capitalized is forbidden but lamziekte is acceptable). The only known word for the digram FZ is alefzero, which appears in the definition of alef null as an alternate form. Likewise the only known word with digram PQ is upquiver, which Webster includes in a list of words with prefix up- but does not define.



cow with
cowquake

Clearly one can criticize these rules. However, one must adopt some authority like Webster to settle any argument about what words are allowed. Without Webster's restraint it is tempting to invent new compound "words" (like offkey for the rare digram FK) which are not single words at all. Having agreed on

Webster it is then disheartening to find a good ZM word, queezmadam, spelled without a hyphen in Funk and Wagnall but with a hyphen in Webster.



The digram table is complete. Wherever the table fails to give a word, the reason is that no allowable word exists with that digram. We now know exactly which digrams can appear because of a study,* made at RCA, in which an electronic computer sorted through all the words of Webster's second edition. It listed all the different tetragrams it found (but not words containing them).

Although I have only the tetragram list with no explanation to go with it, the list seems to cover exactly the same words which are allowed for the table. In the tetragram list the word space # counts as a letter (thus the word "for" contributes the tetragrams ## #f, # #fo, #for, for#, or##, r### to the list).

If a digram occurs at all it occurs at the beginning of some tetragram. Thus to test whether a rare digram, say KX, occurs one need only consult the list for tetragrams beginning KX. The only such tetragram listed is KXIA. This proves that there is such a word. Furthermore by looking for tetragrams #KXI, AKXI, . . . , ZKXI one finds only CKXI listed. Then the word sought contains the pentagram CKXIA. Continuing in this way one finds that the word contains ICKXIA. However, there are so many tetragrams like #ICK, HICK, PICK, SICK, etc. that the table is not helpful in supplying more letters. Indeed the KX word was the last one found: D. Borgmann contributed the word kickxia.



madam eating
queez-madam

* R. B. Thomas, M. Kassler, and G. Wooley, *Advanced character recognition techniques study, report No. 4, Appendix D. Tetragrams legal with respect to Webster's International Dictionary (Unabridged second edition)*. U.S. Army Electronics Research and Development Laboratory, Fort Monmouth and RCA Data Systems Center, Bethesda. Contract No. DA 36-039-AMC-00112 (E), (1963).

In the table which follows, the digrams which have no corresponding words are indicated by XXX. A few words are marked with an asterisk to show that they are obscure forms which Webster put below the line. Conclusions based on the tetragram list may not be absolutely reliable. For instance the list omitted the common tetragram #BE#. It also gave no tetragram beginning QV although I find QVINT below the line in Webster.



fuzzmobile

By relaxing the rules slightly one can find words for some of the "impossible" digrams. Other dictionaries contain words like *avgas*, *tradevman*, and *muzjik*. Proper names, foreign words, or hyphenated words would supply more but one ought to stop short of allowing names of radio stations.

TABLE

	A	B	C	D	E
A	aardvark	cab	act	add	aerie
B	bat	ebb	abcess	abduct	be
C	car	ecbatic	occur	ecdysis	ace
D	dam	bedbug	madcap	odd	den
E	eat	zebra	echo	edit	see
F	fat	surfboard	ofscast	serfdom	fee
G	gas	bugbear	dogcart	kingdom	get
H	ham	washbowl	ashcake	touchdown	hen
I	bias	bib	pick	did	hie
J	jar	rajbansi	xxx	slöjd	jet
K	kale	sickbed	blackcap	jackdaw	keep
L	law	bulb	gulch	old	let
M	man	climb	tomcat	humdrum	men
N	nail	sunbath	once	end	new
O	oat	rob	lock	ode	hoe
P	pan	cupboard	stopcock	snappedragon	pet
Q	qasab*	xxx	xxx	xxx	qere*
R	ran	orb	arc	hard	are
S	sat	misbehave	scan	disdain	set
T	tan	football	itch	letdown	tea
U	squad	tub	such	bud	hut
V	van	xxx	novcic	xxx	over
W	war	sawbuck	showcase	bawdy	we
X	exact	oxblood	excel	sexdigital	axe
Y	yam	maybe	cycle	hydra	yes
Z	zany	blitzbuggy	mezcal	benzdiazine	zero
	F	G	H	I	J
A	aft	age	ah	aim	ajar
B	subfloor	subgroup	abhor	bin	object
C	frolicful	ecgonize	chin	acid	xxx
D	codfish	edge	adhere	din	adjoin
E	left	beg	behind	lei	reject

TABLE (continued)

F	offer	afghan	offhand	fin	ffield
G	songful	egg	light	gin	longjaw
H	wishful	thoroughgoing	withhold	hid	mahjongg
I	if	dig	likelihood	skiing	demijohn
J	xxx	xxx	jhow	jib	hajj
K	hackfire	blackguard	khaki	kin	blackjack
L	self	bilge	jailhouse	lid	aljoba*
M	chamfer	armgaunt	drumhead	mix	jimjam
N	enfold	ring	enhance	nip	enjoy
O	of	bog	oh	oil	sojourn
P	topfull	upgrade	graph	pin	flapjack
Q	xxx	xxx	xxx	qintar*	xxx
R	scarf	urge	rhyme	rid	doorjamb
S	misfire	disgorge	she	sit	misjudge
T	catfish	catgut	the	tin	nightjar
U	buff	hug	uhlan	suit	jujube
V	xxx	xxx	xxx	vine	xxx
W	awful	gewgaw	why	win	plowjogger
X	exfoliate	foxglove	exhale	exit	xxx
Y	crayfish	pygmy	anyhow	eying	pyjamas
Z	topazfels	fizgig	muzhik	zip	xxx

K

L

M

N

O

A	rake	ale	am	an	aorta
B	lambkin	blue	submit	hobnail	boat
C	back	clip	acme	acne	cot
D	bodkin	idle	admit	hardness	do
E	eke	elf	hem	end	eon
F	elkin	fly	hafnium	hafnium	for
G	gingko	glue	dogma	gnu	go
H	latchkey	highly	coachman	ethnic	hot
I	like	ill	dim	in	riot
J	satlijk*	mijl*	ijma	jmana	joy
K	bookkeeper	fickle	jackman	knot	lookout
L	elk	all	elm	kiln	lot
M	bumkin*	gimlet	hammer	hymn	mood
N	hank	inlay	enmesh	winner	no
O	poke	old	home	on	too
P	napkin	plan	helpmate	pneuma	pot
Q	xxx	xxx	xxx	xxx	qoph*
R	ark	pearl	arm	turn	rob
S	ski	isle	smut	snub	son
T	catkin	battle	allotment	catnip	to
U	auk	hull	bum	tune	buoy
V	soukhoz	vlei	xxx	griونا	vow
W	squawk	awl	sawmill	own	won
X	bookkeeper	axle	axman	laxness	axon
Y	tyke	style	rhyme	dyne	you
Z	blitzkrieg	sizzle	mizmaze	haznadar	zoo

TABLE (continued)

	P	Q	R	S	T
A	<i>ape</i>	<i>aquatic</i>	<i>are</i>	<i>as</i>	<i>at</i>
B	<i>subpoena</i>	<i>subquintuple</i>	<i>brat</i>	<i>absolve</i>	<i>debt</i>
C	<i>ecphonesis</i>	<i>acquit</i>	<i>crab</i>	<i>facsimile</i>	<i>act</i>
D	<i>midparent</i>	<i>headquarters</i>	<i>draw</i>	<i>adsorb</i>	<i>hardtack</i>
E	<i>kept</i>	<i>equal</i>	<i>erg</i>	<i>best</i>	<i>bet</i>
F	<i>halfpenny</i>	xxx	<i>free</i>	<i>offset</i>	<i>aft</i>
G	<i>magpie</i>	xxx	<i>grow</i>	<i>songster</i>	<i>springtime</i>
H	<i>dishpan</i>	<i>earthquake</i>	<i>shrub</i>	<i>fuchsia</i>	<i>yacht</i>
I	<i>lip</i>	<i>liquid</i>	<i>ire</i>	<i>is</i>	<i>it</i>
J	xxx	xxx	<i>bojra*</i>	xxx	<i>mujtahid</i>
K	<i>cockpit</i>	xxx	<i>okra</i>	<i>locksmith</i>	<i>cocktail</i>
L	<i>help</i>	<i>catafalque</i>	<i>already</i>	<i>else</i>	<i>belt</i>
M	<i>imp</i>	<i>kumquat</i>	<i>ramrod</i>	<i>flimsy</i>	<i>warmth</i>
N	<i>henpeck</i>	<i>inquire</i>	<i>inroad</i>	<i>inside</i>	<i>ant</i>
O	<i>open</i>	<i>loquacious</i>	<i>or</i>	<i>lost</i>	<i>pot</i>
P	<i>apple</i>	<i>upquiver</i>	<i>pray</i>	<i>psalm</i>	<i>apt</i>
Q	xxx	<i>zaqqum</i>	<i>miqra</i>	xxx	xxx
R	<i>harp</i>	<i>torque</i>	<i>err</i>	<i>purse</i>	<i>art</i>
S	<i>spot</i>	<i>squid</i>	<i>misread</i>	<i>boss</i>	<i>star</i>
T	<i>postpone</i>	<i>heartquake</i>	<i>try</i>	<i>outset</i>	<i>attic</i>
U	<i>up</i>	<i>tuque</i>	<i>urge</i>	<i>us</i>	<i>but</i>
V	xxx	xxx	<i>chevron</i>	<i>perovskite</i>	xxx
W	<i>kewpie</i>	<i>cowquake*</i>	<i>wren</i>	<i>douse</i>	<i>kowtow</i>
X	<i>expect</i>	<i>exquisite</i>	<i>extradius</i>	<i>coxswain</i>	<i>extra</i>
Y	<i>type</i>	<i>triftyque</i>	<i>pyre</i>	<i>cyst</i>	<i>rhythm</i>
Z	<i>benzpinacone</i>	xxx	<i>arzrunite</i>	<i>vammazza</i>	<i>azteca</i>

	U	V	W	X	Y	Z
A	<i>aura</i>	<i>cave</i>	<i>awe</i>	<i>axe</i>	<i>say</i>	<i>maze</i>
B	<i>burn</i>	<i>obvious</i>	<i>cobweb</i>	xxx	<i>by</i>	<i>subzero</i>
C	<i>cut</i>	xxx	<i>cwm</i>	xxx	<i>cyst</i>	<i>eczema</i>
D	<i>dun</i>	<i>adventure</i>	<i>dwelt</i>	xxx	<i>lady</i>	<i>adze</i>
E	<i>neuter</i>	<i>eve</i>	<i>few</i>	<i>hex</i>	<i>eye</i>	<i>fez</i>
F	<i>fun</i>	<i>arfvedsonite</i>	<i>halfwit</i>	xxx	<i>defy</i>	<i>alefzero</i>
G	<i>gun</i>	<i>dogvane</i>	<i>wigwam</i>	xxx	<i>gyp</i>	<i>zigzag</i>
H	<i>hut</i>	<i>ashvamedha</i>	<i>pathway</i>	xxx	<i>why</i>	<i>makhzan</i>
I	<i>diurnal</i>	<i>live</i>	<i>kiwi</i>	<i>radix</i>	<i>biyearly</i>	<i>fizz</i>
J	<i>jut</i>	xxx	xxx	xxx	<i>jynx</i>	xxx
K	<i>skull</i>	<i>kvass</i>	<i>inkwell</i>	<i>kickxia</i>	<i>sky</i>	xxx
L	<i>luck</i>	<i>solve</i>	<i>hallway</i>	<i>calx</i>	<i>silly</i>	<i>colza</i>
M	<i>mud</i>	<i>triumvirate</i>	<i>tramway</i>	xxx	<i>my</i>	<i>lamziekte</i>
N	<i>nut</i>	<i>envy</i>	<i>unwed</i>	<i>lynx</i>	<i>any</i>	<i>frenzy</i>
O	<i>out</i>	<i>rove</i>	<i>how</i>	<i>ox</i>	<i>boy</i>	<i>doze</i>
P	<i>put</i>	<i>hopvine</i>	<i>upward</i>	xxx	<i>pyre</i>	xxx
Q	<i>queer</i>	<i>quint*</i>	xxx	xxx	xxx	xxx
R	<i>run</i>	<i>nerve</i>	<i>forward</i>	<i>arx</i>	<i>awry</i>	<i>furze</i>
S	<i>sun</i>	<i>svelte</i>	<i>swift</i>	xxx	<i>easy</i>	<i>grosz</i>
T	<i>tub</i>	<i>zemstvo</i>	<i>two</i>	<i>postxyphoid</i>	<i>type</i>	<i>pretzel</i>

U	<i>vacuum</i>	<i>louver</i>	<i>ahluwaral</i>	<i>crux</i>	<i>buy</i>	<i>puzzle</i>
V	<i>vue</i>	<i>flivver</i>	xxx	xxx	<i>gravy</i>	<i>euzone</i>
W	<i>swum</i>	xxx	<i>yellowwood</i>	xxx	<i>screwy</i>	<i>frowzy</i>
X	<i>exude</i>	<i>exvoto</i>	<i>boxwood</i>	xxx	<i>xylophone</i>	<i>exzodiacal</i>
Y	<i>yule</i>	<i>wyvern</i>	<i>wayworn</i>	<i>onyx</i>	<i>sayyid</i>	<i>syzygy</i>
Z	<i>azure</i>	<i>mitzvah</i>	<i>zweiback</i>	xxx	<i>crazy</i>	<i>muzzle</i>