

A NEW LOOK AT THE JOTTO PROBLEM

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The so-called Jotto problem--construct five five-letter words out of 25 different letters--was examined in the first issue of *Word Ways* on February 1968. Why is it called this? If one's guess word in the two-person game of Jotto is scored 0 (no letters in common with the target word), one's next guess should be a word containing no letters in common with the first one. If this, too, scores 0, the third word should avoid the ten letters eliminated. In the unlikely event that four 0s are scored, a set of five five-letter words consisting of 25 different letters will have been generated. (For a fuller analysis of Jotto strategy, see "Playing Jotto Against a Computer" in the August 1996 *Word Ways*.)

The Jotto solution offered in February 1968 by Howard Bergerson was (fudgy jams phlox wreck qvint), omitting z. No further solutions were advanced for 26 years; Robert Levinson suggested (dzong crwth jumps flaky vibex) in the February 1994 *Word Ways*. During the next year he discovered a cluster of solutions sharing the three words Japyx vozhd QWERT, the latter two words found (along with dzong) only in the second edition of the *Oxford English Dictionary*.

It seemed likely that further clusters of Jotto solutions could be identified by patient dictionary-searching for consonant-rich words using JQXZV; however, the work factor turned out to be daunting. Both Leonard Gordon and Chuck Fendall programmed a computer to search for all solutions in a set of five-letter isograms (words with no repeated letters). Using slightly different databases, Gordon found 1968 Jotto solutions and Fendall, 1815! Most of these, however, used obsolete variant spellings found only in the OED: qhwom (whom), qwych (which), qwerf (wharf) and the like.

Little purpose would be served in presenting such Jotto solutions to *Word Ways* readers; this article boils them down to approximately 250 solutions using reasonably common words--those left after removing obsolete variant spellings plus reformed spellings such as gownd (gowned) or fumbl (fumble) below the line in Webster's Second Unabridged. The words used in the Jotto solutions are listed at the end of this article. Unlabeled ones can be found in Webster's 10th Collegiate; those not found there are labeled OSPD or Ch if they are found in the Official Scrabble Players Dictionary or Chambers 20th Century Dictionary. Words in none of these three sources are labeled W2 or W3 if in the Merriam-Webster Second or Third Unabridged, RHD in the Random House Unabridged Dictionary, and 0 in the *Oxford English Dictionary*, Second Edition. Starred words have anagrams.

There are, apparently, only two Jotto solutions confined to the three commonest dictionaries: (fjord vibex waltz gymps chunk q) and (fjord vibex waltz nymph gucks q). Vibex and gymps are found only in Chambers.

It is useful to present the list of 250 Jotto solutions in groups of closely-related ones. Two solutions in which one word is an anagram of another are obviously close to each other; in the following, anagrammable words are underlined. Their anagrams can be found in the list at the end of the article; flows and wacks have two anagrams each.

Two Jotto solutions are said to be adjacent to each other if one can be converted to the other by interchange of a pair of letters in two words (for example, lyMph Gucks = Glyph Mucks) or by a swap of the odd-letter-out with one in a word (for example, golFs B = gloBs F).

The densest concentration of Jotto solutions resides in that part of word-space containing qvint, Japyx and Zhmud; the remaining 11 letters generate 28 solutions, 11 of which (underlined) employ an anagrammable word. Any of these 28 solutions can be reached from any other by a chain of letter-interchanges via adjacent solutions. The full network is too complex to diagram, but the 28 solutions are listed below.

qvint Japyx Zhmud frows bleck g*	qvint Japyx Zhmud grows fleck b*
qvint Japyx Zhmud <u>flows</u> breck g	qvint Japyx Zhmud grows bleck f
qvint Japyx Zhmud frowl becks g	qvint Japyx Zhmud grews block f*
qvint Japyx Zhmud frowl gecks b	qvint Japyx Zhmud swerf block g
qvint Japyx Zhmud <u>growl</u> fecks b	qvint Japyx Zhmud flews brock g
qvint Japyx Zhmud <u>growl</u> becks f*	qvint Japyx Zhmud flegs brock w
qvint Japyx Zhmud <u>glows</u> breck f*	qvint Japyx Zhmud <u>golfs</u> breck w
qvint Japyx Zhmud <u>glows</u> freck b	qvint Japyx Zhmud frogs bleck w*
qvint Japyx Zhmud <u>blows</u> freck g	qvint Japyx Zhmud gowfs bleck r*
qvint Japyx Zhmud <u>brows</u> fleck g	qvint Japyx Zhmud gowfs breck l
qvint Japyx Zhmud brews flock g	qvint Japyx Zhmud gowfs clerk b
qvint Japyx Zhmud grews flock b	qvint Japyx Zhmud <u>golfs</u> wreck b
qvint Japyx Zhmud <u>bergs</u> flock w	qvint Japyx Zhmud globs wreck f
qvint Japyx Zhmud <u>brogs</u> fleck w	qvint Japyx Zhmud globs freck w

The solution (qvint Japyx Zhmud grows bleck f) has seven adjacent solutions, indicated by asterisks.

Qvint Japyx (without Zhmud) generates six more solutions; the first two are adjacent to each other.

qvint Japyx bowks fremd gulch z	qvint Japyx gowds fleck rhumb z
qvint Japyx gowks fremd bulch z	qvint Japyx chowk flegm drubs z
qvint Japyx drowk flegm chubs z	qvint Japyx glubs fremd chowk z

Qvint Zhmud (without Japyx) generates a group of five adjacent solutions along with a trio of adjacent solutions.

qvint Zhmud jowpy flack bergs x qvint Zhmud braxy gowfs pleck j
 qvint Zhmud jowpy fleck grabs x qvint Zhmud beryx gowfs plack j
 qvint Zhmud jowpy flegs brack x qvint Zhmud prexy gowfs black j
 qvint Zhmud jowpy flags breck x
 qvint Zhmud jowpy frags bleck x

The additional solutions (qvint Zhmud beryx gawps flock j) and (qvint Zhmud oxfly gawps breck j) are both isolated.

What other words work with qvint? There is one group of three adjacent solutions and three groups of two adjacent solutions which contain qvint fjord.

qvint fjord lawzy gecks bumph x qvint fjord bawze lymph gucks x
 qvint fjord blazy gecks whump x qvint fjord bawze glyph mucks x
 qvint fjord glazy becks whump x
 qvint fjord Uzbak welch gymps x
 qvint fjord zacks whump gleby x qvint fjord Uzbek chawl gymps x
 qvint fjord zacks bumph gwely x

The additional solutions (qvint fjord Uzbek wacks lymph x) and (qvint fjord Sphex clawk gummy z) are both isolated.

Qvint fjeld is equally productive, with one group of three and a group of two.

qvint fjeld grosz whack bumpy x qvint fjeld ampyx wocks burgh z
 qvint fjeld grosz wacky bumph x qvint fjeld ampyx chowk burgs z
 qvint fjeld grosz backy whump x

Six additional solutions are isolated.

qvint fjeld crazy gowks bumph x qvint fjeld braxy chowk gumps z
 qvint fjeld braxy whomp gucks z qvint fjeld braxy chump gawks z
 qvint fjeld zarps gummy chowk x qvint fjeld grosz bucky whamp x

Qvint generates solutions with a variety of other words. Note that the last two solution pairs are adjacent ones.

qvint jambs phlox wreck fudgy z qvint judex wombs glyph frack z
 qvint jumby phlox dwarf gecks z qvint jucks phlox gawby fremd z
 qvint jumby phlox gawds freck z qvint jucks embox dwarf glyph z
 qvint judex wharf gymps block z qvint jucks zambo glyph dwerf x
 qvint judex gowfs lymph brack z qvint jacks phlox dwerf gummy z
 qvint jocks Uzbek dwarf lymph x qvint jambs phlox gucky dwerf z
 qvint buxom zacks dwerf glyph j qvint jumby phlox zacks dwerf g
 qvint jumbo zacks dwerf glyph x qvint phlox zacks gummy dwerf j

The second largest concentration of adjacent Jotto solutions is based on QWERT and vozhd, accompanied by either Japyx or ampyx.

QWERT vozhd Japyx climb gunks f	QWERT vozhd Japyx climb funks g
QWERT vozhd Japyx climb funks k	QWERT vozhd ampyx flick bungs j
QWERT vozhd Japyx blick funks m	QWERT vozhd ampyx blick funks j
QWERT vozhd Japyx flick bungs m	QWERT vozhd ampyx blick jungs f
QWERT vozhd ampyx flick jungs b	QWERT vozhd Japyx flick numbs g

Nearby are two small sets of adjacent solutions.

QWERT vozhd Japyx flung Micks b	
QWERT vozhd Japyx fling mucks b	QWERT vozhd ampyx fling jucks b
QWERT vozhd Japyx fling bucks m	QWERT vozhd ampyx fling bucks j
QWERT vozhd Japyx clink bumfs g	QWERT vozhd Japyx cling bumfs k
QWERT vozhd Japyx <u>glink</u> bumfs c	

QWERT and vozhd alone (without Japyx or ampyx) generate adjacent Jotto solutions. Consider the following:

QWERT vozhd jucks fangy blimp x	QWERT vozhd jacks bingy flump x
QWERT vozhd jacks fungy blimp x	QWERT vozhd jacky funks blimp x
QWERT vozhd jacks bungy flimp x	QWERT vozhd jacky bungs flimp x
QWERT vozhd jimpy flack bungs x	QWERT vozhd jimpy black funks x
QWERT vozhd jimpy bucks flang x	QWERT vozhd jimpy backs flung x
QWERT vozhd jumpy backs fling x	QWERT vozhd jumby <u>packs</u> fling x
QWERT vozhd jumps backy fling x	QWERT vozhd jumby <u>spick</u> flang x
QWERT vozhd jumby flack pings x	QWERT vozhd bunjy flack gimps x
QWERT vozhd jumby flick <u>spang</u> x	QWERT vozhd bunjy flick gamps x
QWERT vozhd jumpy flick bangs x	QWERT vozhd jumps blick fangy x
QWERT vozhd jumpy blick fangs x	

In addition there are several isolated QWERT vozhd solutions.

QWERT vozhd jumps bingy flack x	QWERT vozhd jambs picky flung x
QWERT vozhd jungs backy flimp x	QWERT vozhd unfix gymps black j
QWERT vozhd jungs backy flimp x	

QWERT even generates a few solutions without the help of vozhd.

QWERT Japyx dzong chimb flusk v	QWERT Japyx Zhmud flick bongs v
QWERT Japyx dzong blick humfs v	QWERT Japyx Zhmud fling bocks v
QWERT jumby dzong Pshav flick x	

In addition to qvint and QWERT, waqfs is a useful word for Jotto solutions. Over half of these combine with vozhd. Adjacent solutions are found in the left column, and isolated solutions in the right column.

waqfs vozhd jumby glent prick x
 waqfs vozhd jumpy glent brick x
 waqfs vozhd jumpy glint breck x

waqfs vozhd unmix grypt bleck j
 waqfs vozhd nexum grypt blick j

waqfs vozhd benjy glump frick x
 waqfs vozhd bemix clunk grypt j
 waqfs vozhd jumby clipt kreng x
 waqfs vozhd jumby crept glink x
 waqfs vozhd cylix brung kempt j
 waqfs vozhd jimpy gluck brent x
 waqfs vozhd jimpy grunt bleck x
 waqfs vozhd cimex grypt blunk j

Other waqfs solutions include:

waqfs dzong thrix jumby pleck v
 waqfs dzong thrix jumpy bleck v

waqfs Zhmud vixen grypt block j
 waqfs Zhmud vibex grypt clonk j
 waqfs Zhmud vibex crypt klong j

waqfs dzong vibex lymph truck j
 waqfs jived bortz gluck nymph x
 waqfs judex glitz brock nymph v

(Waqfs kvint crumb glyph judex z) and (wakfs qvint crumb glyph judex z) illustrate a variant-spelling swap.

There are only a handful of Jotto solutions using other words that contain the letter Q.

Qutbs jimpy vozhd wreck flang x
 Qutbs jimpy vozhd wrang fleck x
 Qutbs Japyx vozhd wreck fling m
 Qutbs ampyx vozhd wreck fling j
 Qutbs Japyx vozhd wring fleck m
 Qutbs ampyx vozhd wring fleck j
 Qutbs Japyx vozhd wrick flegm n
 Qutbs fjeld zingy vrack whomp x
 Qutbs Japyx Mordv whing fleck z

trinq jumby vozhd gawps fleck x
 trinq jumps vozhd gawby fleck x
 trinq Japyx vozhd wembs gluck f
 trinq Japyx Zhmud gowfs bleck v

Qungs fjeld ampyx bortz whick v
 Qungs Japyx blitz chowk fremd v
 Qungs Japyx vozhd twelf brick m
 Qungs ampyx vozhd twelf brick j
 Qungs jimpy vozhd twelf brack x
 Qungs Japyx Mordv wheft blick z
 Qungs Japyx Mordv whift bleck z
 Qungs prexy vozhd twick flamb j

jungs ampyx vozhd twelf brick m

jungs prexy vozhd twick flamb m

Finally, one must report those Jotto solutions which do not contain the letter Q. All but the last four take part in adjacent Jotto solutions.

Japyx vozhd wreck tumbs fling
 Japyx vozhd wreck numbs glift
 Japyx vozhd wreck bumfs glint
 Japyx vozhd wrick bumfs glent

Japyx vozhd wembs trick flung
 Japyx vozhd wembs truck fling
 Japyx vozhd wembs crunk glift
 Japyx vozhd wembs clunk grift

Japyx vozhd wicks flegm burnt
 Japyx vozhd wrick flegm bunts
 Japyx vozhd twick flegm burns
 Japyx vozhd twick Flems brung
 Japyx vozhd twink flegm curbs
 Japyx vozhd twink flegs crumb

Japyx vozhd twelf mucks bring
 Japyx vozhd twelf micks brung
 Japyx vozhd wefts crumb glink
 Japyx vozhd twelf crumb kings
 Japyx vozhd wrung kembs clift
 Japyx vozhd wring fleck tumbs
 Japyx vozhd wembs flick grunt
 Japyx vozhd twick berms flung

Eliminating vozhd but retaining Japyx, further solutions appear.

Japyx zimbs vetch drowk flung
 Japyx dzong kevil crwth bumfs
 Japyx Zhmud verbs twick flong

Japyx Fultz Mordv whing becks
 Japyx dzong thruv wembs flick

The two commonest Jotto solutions, reported earlier, contain neither Japyx nor a word with Q. Others of this genre are:

fjord vibex klutz gymps chawn
 fjord vibex Muntz wacks glyph
 jumps beryx vozhd twick flang
 jumps beryx vozhd twang flick
 jumps vibex dzong crwth flaky
 jumpy vibex dzong crwth flask
 jocks vibex Muntz dwarf glyph
 jocks vibex Zhmud flawn grypt
 jufts vibex dzong lymph wrack

jacks vibex Zhmud flown grypt
 fjeld boxty zings vrack whump
 jams prexy vozhd twick flung
 judex blitz vrack gowfs nymph
 jucks ampyx vozhd twelf bring
 jucks beryx vozhd twang flimp
 jucks bemix vozhd flawn grypt
 jufts ampyx vozhd wring bleck

Reviewing the Jotto solutions, one discovers that all consonants but TDPHS can be eliminated from the five-word set. Examples eliminating these five consonants bring in other words such as placenames. The three hardest-to-exclude letters, PHS, appear in an adjacency set.

qvint fjeld xysma Zbrug chowk p
 qvint fjeld ampyx Zbrug wocks h
 qvint fjeld ampyx Zbrug chowk s

Zbrug is a river in the former USSR, listed in the Times Atlas of the World, and xysma can be found in medical dictionaries. There are many TD Jotto solutions involving obsolete OED words, including the following adjacent ones. Leonard Gordon found the purely geographical (Qishn Växjö Zbrug Clwyd Kempt), the latter a Canadian island.

qwhom Japyx Zbrug vents flick d
 qwhom Japyx Zbrug vends flick t

If one admits placenames, a few additional Jotto solutions involving Bronx, Rzhev and Växjö can be found. The last is a town of some ten thousand in Sweden, but may be disqualified by the unlauted letters. The

best solution involving Rzhev is (jumps boxty Rzhev dwang flick q), Bronx is (djave Bronx Fultz whick gymps q), and Växjö is (Växjö fuzed crwth gymps blink q).

How far apart can two Jotto solutions be? In theory, they can be 11 interchanges apart, as illustrated by the hypothetical solutions (abcde fghij klmno pqrst uvwxy z) and (afkpu bglqv chmrw dinsy ejotz y). What is the largest separation between two actual Jotto solutions?

Finding two Jotto solutions 10 interchanges apart is equivalent to another logological problem of interest: find a 5x5 transposal word square with 25 different letters. In a transposal word square, each row and column of letters can be rearranged to form a word. Such squares were discussed in "Single and Double Transposal Squares" in the May 1980 Word Ways.

Can one find two Jotto solutions containing five different words that are joined to each other by a chain of adjacent Jotto solutions?

The Jotto problem can be generalized to words of other lengths. For example, the best solutions known for four six-letter words containing 24 letters of the alphabet were reported in the August 1996 colloquy. Chuck Fendall has searched without success for three eight-letter words containing 24 letters of the alphabet. However, it may be possible to find two ten-letter words containing 20 letters.

SOURCES OF WORDS USED (no label = Webster's 10th Collegiate)

ampyx W2

backs backy W2 bangs bawze O becks bemix Ch benjy W2 bergs*
berms Beryx W2 bingy W2 black blazy W2 bleck W2 blick W2 blimp
blitz block blows* blunk Ch bocks borgs* O bortz OSPD bows
W2 bowls* bows* Ch boxty Ch brack Ch braxy OSPD breck W2
brent OSPD brews brick brock brogs* Ch brows* brugh* W2
brung W2 brunt* bucks bucky W2 bulch W2 bumfs bumpf bumpy
bungs bungy bunjy Ch bunts burds Ch burgs* burns burnt*
buxom

cawks* Ch cawky W3 chawk* W2 chawl Ch chawn W2 chowk W2
chubs chump chunk cimex Ch clawk W2 clerk clift Ch cling clink
clipt Ch clonk clunk crazy crept crink W2 cromb crumb crunk
W2 crwth Ch crypt curbs* cylix* OSPD

drowk W2 drubs dwarf dwerf W2 dzong O

embox Ch

falks* W2 fangs fangy W2 fecks Ch fiqhs RHD fjeld Ch fjord flack
flaky flamb W2 flang O flask flawn Ch fleck flegm O flegs Ch
Flems W2 flew flick flimp Ch fling flock flogs* flong Ch flown

flows* flump flung flusk W2 fowls* frack Ch freck W2 fremd OSPD
 frogs frowl W2 frows fudgy W2 Fultz W2 funks Ch funky O funks

gamps gawby W2 gawds W2 gawps gecks Ch gerbs* W2 gimps
 ginks* glazy Ch gleby Ch glent Ch glift Ch glink* W2 glint glitz
 globs glowr* W2 glows* glubs W2 gluck W2 glump W2 glyph golfs*
 gowds Ch gowfs Ch gowks Ch gowls* Ch grews Ch grift OSPD
 grosz grows growl* grubs* grunt grypt Ch gucks gucky gulch
 gummy W2 gumps gwely W2 gymps Ch

humfs Ch

jacks jacky OSPD jambo Ch Japyx W2 jimpy W2 jocks jowpy W2
 jucks W2 judex W2 jufts W2 jumby Ch jumps jumpy jungs O

kembs Ch kempt kevil OSPD kings* Kling* W2 klong OSPD klutz
 kreng Ch kvint W2

lawzy W2 lymph

Micks mucks Muntz* (metal) Ch

nexum W2 nimbs O numbs nymph

oxfly W2

packs* pangs* phlox picks* picky plack Ch pleck W2 prexy*
 Pshav W2 Pyrex*

Qungs W2 Qutbs W3 qvint W2 QWERT O

rhumb

scrub* spack* Ch spang* Sphex W2 Spick* swack* Ch swerf Ch
 swick* W2

thrix Dorland trick trinq W2 truck tumbs W2 twang twelf W2
 twick W2 twink Ch

unfix unmix W2

verbs vetch vibex Ch vixen vozhd O vrack W2

wacks* OSPD wacky* welch wembs Ch whack* whelp whick W2
 whift W2 whing W2 whomp whump wicks* wocks Ch wolfs* wombs
 wrang OSPD wreck wrick Ch wring wrink W2

xylic* Ch

zacks Ch zambo Ch zarps W2 Zhmud W2 zimbs Ch zings zingy
 zygal* W2