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 Os 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 grows fleck g* qvint Japyx Zhmud grows fleck f* qvint Japyx Zhmud grows block f* qvint Japyx Zhmud swerf block g qvint Japyx Zhmud flows freck b qvint Japyx Zhmud flows freck f* qvint Japyx Zhmud flows freck b qvint Japyx Zhmud flows freck f* qvint Japyx Zhmud flows freck b qvint Japyx Zhmud flows freck f* qvint Japyx Zhmud flows freck b qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w qvint Japyx Zhmud grows fleck g qvint Japyx Zhmud grows fleck w

The solution (qvint Japyx Zhmud grows fleck 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 gulech z qvint Japyx bowks fremd bulch z qvint Japyx bowks fremd_thumb z qvint Japyx bowks fremd_thumb z

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

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

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

Six additional solutions are isolated.

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

In addition there are found in the Jotto solutions.

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

The following table lists adjacent solutions grouped by QWERT and vozhd. Not every combination of adjacent solutions is shown, but only those with significant frequency.

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<th>QWERT vozhd</th>
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<td>Japyx climb gunks f</td>
<td>Japyx climb ganks F</td>
<td>Japyx climb ganks F</td>
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<td>Japyx climb gunks k</td>
<td>Japyx climb ganks k</td>
<td>Japyx climb ganks k</td>
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<td>Japyx blick gungs f</td>
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Nearby are two small sets of adjacent solutions.

The following table lists adjacent solutions grouped by QWERT and vozhd. Not every combination of adjacent solutions is shown, but only those with significant frequency.

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<tr>
<td>Japyx flung Micks b</td>
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<td>Japyx flung Micks b</td>
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<td>Japyx fling mucks b</td>
<td>Japyx fling mucks b</td>
<td>Japyx fling mucks b</td>
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<td>Japyx fling gunks m</td>
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<td>Japyx fling gumps x</td>
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</tbody>
</table>

In addition there are several isolated QWERT vozhd solutions.

The following table lists isolated QWERT vozhd solutions. Not every combination of isolated QWERT vozhd solutions is shown, but only those with significant frequency.

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<tr>
<th>QWERT vozhd</th>
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<tbody>
<tr>
<td>Japyx jumps bingy flack x</td>
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<td>Japyx jumps bingy flack x</td>
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<td>Japyx jumps bingy flack x</td>
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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.
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 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 jumpy vozhd wreck flang x
Qutbs jumpy 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 Nordv whing fleck z
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 jumpy vozhd twelf brack m
Qungs Japyx Nordv wheft blick z
Qungs Japyx Nordv whift bleck z
Qungs presxy vozhd twick flamb j

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 tums fling
Japyx vozhd wreck numbs glift
Japyx vozhd wreck bumfs glint
Japyx vozhd wreck bumfs glent

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

Eliminating vc

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Japyx dzong j
Japyx zhmd

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fjord vibex
jumps bery
jumps vibex
jumpy vibex
jocks vibex
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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
- jumps beryx vozhd twick flang
- jumps beryx vozhd twang flick
- jumps vibex dzong crwth flaky
- jumps vibex dzong crwth flak
- jocks vibex Muntz dwarf glyph
- jocks vibex Zhmud flawn grypt
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- jock s vibex Zhmud flawn grypt
- jock s vibex Zhmud flaw...
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 pqrst uvwxy z) and (afkpu bgqv 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 0 becks bemix Ch benjy W2 bergs* berms Beryx W2 bingy W2 black blazy W2 bleck W2 blick W2 b lump blitz block blows* blank Ch bocks bergs* 0 bortz OSPD bowks 0 bowls* bowrs* Ch boyx Ch brack Ch braxy OSPD breck W2 brent OSPD brews brick brock brogs* Ch brows* W2 brung W2 brunt* bucks bucky W2 bulch W2 bums bump bumpy bungs bungy bunjy Ch bunts bunds Ch burgs* burns burnt* buxom
cawks* Ch cawkx W3 chawk* W2 chawl Ch chawn W2 chowk W2 chubs chump chunk cimex Ch clawk W2 clerx clift Ch cling clink clipt Ch clokx clunk crazy crept crikx W2 cromb crumb crank crxth Ch crypt curbs* clyx* OSPD
drowk W2 drubs dwarf dwerf W2 dzong 0
embox Ch
falks* W2 fangs fangy W2 feeks Ch fighs RHD fjeld Ch fjord flack flaky flamb W2 flang 0 flask flawn Ch fleck flegm 0 flegs Ch Flems W2 flows flick flimp Ch fling flock flogs* flong Ch flown
flows* flump Ch frogs frowl W2
amps gawby ginks* glazy globs glorw* gows Ch gory grosz grows* gumby W2 gumz
humfs Ch
jacks jacky W2 jucks W2 judged
kembs Ch kere kreng Ch kvix
lawzy W2 lymp
Micks mucks
nexum W2 nim
oxfly W2
packs* pangy Pshav W2 Pryce
Qungs W2 Quie
rubm
scrub* spack swick* W2
thrix Doria thwick W2 twim
unfix unmix W2
verbs vetch
wacks* OSPD
whift W2 whig wrang OSPD
xylic* Ch
zacks Ch zaig zygai* W2
flows* flump flung flusk W2 fowls* frack Ch freck W2 fremd OSPD frogs frowl W2 frows fudy W2 Fultz W2 fungs Ch fungy 0 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 glower* W2 glows* glubs W2 gluck W2 glump W2 glyph golfs* gowds Ch gowks Ch gowls* Ch grews Ch grift OSPD grosz grows growl* grubs* grunt crypt Ch gucks gucky gulch gumby W2 gumps gwey W2 gyms Ch
humfs Ch
jacks jacky OSPD jampy W2 jampy W2 jomps jowpy W2 jucks W2 judex W2 jubits W2 jomby Ch jumby jumpy junga 0
kembs Ch kempt kevil OSPD kings* Klang* W2 klong OSPD klutz kreng Ch kvint W2
lawzy W2 lymph
Micks mucks Muntz* (metal) Ch
nexum W2 nimbs 0 numb 0 nymph
oxfly W2
packs* pangs* phlox picks* picky plack Ch pleck W2 prexy* Pshav W2 Pyrex*
Qungs W2 Quibs W3 qvint W2 QVERT 0
rhumb
scrub* spack* Ch spang* Sphinx W2 Spick* swack* Ch swerf Ch swick* W2
thrix Dorland trick trinq W2 truck tumb W2 twang twelf W2 twick W2 twink Ch
unfix unmix W2
verbs vetch vibex Ch vixen vozhd 0 vrack W2
wacks* OSPD wacky* welch wembs Ch whack* whelp which W2 whistle W2 whine W2 whomp whumps wicks* wocks Ch wofls* wombs wrang OSPD wreck wrick Ch wring wrink W2
xylie* Ch
zacks Ch zambo Ch zarps W2 Zhmud W2 zimbs Ch zings zingy zygal* W2