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 O in the Oxford English Dictionary, Second Edition. Starred words have anagrams.
There are, apparently, only two Jotto solutions confined to the three commonest dictionaries: (fyjord vibex waltz gymps chunk q) and (fyjord 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 flows breck g qvint Japyx Zhmud grows block f* qvint Japyx Zhmud flows breck f* qvint Japyx Zhmud frows bleck f* qvint Japyx Zhmud flows breck g qvint Japyx Zhmud frows bleck f* qvint Japyx Zhmud grows bleck f* qvint Japyx Zhmud grows bleck g qvint Japyx Zhmud grows bleck f* qvint Japyx Zhmud frows bleck f* qvint Japyx Zhmud frows bleck g qvint Japyx Zhmud grows bleck f* qvint Japyx Zhmud grows bleck g qvint Japyx Zhmud grows bleck f*

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 bowks fremd bulch z qvint Japyx bowks fremd drubs z qvint Japyx bowsk defegm chubs 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.
The second largest concentration of adjacent Jotto solutions is based on QWERT and vozhd, accompanied by either Japyx or ampyx.

<table>
<thead>
<tr>
<th>QWERT vozhd Japyx climb gunks</th>
<th>QWERT vozhd Japyx climb funks</th>
</tr>
</thead>
<tbody>
<tr>
<td>QWERT vozhd Japyx climb funks</td>
<td>QWERT vozhd ampyx flick bungs</td>
</tr>
<tr>
<td>QWERT vozhd Japyx blick funks</td>
<td>QWERT vozhd ampyx blick funks</td>
</tr>
<tr>
<td>QWERT vozhd ampyx flick bungs</td>
<td>QWERT vozhd ampyx blick jungs</td>
</tr>
<tr>
<td>QWERT vozhd Japyx flick bungs</td>
<td>QWERT vozhd Japyx flick numbs</td>
</tr>
</tbody>
</table>

Nearby are two small sets of adjacent solutions.

<table>
<thead>
<tr>
<th>QWERT vozhd Japyx flung Micks</th>
<th>QWERT vozhd ampyx fling jucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>QWERT vozhd Japyx fling Micks</td>
<td>QWERT vozhd ampyx fling bucks</td>
</tr>
<tr>
<td>QWERT vozhd Japyx fling Micks</td>
<td>QWERT vozhd Japyx fling bungs</td>
</tr>
<tr>
<td>QWERT vozhd Japyx fling bungs</td>
<td>QWERT vozhd Japyx fling numbs</td>
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<tr>
<td>QWERT vozhd Japyx fling bungs</td>
<td>QWERT vozhd Japyx fling numbs</td>
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In addition there are several isolated QWERT vozhd solutions.

<table>
<thead>
<tr>
<th>QWERT vozhd jumps bingy flack</th>
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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 pleck v
waqfs Zhmud vibex grypt block 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 Jlmpy vozhd wreck flang x
Qutbs Jlmpy vozhd wrang fleck x
Qutbs Japyx vozhd wreck fling m
Qutbs ampyx vozhd wreck fleck 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 jimpy vozhd twelf brick j
Qungs Japyx Nordv wheft blick z
Qungs Japyx Nordv whift blick z
Qungs prexy 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 tumbs fling
Japyx vozhd wreck numbs glift
Japyx vozhd wreck bumfs glint
Japyx vozhd wrick bumfs glint

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

Eliminating voc...

Japyx zimbs wembs trick flung
Japyx dzong thrix Jumpy brent x

The two com...

fjord vibex
jumps bery
jumpy vibe
jocks vibex
jufts vibex

Reviewing the TDPHS can be tough...

q vint fjeld
q vint fjeld
q vint fjeld

Zbrug is a ri...

q whom Jap)
q whom Jay

If one adm...
Ink g r y p t j
i.pt k ren g x
'gupt glink x
ng k empt j
lck bre n t x
unt ble ck x
y-pt blunk j
Iph truck
J
Japyx vozhd
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 2hmud flawn grypt
jufts vibex dzong lymph wrack
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 r.ldjacency set.
q vint fjeld xysma 2brug chowk p
q vint fjeld ampyx 2brug wocks h
q vint fjeld ampyx 2brug 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 2brug vents flick d
qwhom Japyx 2brug 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 umlauted letters. The
best solution involving Rzhev is (jumps boxy Rzhev dwang flick q), Bronx is (davve 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 bgiqv 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.

SOURCE 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 borgs* 0 bortz OSPD bowks 2 bowls* bowrs* Ch boxy Ch brack Ch braxy OSPD breck W2 brent OSPD brews brick brock brogs* Ch brobs* brugh* W2 brung W2 brunt* bucks bucky W2 bulch W2 bums bump 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 clawn W2 clerk cliff Ch cling clink clipt Ch clark clunk clunk crazy crept crink W2 cromb crumb crank W2 crwth Ch crypto curbs* cylx* OSPD
drowk W2 drubs dwarf dwerrf W2 dzong 0
d mbox Ch

cawks* W2 fangs fangy W2 fecks Ch fiqhs RHD fielj Ch fjerd flack flaky flamb W2 flang O flask flawn Ch fleck flegm O flags Ch Flems W2 flews flick flimp Ch fling flock flags* flong Ch flown

flows* flump frogs frowl W:
gamps gawby ginks* glazy globs glowr* gowds Ch gos Ch grosz grows* gumby W2 gumr* humffs Ch jacks jacky Ch jucks W2 judez

kembs Ch kerep Ch krenge Ch kvis
lawzy W2 lyme

Micks mucks mucka

nexum W2 nimns

oxfly W2 packs* pangs Pshav W2 Pyrd

Qungs W2 Quot

rhumb

scrub* spack swick* W2
thrix Dorland twick W2 twin

unfix unmix verb vetch

wacks* OSPD whiff W2 while wrang OSPD xlyc*

zygal* Ch
flows* flump flung flusk W2 fowls* frack Ch freck W2 fremd OSPD frogs frowl W2 frows fudyg W2 Fultz W2 fungs Ch fungy 0 funks
gamps gawby W2 gawds W2 gawps geck Ch gerbs* W2 gimpss ginks* glazy Ch gleby Ch glent Ch glift Ch glink* W2 glint glitz
globs glorw* W2 glows* glubs W2 gluck W2 glump W2 glyph golfs*
gowds Ch gowfs Ch gowks Ch gowlss* Ch grows Ch grift OSPD
gross grows growl* grubs* grunt gryp Ch gucks gucky gulch
gumby W2 gumps gweyly W2 gyms Ch

humfs Ch

jacks jacky OSPD jambo Ch Japyx W2 jimpys W2 jocks jowpy W2 jucks W2 judex W2 juftys W2 jumby Ch jumps jumpy jungas 0

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 0 numbs nymph

oxfly W2

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

Pshav W2 Pyrex*

Qungs W2 Qutbs W3 qvint W2 QWERT 0

rhumb

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

swick* W2

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

unfix ummix W2

verbs vetch vibex Ch vixen vozhd 0 vrack W2

wacks* OSPD wacky* welch wembs Ch whack* whemp whic Ch

whift W2 whing W2 whomp wumps wicks* wocks Ch wolfs* wembs
wrang OSPD wreck wrick Ch wring wrink W2

xylic* Ch

zacks Ch zambo Ch zarps W2 Zhmd W2 zimbs Ch zings zingly

zygal* W2