A NEW LOOK AT THE JOTTO PROBLEM

A. ROSS ECKLER
Morristown, New Jersey

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 0’s 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: (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 bleck g* qvint Japyx Zhmud grows fleece b* qvint Japyx Zhmud flows breck b qvint Japyx Zhmud grews bleck g qvint Japyx Zhmud grews block f* qvint Japyx Zhmud gowes breck b qvint Japyx Zhmud gowes block f* qvint Japyx Zhmud gowes fleece b qvint Japyx Zhmud gowes fleece f* qvint Japyx Zhmud gowes fleece g qvint Japyx Zhmud gowes fleece w qvint Japyx Zhmud gowes fleece w qvint Japyx Zhmud gowes fleece b qvint Japyx Zhmud gowes fleece w qvint Japyx Zhmud gowes fleece f* qvint Japyx Zhmud gowes fleece g qvint Japyx Zhmud gowes fleece 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 bowks fremd bulch z qvint Japyx bowks fremd bulch z qvint Japyx bowks fremd bulch 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 Uzbek 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 the QWERT Japyx solutions. Over half of them are found in the Jotto solutions.
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 blick fungs m
QWERT vozhd ampyx blick fungs j
QWERT vozhd Japyx flick bungs m
QWERT vozhd ampyx flick bungs j
QWERT vozhd Japyx flick numbs g
QWERT vozhd ampyx flick numbs g

Nearby are two small sets of adjacent solutions.

QWERT vozhd Japyx flung jocks b
QWERT vozhd Japyx fling mucks b
QWERT vozhd Japyx fling bucks m
QWERT vozhd Japyx clink bums f
QWERT vozhd Japyx glink bums c
QWERT and vozhd alone (without Japyx or ampyx) generate adjacent Jotto solutions. Consider the following:

QWERT vozhd jucks fangy glimp x
QWERT vozhd jacks fungy glimp x
QWERT vozhd jacks bungy flimp x
QWERT vozhd jimpys flack fungs x
QWERT vozhd jimsy funks fling x
QWERT vozhd jumby flack pangs x
QWERT vozhd jumpy flack bangs x
QWERT vozhd jumby blick fungs x
QWERT vozhd jumby blick fangs x

In addition there are several isolated QWERT vozhd solutions.

QWERT vozhd jumps bingy flack x
QWERT vozhd jungs backy flimp x
QWERT vozhd jungs backy flimp x
QWERT vozhd jumby flack gumps x
QWERT vozhd jumby flack spang x
QWERT vozhd jumby flick gumps x
QWERT vozhd jumpy blick fangs x
QWERT vozhd jumpy blick fangs x
QWERT even generates a few solutions without the help of vozhd.

QWERT Japyx dzong chimp flusk v
QWERT Japyx Zhmud flick bongs v
QWERT Japyx dzong blick humps v
QWERT Japyx Zhmud fling bocks v
QWERT jumby dzong Pshav flck x

In addition to qvint and QWERT, wqfs 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 glint prick x
waqfs vozhd jumby glint brick x
waqfs vozhd jumby glint breck x
waqfs vozhd unmix grypt bleck j
waqfs vozhd nexum grypt bleck j
waqfs vozhd benjy glump frick x
waqfs vozhd bemix clunk grypt j
waqfs vozhd jumby clipt kren x
waqfs vozhd jumby crept glink x
waqfs vozhd cylix brung kempt j
waqfs vozhd jumby brenk brent j
waqfs vozhd jumby grunt bleck x
waqfs vozhd cimex grypt blink j

Other waqfs solutions include:
waqfs dzong thrix jumby pleck v
waqfs dzong thrix jumpy pleck v
waqfs Zhmud vixen grypt block j
waqfs Zhmud vibex grypt clonk j
waqfs Zhmud vibex grypt klorg j
(waqfs kvint crumb glyph judex z) and (wakfs kvint 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.

Quqbs jimpy vozhd wreck flang x
Quqbs jimpy vozhd wrang fleck x
Quqbs Japyx vozhd wreck fling m
Quqbs ampyx vozhd wreck fling j
Quqbs Japyx vozhd wing fleck m
Quqbs ampyx vozhd wing fleck j
Quqbs Japyx vozhd wrick flegm n
Quqbs fjeld zingy vrack whomp x
Quqbs Japyx Nordv whing fleck z
Quqbs Japyx Nortz whing fleck m
Quqbs Japyx Nortz whing fleck j
Quqbs Japyx Nordv whift blick z
Quqbs fjejd ampyx bortz whick v
Quqbs Japyx blitz chowk fremd v
Quqbs Japyx vozhd twelf brick m
Quqbs ampyx vozhd twelf brick j
Quqbs jimpy vozhd twelf brick j
Quqbs Japyx Nordv wh elf bleak z
Quqbs Japyx Nordv whift bleak z
Quqbs prexy vozhd twick flamb m
Quqbs 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 tums flank
Japyx vozhd wreck numbs glift
Japyx vozhd wreck bums flint
Japyx vozhd wreck bums glint
Japyx vozhd wrecks fling
Japyx vozhd wembs trick flung
Japyx vozhd wembs truck fling
Japyx vozhd wembs crunk glift
Japyx vozhd wembs clunk glift

Eliminating vocs

Japyx zimbs v
Japyx dzong v
Japyx Zhmud v
Japyx nor v

The two coms

fjord vibex
jumps bery
jumpy vibe
jocks vibex
jufts vibex

Reviewing the TDJotto can be
these five co
the three hardest

Revie win g
TDPHS can b,
these five co
three hardest'

q whom Jap)
q whom JaPJ

Zbrug is a ri
Växjö Zbrug C

q whom Japy
q whom Japy

If one adm Rzhev
If one adm Rzhev

Bronx, Rzhev
Bronx, Rzhev
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.

```
quint fjdyl xysma Zbrug chowk p
quint fjdyl ampyx Zbrug wocks h
quint fjdyl 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 Vaxjo Zbrug Cwyd 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 Vaxjö 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 boxty Rzhev dwang flick q), Bronx is (jaye 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 (abcdefg hi j m no pq rst uv w xy z) and (afk pu bg lv 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
backy W2 bangs bawze 0 becks bemix Ch benjy W2 bergs* berms Beryx W2 bingy W2 black blazy W2 bleck W2 blick W2 blimp blitz block blows* blick Ch bocks borgs* 0 borts OSPD bowks bowls* bowrs* Ch boxty Ch brack Ch braxy OSPD breck W2 brent OSPD brews brick brock brogs* Ch bros* W2 brung W2 brut* 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 clawk W2 clerk clift Ch cling clink clipt Ch cloak clunk crazy crept crink W2 cromb crumb crank crwth Ch crypt curbs* cylix* OSPD drowk W2 drubs dwarf dwerf W2 dzong 0 embox Ch falls* W2 fangs fangy W2 fecks Ch fihgs RHD fjeld Ch fjord flack flaky flamb W2 flang 0 flask flawn Ch feckle flieg 0 floggs Ch Flems W2 flews flick flimp Ch fling fluck flugs* flong Ch flown flows* flump frogs frowl W2 gamps gawby ginks* glazy gloves glowr* gowsd Ch gors Z grosz grows* gumby W2 gumfs Ch jacks jacky Ch jucks W2 judek kembs Ch kengy Ch kreng Ch kviky lawzy W2 lympy Micks mucks mumb melum nexum W2 nimby oxfly W2 packs* pangy Pshav W2 Pyr Qungs W2 Quit rhumb scrub* spack swick* W2 thrill Dorland twick W2 twin unfix unmix verb vetch wacks* OSPD whift W2 whoops wrang OSPD xylic* Ch zacks Ch zanzy zygal* W2
gamps gawby W2 gawds W2 gawps gecks Ch gerbs* W2 gimps ginks* glazey Ch gleby Ch glent Ch glift Ch glink* W2 glib W2 glitz globs glowr* W2 glows* glubs W2 glut W2 glump W2 golfs* gowsds Ch gowsks Ch gowls* Ch gows Ch grift OSPD gromz grows growl* grubs* grunt grypt Ch gucks gucky gulch gumby W2 gumps gowy W2 gyms Ch

humfs Ch

jacks jacky OSPD jambo Ch Japyx W2 jimpys W2 jocks jowpy W2 jucks W2 judex W2 jufts W2 jumby Ch jumps jumpy jungo W2

kems Ch kempt kevil OSPD kings* Kling* W2 klong OSPD kluzt kren 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 O

rhumb

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

thrix Dorland trick tring W2 truck tums 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 whick W2 whif W2 whing W2 whomp whomp wicks* wocks Ch wolfs* wombs wrang OSPD wreck vreck Ch wring wrinkle W2

xylie* Ch

zacks Ch zambo Ch zarps W2 Zhmud W2 zimbs Ch zings zinny zygals* W2