REGULAR LATIN WORD SQUARES

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A Latin square is an $n \times n$ array filled with $n$ different symbols each occurring only once in each row and once in each column, like a sudoku puzzle. In the following $3 \times 3$ example the letters A,B,C can be replaced by the numbers 1,2,3.

\[
\begin{align*}
A & \quad B & \quad C \\
C & \quad A & \quad B \\
B & \quad C & \quad A
\end{align*}
\]

A Latin square is said to be regular (also reduced, normalized or in standard form) if both its rows and its columns are in the same order, as in a regular word square, for example:

\[
\begin{align*}
A & \quad B & \quad C \\
B & \quad C & \quad A \\
C & \quad A & \quad B
\end{align*}
\]

Here are some $3 \times 3$ squares of this sort using only words allowed in international Scrabble. ETH is an old English letter, DSO a yak/cow cross, AIT a small island, ITA a palm tree, TAI a sea bream, ICH a fish disease, RYA a Scandinavian rug, ARY any and SHA = sh! (be quiet).

\[
\begin{align*}
E & \quad A & \quad T & \quad S & \quad P & \quad A & \quad S & \quad O & \quad D \\
A & \quad T & \quad E & \quad H & \quad T & \quad P & \quad A & \quad S & \quad D & \quad S \\
T & \quad E & \quad A & \quad T & \quad H & \quad A & \quad S & \quad P & \quad D & \quad S & \quad O
\end{align*}
\]

\[
\begin{align*}
A & \quad I & \quad T & \quad C & \quad H & \quad I & \quad R & \quad Y & \quad A & \quad A & \quad S & \quad H \\
I & \quad T & \quad A & \quad H & \quad I & \quad C & \quad Y & \quad A & \quad R & \quad S & \quad H & \quad A \\
T & \quad A & \quad I & \quad T & \quad H & \quad A & \quad C & \quad H & \quad A & \quad R & \quad Y & \quad H & \quad A & \quad S
\end{align*}
\]

On the left below is the first published regular Latin word square, which appeared in the 1860 edition of American Almanac, where it was described as a 'palindromic word square', because it reads the same backwards as forwards. METI is a town in Ethiopia. [Geo]
The square on the right is also palindromic. It contains words from Web3 only. NEMA is a parasitic worm and ENAM is a type of land grant in India.
TIME MANE
ITEM AMEN
METI NEMA
EMIT ENAM

The square on the left below contains four ChD words, but only two different letters are used so it is not a Latin square. ANAN is an expression of failure to understand.

It is possible to construct a 4 x 4 square using just Scrabble words, all of which are found in ChD. Remarkably, there are only four allowable transposals of the letters ACOT and they can be used to make a perfect regular Latin square. OCTA is a unit of sky cover (one eighth) and ATOC is a species of skunk.

ANNA COAT
NAAN OCTA
NANA ATOC
ANAN TACO

A 5 x 5 Latin square using only Scrabble words has yet to be found. Here is one with two Scrabble terms, RESAT (an exam, e.g.) and ARETS (assnys), as well as ESTRA, an island off Sweden [Geo], STAER, dialect for 'stair', steep [EDD] and TARSE, penis [OED].

RESAT
ESTRA
STAER
ARETS
TARSE

At the 6 x 6 level things get harder. Several proper names have been used in the following square.

IRONES
RESINO
OSERIN
NIROSE
ENISOR
SONERI

IRONES aromatic oils [Web3]
RESINO surname listed 67 times in US TDs
OSERIN surname listed 15 times in US TDs
NIROSE female given name [100+ on Facebk]
ENISOR Romanian surname [100+ forebears.io (Net)]
SONERI cloth of gold [ChD]

A 7 x 7 regular Latin word square is possible, but a couple of the names are dubious.

TRASINE
RANITES
ANIREST
SIRENTA
ITENSAR
NESTARI
ESTARIN

TRASINE canal in central Lithuania [Geo]
RANITES pl. of ‘ranite’, a zeolitic mineral [OED]
ANIREST online clothing supplier located in Germany [Net]
SIRENTA female given name, e.g. Sirenta Reeves + others [Facebk]
ITENSAR George and Belle Itensar, 1880 US Census [ancestry.com (Net)]
NESTARI engineering company in Malaysia [Net]
ESTARIN sea elves’ god in the fantasy world of Dragonlance [Net]

The challenge now is to improve the quality of the larger squares by using more dictionary words, and to construct a reasonable 8 x 8 example.

References
ChD Chambers Dictionary, 11th ed., 2008
EDD English Dialect Dictionary, J Wright, 1905
Facebk Facebook, online social networking site [Net]
Geo geonames.usgs.gov placename database [Net]
Net Internet, using Google search program
TD Telephone Directory [whitepages.com (Net)]
Web3 Webster’s 3rd New International Dictionary, 1976