WIDE ALPHAMETICS

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An alphametic, as most Word Ways readers are surely aware, is a puzzle like \( \text{SEND} + \text{MORE} = \text{MONEY} \), in which letters are to be replaced with decimal digits to make a valid addition sum. Such puzzles were originally called "cryptarithms" and sometimes just used jumbles of letters rather than words or phrases; the term "alphametic" was introduced by J. A. H. Hunter in the 1950's for cryptarithms which use actual words.

The goal of this investigation was to construct examples of two-addend alphametics which are as wide as possible. Since alphametic composers generally prefer puzzles which have a unique solution (i.e., there is only one possible assignment of digits to letters which works), I only allowed alphametics which obey this constraint. As it turns out, enforcing this extra restriction only eliminated a few finds.

There are four types of two-addend alphametic, with the words having \( N, N, \) and \( N \) letters, or \( N, N+1, N+1, N+1 \), or \( N, N+1, N+2 \). The tables below list the widest alphametics I was able to find for each of these four type. For a given type and value of \( N \) a computer program constructed all possible alphametics of the required form, using words lists of the appropriate length, and checked each to see if it has exactly one numerical solution. I then hand-checked the output and retained only those alphametics in which all three words are main entries in either Webster's Third Unabridged or the Oxford English Dictionary. Inferred plurals are also allowed.

If a list below is marked "Full", then it is the full list of all alphametics that were found for the given word lengths; if it is marked "Partial" then just a selection is given, favoring those using more common words, from among all those found.

Type \( N,N,N \) (12, 12, 12) Partial

<table>
<thead>
<tr>
<th>ALPHAMETIC 1</th>
<th>ALPHAMETIC 2</th>
<th>ALPHAMETIC 3</th>
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<tbody>
<tr>
<td>ACOUSTICIANS</td>
<td>INCANTATIONS</td>
<td>TOTALITARIAN</td>
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<tr>
<td>ANTAGONISTIC</td>
<td>INTUITIONIST</td>
<td>DISSOCIATING</td>
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<td>ANTAGONIZING</td>
<td>INTERROGATOR</td>
<td>REITERATIONS</td>
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<tr>
<td>ASSASSINATES</td>
<td>MISPLACEMENT</td>
<td>LISTLESSNESS</td>
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<tr>
<td>ASSASSINATES</td>
<td>DISPOSITIONS</td>
<td>CONSTITUTION</td>
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<td>ATTAINMENTS</td>
<td>ILLITERATELY</td>
<td>RESTLESSNESS</td>
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<td>NECESSITATES</td>
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<td>REAPPRAISALS</td>
<td>BRISTLETAILS</td>
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<tr>
<td>MALTREATMENT</td>
<td>TERRESTRIALS</td>
<td>ANTISEMITISM</td>
</tr>
<tr>
<td>MEASUREMENTS</td>
<td>REAPPEARANCE</td>
<td>TEMPERATURES</td>
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</tbody>
</table>
REINCARNATES + TERRESTRIALS = CONTRACTIONS
TEARLESSNESS + TRANSVESTITE = RESERVATIONS

Type N,N,N (13, 13, 13) Full

AEROGEOLOGIST + ASTROLOGASTER = ESSENTIALNESS
ALANTOLACTONE + CONDENSATIONS = INSATIATENESS
CONCUSPENCE + CONSCIOUSNESS = SUPERSEDENCES
ECTOCARPACEAE + POSTPROCESSOR = NONPERCEPTION **
ELECTROTACTIC + INTERZOOECIAL = CONTORTIONATE
POSTCANONICAL + TRIPARTITIONS = COCONSPIRATOR

Type N,N,N+1 (12, 12, 13) Full

ALIMENTATION + TESTIMONIALS = SENTIMENTALLY
ANTIPARALLEL + PRETREATMENT = IMPERTINENTLY
CAPACITATION + INCAPACITATE = TENTATIVENESS
CONCATENATES + NEUROCENTRUM = RESTAURAURERS
CONSPIRATORS + STEREOSTATIC = REAPPROPRIATE
CORRECTITUDE + UNCTIOUSNESS = REDUCTIONISTS
DETERMINANTS + REASSESSMENT = MILLENNIARIISM
EOSINOPHILA + OSCILLOSCOPE = SHAPELESSNESS
EXAGGERATORS + REINSERTIONS = INSENSATENESS
INOBTAINABLE + SELENOLOGIST = BIBLOGENESIS
RETALIATIONS + SINISTERNESS = LINEARIZATION

Type N,N+1,N+1 (12, 13, 13) Partial

ADESSENARIAN + TETRODONTIDAE = TRANSMISSIONS
ANACHRONISMS + TRANSMISSIONS = ASCOTHORACICA
ASSASSINATES + CANCEROUSNESS = CONCURRENCIES
CITRICOLTORE + BACCALAUREATE = RECOLLECTIBLE
OPPOSITIONAL + TRANSPERSONAL = TASTELESSNESS
PHAEOSPOREAE + SENSELESSNESS = SHARECROPPERS

Type N,N+1,N+2 (11, 12, 13) Full

CENTERPIECE + CONIFICATION = PROPRIOCEPTOR
CONCOCTIONS + UNPERCEPIENT = OPPORTUNISTIC
IRRITATIONS + PREPOSITIONS = TETARTEMORION

** POSTPROCESSOR is the only exception I permitted to the rule of requiring words to appear in Web3 or the OED. This word is a common term in computer engineering, so I allowed it in order to snag another (13,13,13) solution.

Each type was searched with increasing values of N until no alphametics of the given form could be found. No (14,14,14) or (13,13,14) or (13,14,14) or (12,13,14) alphametics were found — indeed, no alphametic having even a single 14-letter word. Readers are challenged to find such an alphametic — especially one having that most pleasing form, (14,14,14). Note that words longer than 13 letters are not addends.

A Variant:

I came across a wordplay example of mine in a Croatian:

FISMOGIST

cryptoclu

The goal here is to change some back-letters which in the (composed 2002 as child solved, as the width of this problem appear in the

The answer can be extended into an

ECTOCA

cryptoclu

Remarkably word phrases

AEROGEOS

cryptoclu

CONCU

cryptoclu

Readers will try extend such just enjoy...
than 13 letters can be easily incorporated into an alphametic if we’re allowed to go beyond two addends.

A Variant: Alphametic with cryptoclue

I came across this alphametic variant recently in correspondence with Zoran Radisavljevic, a wordplay enthusiast in Serbia, who showed me this wide example of the form composed in Croatian:

PISMOSISTOKA + PROKRSTARITI = STAROKATOLIK
cryptoclue: 7082493 95613

The goal here is to first solve the alphametic, which must by necessity have a unique solution, and then back-substitute letters for the digits in the cryptoclue to get the final answer, a word or phrase, which in this case is TROPSKA KLIMA, Croatian for “tropical clime”. Zoran sent me this puzzle (composed by Josip Stifter and Vladimir Kuterovac, published in Kvizorama No. 548, May 10, 2002) as challenge: could a similar puzzle be constructed in English to equal or better the 12-letter width of this example? Note that the cryptoclue should include all the different digits which appear in the puzzle, but of course some digits may be used more than once.

The answer to Zoran’s challenge is “yes”, since several of the (13,13,13) alphametics listed above can be extended to a (13,13,13)+13 alphametic-plus-cryptoclue puzzle. Here are two examples:

ECTOCARPACEAE + POSTPROCESSOR = NONPERCEPTION
cryptoclue: 2309686854137

ALANTOLACTONE + CONDENSATIONS = INSATIATENESS
cryptoclue: 5668902317843

Remarkably, each of these puzzles consists entirely of 13-letter words, with no need for multi-word phrases. In these two the cryptoclues are two-word phrases:

AEROGEOLOGIST + ASTROLOGASTER = ESSENTIALNESS
cryptoclue: 51546 94703082

CONCUPISCENCE + CONSCIOUSNESS = SUPERSEDEANCES
cryptoclue: 98624 59123077

Readers who take up the challenge of finding a 14,14,14 (or larger!) alphametic may also wish to try extending any successful constructions to also have a cryptoclue. Or, ignore the challenge and just enjoy solving the 41 alphametics!