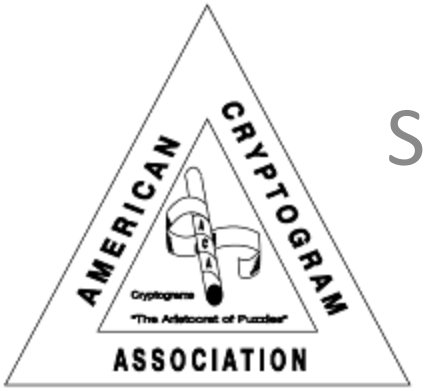
Examples of Solving *Cm* Cons*



Solving C-2 from Sample *Cm* Cryptarithm

* "*Cm* Cons" means "cipher constructions in *The Cryptogram*" -- the bi-monthly publication for members of the American Cryptogram Association (ACA) -- www.cryptogram.org

Examples of Solving

This series shows specific examples of solving ACA ciphers. It tries to give successive hints of what to look at, then follows through by using each hint, building to the solution.

Try to solve the cipher on your own, using as many hints as you need, or just read along.

Please report errors or send suggestions to nudge@cryptogram.org

References

- The ACA and You, Ch. 4, How to Solve a Problem in *The Cryptogram*.
- An Approach to Cryptarithms, by FIDDLE, 1963.

What is a Cryptarithm?

A cryptarithm is an arithmetic operation in which letters have been used to represent the digits. Use the rules of arithmetic to infer what digit each letter represents. Each cryptarithm has a unique solution.

Cryptarithms in *Cm* are written in a single line to conserve space.

Getting started on a Cryptarithm

Start by rewriting the arithmetic in normal form. Then learn facts about the digits. E.g.,

- What represents zero, one, or nine?
- What cannot represent zero?
- What digit is greater than another?
- What set of digits can each letter represent?

Solving C-2 from Sample *Cm*

```
C-2.Multiplication.(Two words, 9-0) VERMONSTER
SUNNY * DAY = ADOONY; + NAMTSY; + SRMRNY = SAOMRASY
```

<u>What does the first line tell us?</u>

Cipher ID: C-2

Type: Multiplication

Key: the letters will spell out two words when listed in order from 9 to 0 (9876543210)

Created by ACA member VERMONSTER

Solving C-2 from Sample *Cm*

Rewrite the cryptarithm in traditional format, aligning digits correctly. Always a good first step.

```
SUNNY * DAY = ADOONY; + NAMTSY; + SRMRNY = SAOMRASY
```

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
          (2 wds)
```

Solving C-2 from Sample *Cm*

Rewrite the cryptarithm in traditional format, aligning digits correctly. Always a good first step.

```
SUNNY * DAY = ADOONY; + NAMTSY; + SRMRNY = SAOMRASY
```

```
      SUNNY
     x DAY
    ADOONY
   NAMTSY
  SRMRNY
  SAOMRASY


9876543210
            (2 wds)
```

We are multiplying by a three-digit number and we have three partial products. Therefore, all digits of the multiplier (DAY) are nonzero, and everything lines up nicely.

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
What can we say about Y?

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY


 9876543210
```

(2 wds)

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
Digits that behave like Y are: (0,1,5,6)

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
          (2 wds)
```

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
Possible digits for Y: (0,1,5,6)
Y has a six digit partial product. Y cannot be zero.

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY

 9876543210
            (2 wds)
```

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
Possible digits for Y: (1,5,6)
Y has a partial product that is not SUNNY. Y cannot be one.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
          (2 wds)
```

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
Possible digits for Y: (5,6)
SUNNY times D, A, and Y all end in Y. Only 6*1 and 6*6 end in 6, so can't satisfy three different values ending in 6. Y cannot be 6.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
          (2 wds)
```

Solving C-2 from Sample *Cm*

Y times SUNNY gives a partial product that ends with Y.
Possible digits for Y: (5)
Y must be 5. SUNNY times D, A, and Y all end in Y. Any odd number times 5 ends in 5, so that'll work, too. Record Y=5.
Remember also that D and A must be odd.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
    Y       (2 wds)
```

D is one of (3, 7, 9). A is one of (3, 7, 9).

Solving C-2 from Sample *Cm*

All of the partial products have six digits. The one starting with S must be larger than the rest – it is closer to 10 * SUNNY.
So D > A, D > Y. D is one of (7, 9). Also, S > N, S > A.

```
      SUNNY
    x  DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY


9876543210
    Y       (2 wds)
```

D is one of (7, 9). D > A. A is one of (3, 7).

Solving C-2 from Sample *Cm*

Y times SUNNY ends with NY; D times SUNNY ends with NY.
We can tabulate the products of a range of NNY times 5, 7, and 9. See which *7 or *9 products have the same right two digits as the corresponding *5 entry. Can omit N=0, 5.

```
      SUNNY
    x DAY
    ADOONY
   NAMTSY
  SRMRNY
  SAOMRASY

9876543210
    Y       (2 wds)
```

D is one of (7, 9). D > A. A is one of (3, 7).

Solving C-2 from Sample *Cm*

Y times SUNNY ends with NY; D times SUNNY ends with NY.
We can tabulate the products of a range of NNY times 5, 7, and 9. See which *7 or *9 products have the same right two digits as the corresponding *5 entry. Can omit N=0, 5.

```
    SUNNY
  x DAY
 ADOONY
NAMTSY
SRMRNY
SAOMRASY


9876543210
    Y       (2 wds)
```

D is one of (7, 9). D > A. A is one of (3, 7).

N	NNY	* 5(Y)	* 7	* 9
1	115	575	805	1035
2	225	1125	1575	2025
3	335	1675	2345	3015
4	445	2225	3115	4005
6	665	3325	4655	5985
7	775	3875	5425	6975
8	885	4425	6195	7965
9	995	4975	6965	8955

Solving C-2 from Sample *Cm*

Y times SUNNY ends with NY; D times SUNNY ends with NY.
In rows 225 & 775 (N=2, N=7) the last two digits of the 5 & 9 are the same. This identifies that D=9 (record it), N is one of (2, 7).

```
     SUNNY
   x DAY
  ADOONY
 NAMTSY
SRMRNY
SAOMRASY


9876543210
D   Y       (2 wds)
```

N is one of (2, 7). A is one of (3, 7).

N	NNY	* 5(Y)	* 7	* 9
1	115	575	805	1035
2	225	1125	1575	2025
3	335	1675	2345	3015
4	445	2225	3115	4005
6	665	3325	4655	5985
7	775	3875	5425	6975
8	885	4425	6195	7965
9	995	4975	6965	8955

Solving C-2 from Sample *Cm*

N + Y ends with S. If N=2, then S=7. If N=7, then S=2.
So…

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY


 9876543210
 D   Y      (2 wds)
```

N is one of (2, 7). A is one of (3, 7).

Solving C-2 from Sample *Cm*

N + Y ends with S. If N=2, then S=7. If N=7, then S=2.
Either way, 7 is in use, so A can only be 3. Record that.

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY


 9876543210
 D   Y A    (2 wds)
```

N is one of (2, 7). S is one of (2, 7).

Solving C-2 from Sample *Cm*

N + Y ends with S. If N=2, then S=7. If N=7, then S=2.
Either way, 7 is in use, so A can only be 3. Record that.
We also know S > N, so S=7, N=2. Record those.

```
      SUNNY
    x  DAY
    ADOONY
   NAMTSY
  SRMRNY
  SAOMRASY

 9876543210
 D S Y AN   (2 wds)
```

Solving C-2 from Sample *Cm*

SUNNY ends in 225. We can calculate some digits.

Y * 225 = 1125.

A * 225 = 675.

D * 225 = 2025.

```
      SUNNY
    x DAY
    ADOONY
   NAMTSY
  SRMRNY
  SAOMRASY

 9876543210
 D S Y AN   (2 wds)
```

Solving C-2 from Sample *Cm*

SUNNY ends in 225. We can calculate some digits.

Y * 225 = 1125. ONY=125. O=1.

A * 225 = 675. TSY = 675. T=6.

D * 225 = 2025. RNY=025. R=0. Record O, T, R.

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY


 9876543210
 D STY ANOR (2 wds)
```

Solving C-2 from Sample *Cm*

We are still missing U and M. U is only in SUNNY. M is in two of the partial products and the final sum.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
D STY ANOR (2 wds)
```

Solving C-2 from Sample *Cm*

We are still missing U and M. U is only in SUNNY. M is in two of the partial products and the final sum.
We can find U by using the first partial product (all other letters known).

```
      SUNNY
    x DAY
    ------
     ADOONY
    NAMTSY
   SRMRNY
   -------
   SAOMRASY

 9876543210
 D STY ANOR (2 wds)
```

Solving C-2 from Sample *Cm*

We are still missing U and M. U is only in SUNNY. M is in two of the partial products and the final sum.
We can find U by using the first partial product (all other letters known).
5 * SUNNY = 391125. So SUNNY = 78225. Record U=8.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
DUSTY ANOR (2 wds)
```

Solving C-2 from Sample *Cm*

We can calculate M, but 4 is the only one digit left, so M=4.

```
      SUNNY
    x DAY
   ADOONY
  NAMTSY
 SRMRNY
 SAOMRASY

9876543210
DUSTYMANOR (2 wds)
```

Solving C-2 from Sample *Cm*

All done! And the letters ordered 9-0 form two words.

Record the solution so you could later submit it for credit.

C-2 DUSTYMANOR

```
      SUNNY
    x DAY
    ADOONY
   NAMTSY
  SRMRNY
  SAOMRASY

9876543210
DUSTYMANOR (2 wds)
```

Thank you. Try another. Try the ACA!

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