A WORD GRAPH BESTIARY

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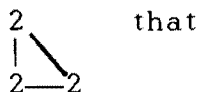
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W——H      A
 ╱ |    ╱ |
C——I   T——H
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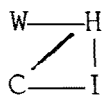
Spell out a word by connecting its different letters by lines, as illustrated at the left for WHICH and THAT. Allowing repeated traverses of the connector lines, NOTION traces out the WHICH graph; SENSE traces out the THAT graph. Allowing dwell on each doubled letter, BEETLE traces out the WHICH graph: SEEKS traces out the THAT graph. Words can be classified by their graphs just as they can by their letter patterns. AREA has the same pattern as THAT. ORDER and VERSE have the same pattern as WHICH.
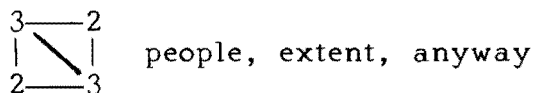
Each graph can be characterized by the number of connector lines emanating from each letter; the graph of WHICH is (1,2,2,2) and THAT, (2,2,2). These numbers tell us whether or not we can find a word for which each connector line is traversed exactly once. This feat is possible only if there are at most two letters having odd numbers of connections: if there are three or more such letters, at least one connection line must be traversed a second time. For instance, the graph that fully connects four different letters, each to three others, as in a flattened tetrahedron, is denoted by (3,3,3,3): one connector line must be traversed twice, and the shortest word associated with such a graph is eight letters long (UNENDUED is the only dictionary word known).

The number of different word graphs increases rapidly with the number of different letters in the word: 2 for three letters, 6 for four letters, 21 for five letters. All but two of these graphs (the pentagon with an inscribed star, characterized by (4,4,4,4,4), and the flattened Egyptian pyramid, characterized by (4,3,3,3,3)) can be traced out by minimum-length words. (No word of any length traces out the pentagon-star, and PREPOSSESSORS is the shortest word tracing out the pyramid.) All of the other word graphs are illustrated below, each accompanied by a type collection of minimum-length words corresponding to different letter patterns.
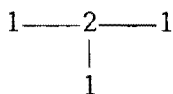
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1——2——1    the
```
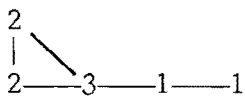
```
2
|  ╲
2——2       that
```

```
1——3
 ╱ |
2——2       which, areas
```

```
3——2
| ╲ |
2——3       people, extent, anyway
```

```
1——2——2——1    with            1——2——1
                                  |           state
                                  1

    3
   /|                           2——2
  /·3        unendued           |   |      going
 /·/                            2——2
3——3
```
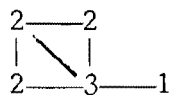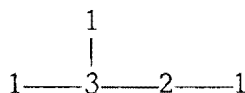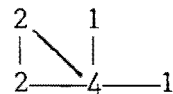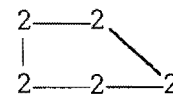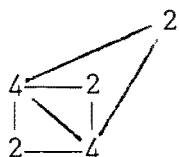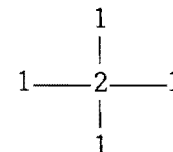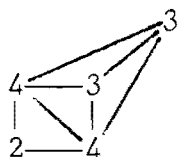
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1——2——2——2——1    would        2——2
                               |\  |       before, either
2                              2——3——1
|
2——3——1——1    always, former  2   1
                               |\  |       within
    1                          2——4——1
    |
1——3——2——1    future, spirit  2——2
                               |   \
2     2                        2——2——2    rather
|\    |
2——4——2    descend, species       1
           expense                 |
                               1——2——1    militia
         2                         |
        /|                         1
4——2   / |
|  \  /  |  sighings, tipsiest,  2——3
2——4/    |  sciences             |   |\
                                 2——3——2
         3
        /|
4——3   /·|  cercariae, inscience,  3——2
|  \  /·/|  repursues, triarctic,  |\  |
2——4/   /   intortion, ensconces   |·2 |
                                   2——3

1——3    decency, forlorn, bearers, depends, engaged,
 /|        penance, briefer
2——3——1

3——2
|\  |   Indians, checked, treated, sunburn, incense, instant
2——4——1

3
|\       torturous, tactician, enfiefing, intensest, threshers,
| 3——4——1   briberies
|/
3

2——3    Indiaman, marasmus, bearable, autunian, satirist,
|/  |      gadgeted, prepared, tortuous, tactical, anteater,
3——3——1    preripen, opinions, Ionornis, calculus, cohoshes,
           managing, condoned, penitent, desirers, sciatica,
           rehashes, retorted, tarpaper, stiltish, antinial,
           stagnant, seatmate, dealable
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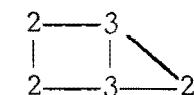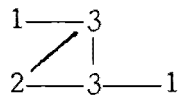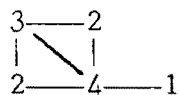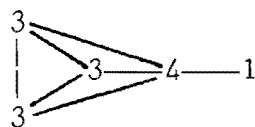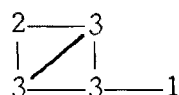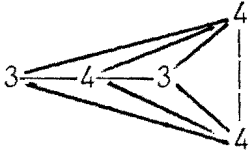
average
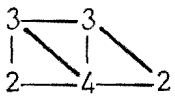
```
3———3
|  \ |\
|   \| \
2———4———2
```
disdains, gregaria, ganglial, seascape, eutectic, abrasers, prospers, recircle, schistic, twisties, aestuate, rhinaria, dastards, siltiest, intertie, extorter
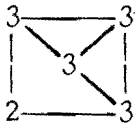
```
3————3
|  \ |
|   3 |
|  / \|
2————3
```
perspires, preparate, carcerate, repropose, semismile, rabirubia, coniceine, unendured, retiariae, trimerite, incidence, oinomania, nascences, intentive

```
        4
       /|
3—4—3  |
       |
        4
```
insciences

Finally, here are samples of non-minimum-length words (one for each word length) for various graphs:

(1,1,1,2,3) future, resists, helpless, preferred, corroboree, paramammary, assassinists
(1,1,1,1,4) militia, parallax, beekeeper, severeness, cassabanana,
(1,1,2,2,4) within, deserve, poolroom, persevere, bottomost, reverseless, coccidioidin, tenselessness
(1,2,2,2,3) before, gnawing, phosphor, sasswoods, lighttight, lallapalooza, occipitootic, killeekillees
(2,2,2,2,2) rather, momento, cockatoo, etiquette, ingraining, presuppress, resuppresses, presuppresses
(1,1,2,3,3) decency, diggings, hillbilly, nineteenth, nonionizing, tooodleoodle
(1,2,2,3,4) sunburn, ignition, redheaded, excellence, addleheaded, bhutatathata, leaselessness
(2,2,2,2,4) descend, recreate, bumblebee, parapraxia, notodontoid, barbaralalia, leglessnesses
(2,2,2,3,3) average, mishmash, appellate, crisscross, repossessor
(2,2,2,3,3) texture, illuvial, undeluded, onionskins, engineering, acetoacetate, endlessnesses
(1,2,3,3,3) bearable, valvaless, assistants, tattletales, acatallactic
(2,2,2,2,4) sighings, desuetude, streetless, mammillaria, newslessness
(2,2,3,3,4) disdains, attractor, perpetrate, flannelleaf, nonintention, sleeplessness
(1,3,3,3,4) torturous, incipience, insenescence
(2,3,3,3,3) perspires, tenostoses, dingdonging, prepossessor, consenescence
(2,3,3,4,4) cercariae, hardheaded, unconsonous, inefficience
(3,3,3,4,4) insciences, intensities