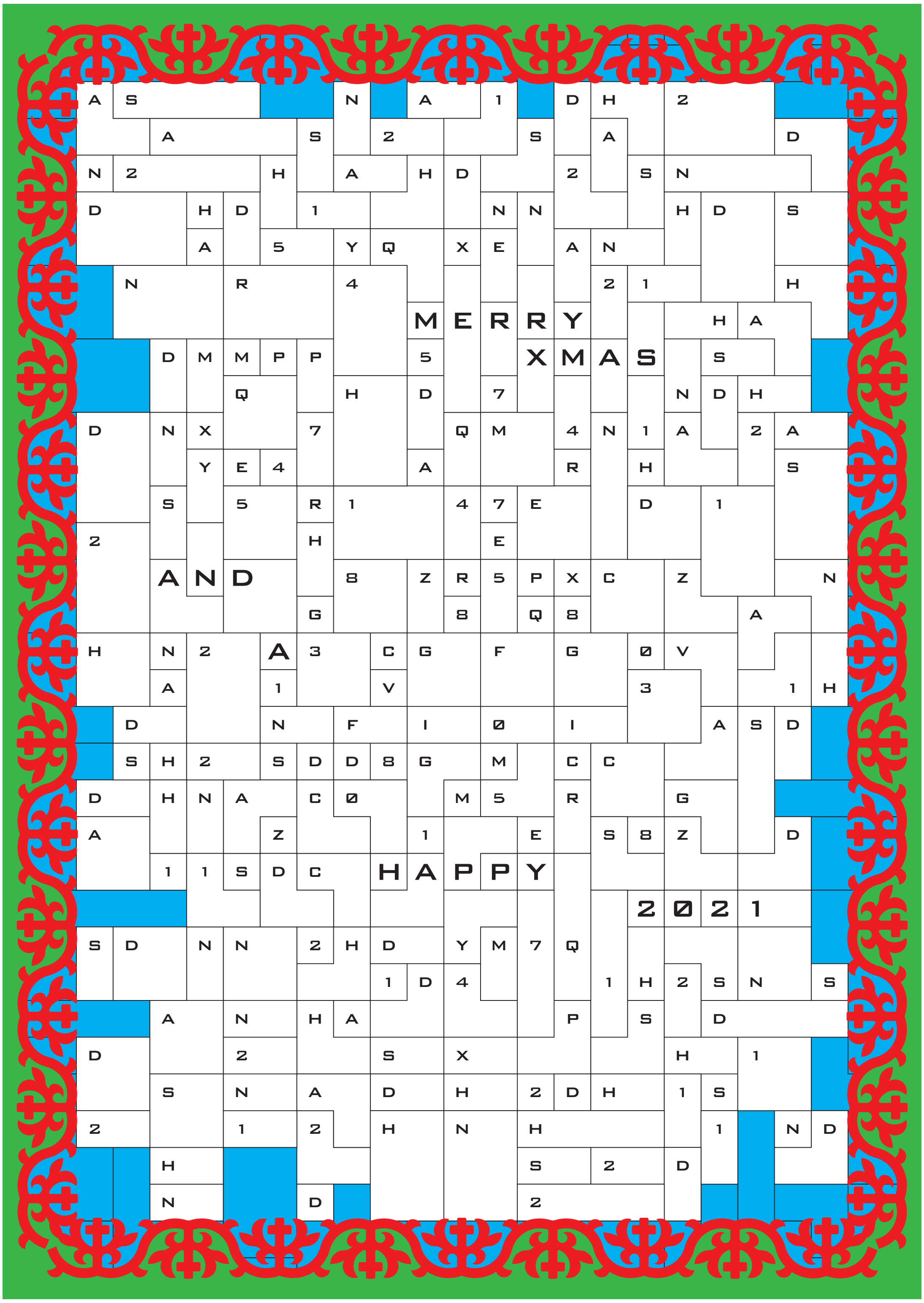
Christmas puzzle 2020



Solution booklet

Dear puzzler

I had a number of goals when I designed the 2020 Christmas puzzle.

First of all I wanted it to look like code without being unreadable; the Christmas wish had to be out in the open this time around. This way the puzzle really was optional. I don't want people to receive my card and think they HAVE to solve it (but I do want them to WANT to solve it).

Naturally I wanted it to be Christmassy in theme as well, but I doubt if anyone associated the network puzzles with Christmas balls like I intended... Perhaps I should have put a tree behind them or something.

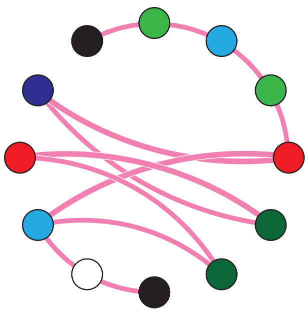
Finally, I want the yearly Christmas puzzle to be more accessible and less convoluted than my other puzzles sometimes get. It is not for me to judge if I succeeded (I think I improved on last year's but I also think I have a little further to go still) but with this solution booklet, you can decide for me.

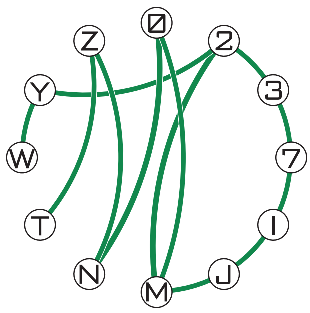
Most of all I hope you had fun with them. Let me know what you thought.

Oh and by the way. This booklet will show how I intended the puzzles to be solved; if you did it some other way, that is fine too!

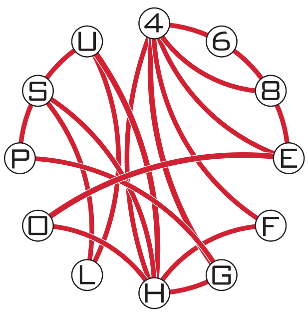
Solution, part one

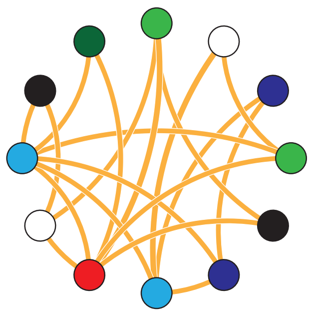
Step one is to figure out which of the six puzzles form pairs. This shouldn't be *too* hard, since they have varying degrees of 'connectedness' that should be easy to spot.



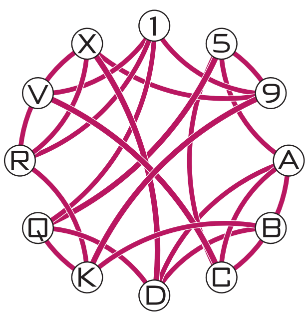


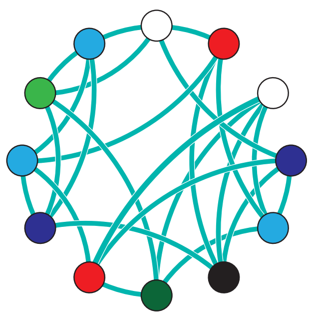
The first two can easily be recognized by the long strings of nodes at either end. This is what makes them the easiest of the lot.





The second and third pair are denser and so it is harder to separate them; this pair has a few obvious nodes that have only two lines, like the dark green and black ones and the P and F.



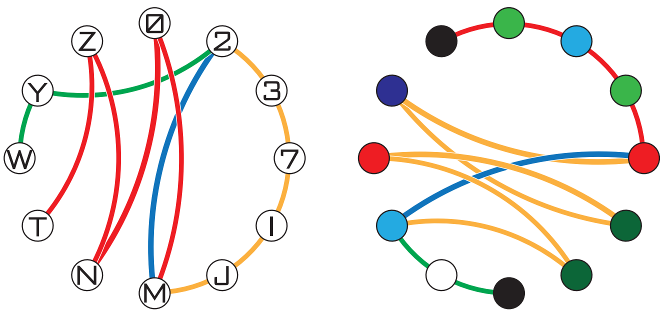


The last two have four lines going out from each node (which is also what makes them the hardest ones).

Solution, part two

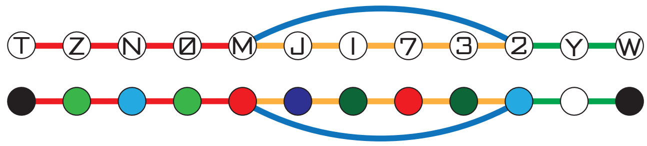
Now the real fun begins. We must figure out which node in the second network corresponds to each node in the first network. The result is a mapping from symbols to colors. Depending on the difficulty, a different strategy is needed.

The easiest pair



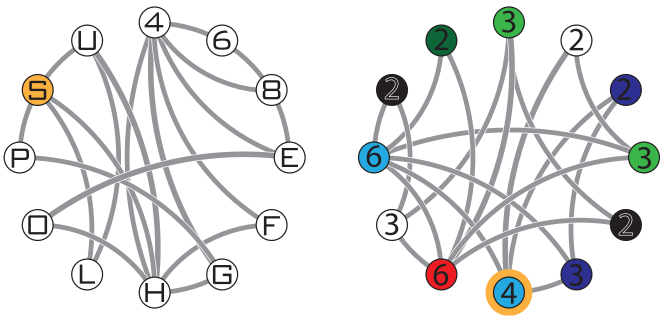
These two have the form of a loop with two 'arms' of unequal length. Both sides of the loop also have different length, which is how you can quickly identify everything. For clarity, I have colored both arms and both sides of the loop with different colors. This should make it clear what is what.

This yields the following mapping. Not all of them are used in the outer puzzle though; and we still need the other two.

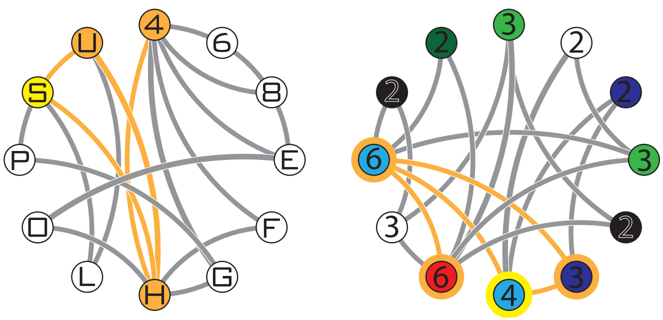


The middle pair

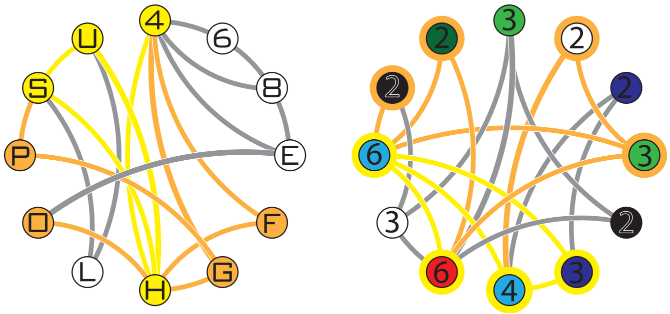
Now it gets harder, and we must (1) identify one or more nodes that are unique to the network, and (2) gradually work our way out from those. In the steps below I have colored nodes and lines identified in the step with orange, and information from previous steps has been made yellow.



Counting the number of lines going out from each node (the degree, for short, shown in the colored nodes) will quickly identify a starting point: the only node with degree 4 (light blue / S).

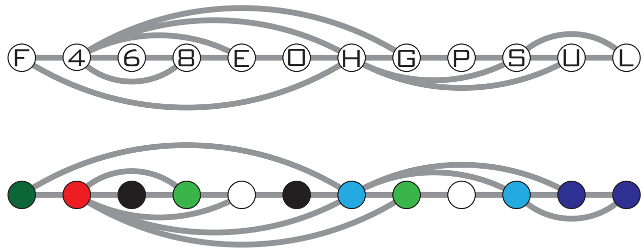


Only one of the two degree 6 nodes is connected to this starting node, which identifies both; the degree 6 node that is connected to the degree 4 node also forms a triangle with it and the dark blue degree 3 node (and not with other nodes). The corresponding node in the other graph is U.



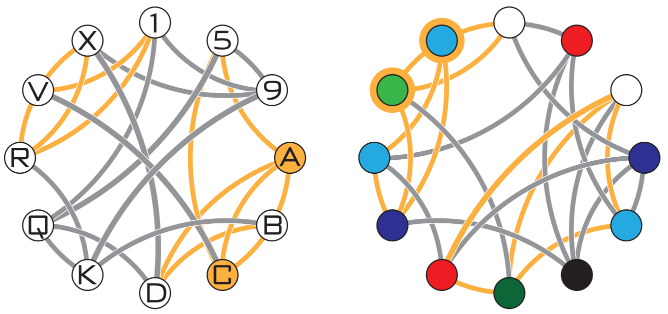
Two nodes are connected to both degree 6 nodes, of degree 2 (dark green / F) and degree 3 (light green / G). The degree 3 node is connected to one more degree 2 node, (white / P). Similarly, the blue degree 6 node is connected to one more degree 2 node (black / O). The rest is now identified by their degree and the number of known nodes they connect to.

The resulting mapping is slightly more convoluted, but still *planar*, which pleases the geek in me immensely.

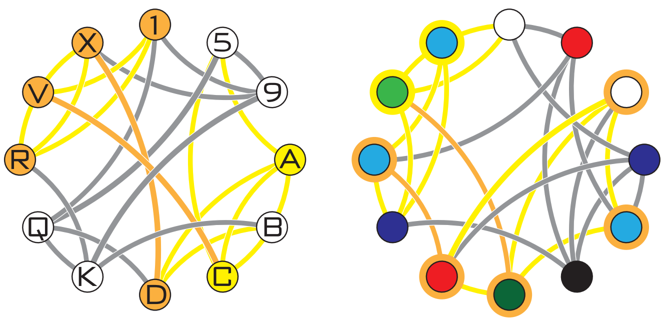


The hardest pair

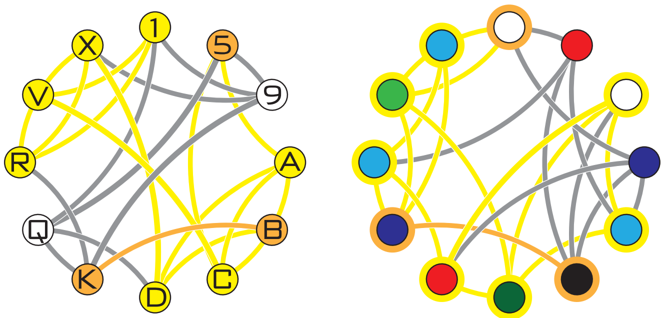
For the hardest pair, the node degrees won't help; they are all 4. Now we need to look at cycles in the network. Again, in each step, nodes and lines identified in the step are orange, and information from previous steps has been made yellow.



The diagram shows all 'triangles' or cycles-of-three. We see one group of two, and one group of three connected cycles. In the group of three, two nodes are shared by all cycles, and one of them (light blue / A) has all its lines in the cycles.

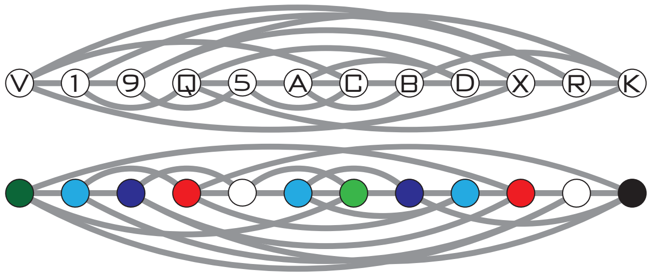


The other (light green / C) connects to a node in the other cycle group (dark green / V). This in turn identifies the other node with three of its lines among those cycles (white / R). The only other bridge between cycle groups connects (light blue / D) to (red / X). The remaining node in the group of two cycles is (light blue / 1).



In the group of three cycles, one of the remaining two nodes (dark blue / B) has one remaining unidentified connection, to (black / K), and the other (white / 5) has two.
The remaining two nodes can be identified by how many of their lines connect to each group: (red / 9) splits them 2 / 2 and (dark blue / Q) splits them 1 / 3.

This completes the third mapping. It's quite a tangle, but it does give us the last information we need for the outer puzzle.



This leaves the (slightly tedious) task of coloring each area with the color corresponding to the symbol in it: