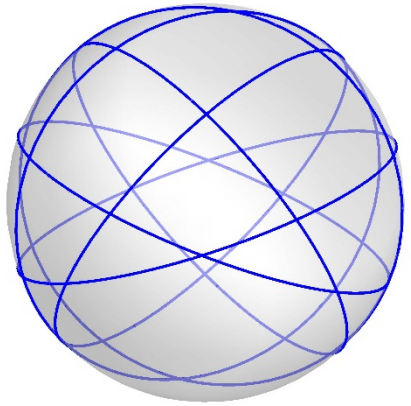


Great Circles Problem

Kha Man

Recent news

- I generated **1000** graphs for each 6,7,8 great circles.
  - **6** great circles: have **4** non-isomorphic graphs.
  - **7** great circles: have **11** non-isomorphic graphs.
  - **8** great circles: have **114** non-isomorphic graphs.

- My previous idea only worked for the graphs consist of quadrilaterals and triangles. Therefore, mostly it doesn’t work for all possible non-isomorphic graphs.

Observation

- I am going to show all the non-isomorphic graphs of 1000 graphs with 6 and 7 graphs because it has small amounts enough to see the symmetry

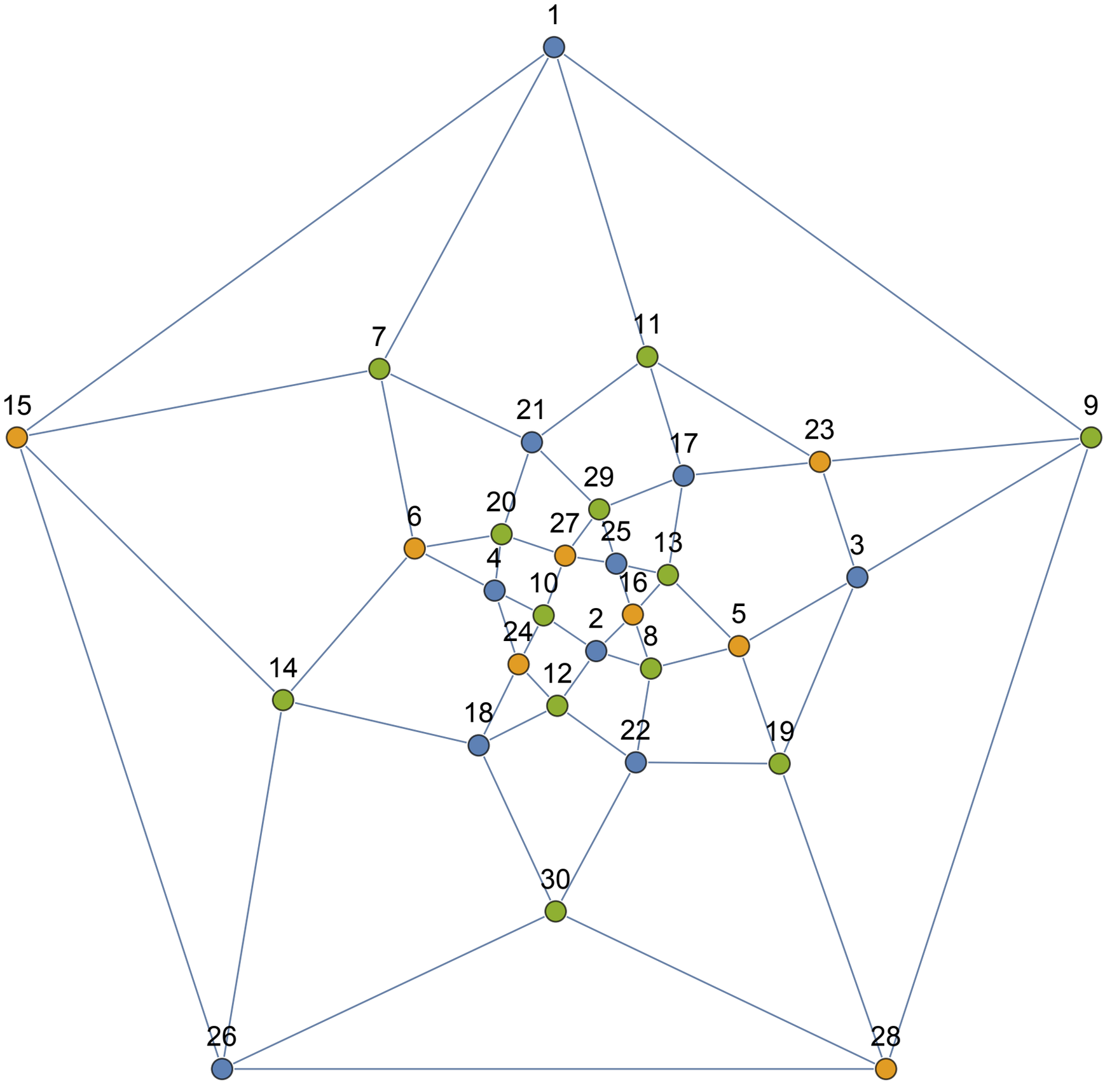
- The planar embedding is plotted out by GraphLayout-> “**TutteEmbedding**” (Wikipedia) (Mathematica)

Observation

- We already knew that the center of the sphere is the point symmetry. Luckily, when 2 intersections were made by a pair of 2 great circles, I named it 2 consecutive integers, where the odd is the 1st one. It means when you see 10, its duplication in term of other intersection by the same 2 great circles is 9.
  - This feature is extremely beneficial when finding a duplicate of a shape in the planar embedding of graph. For example, I found a triangle containing the vertex 3; then obviously I will see another triangle containing the vertex 4 which is intersected by 2 same great circles with vertex 3

- We may see there are some graphs that have symmetry reflection via the middle of the graph but sometimes **it's not correct**. I recommend the rule above to keep tracking the duplications.

Non-isomorphic graphs made by 6 great circles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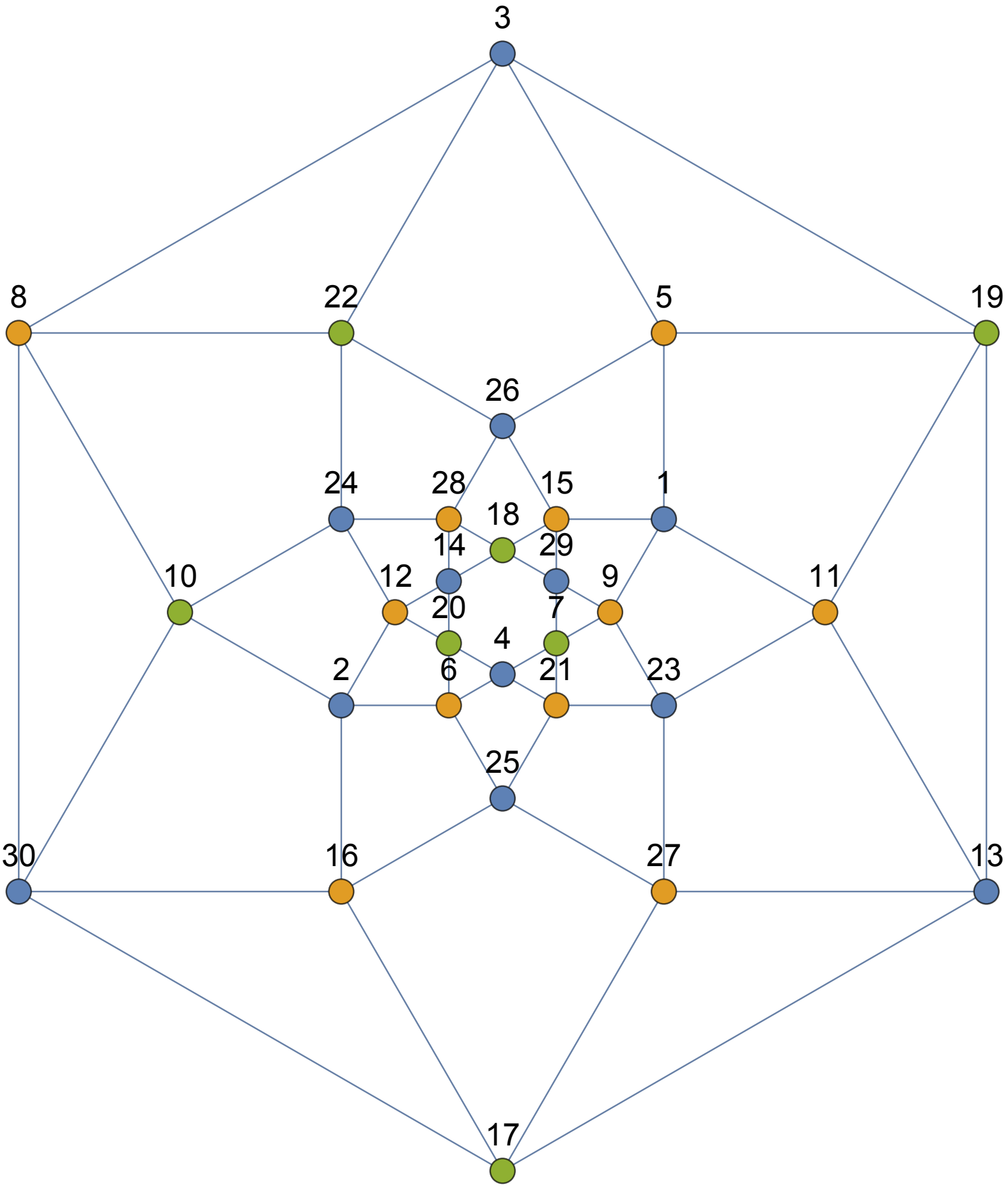
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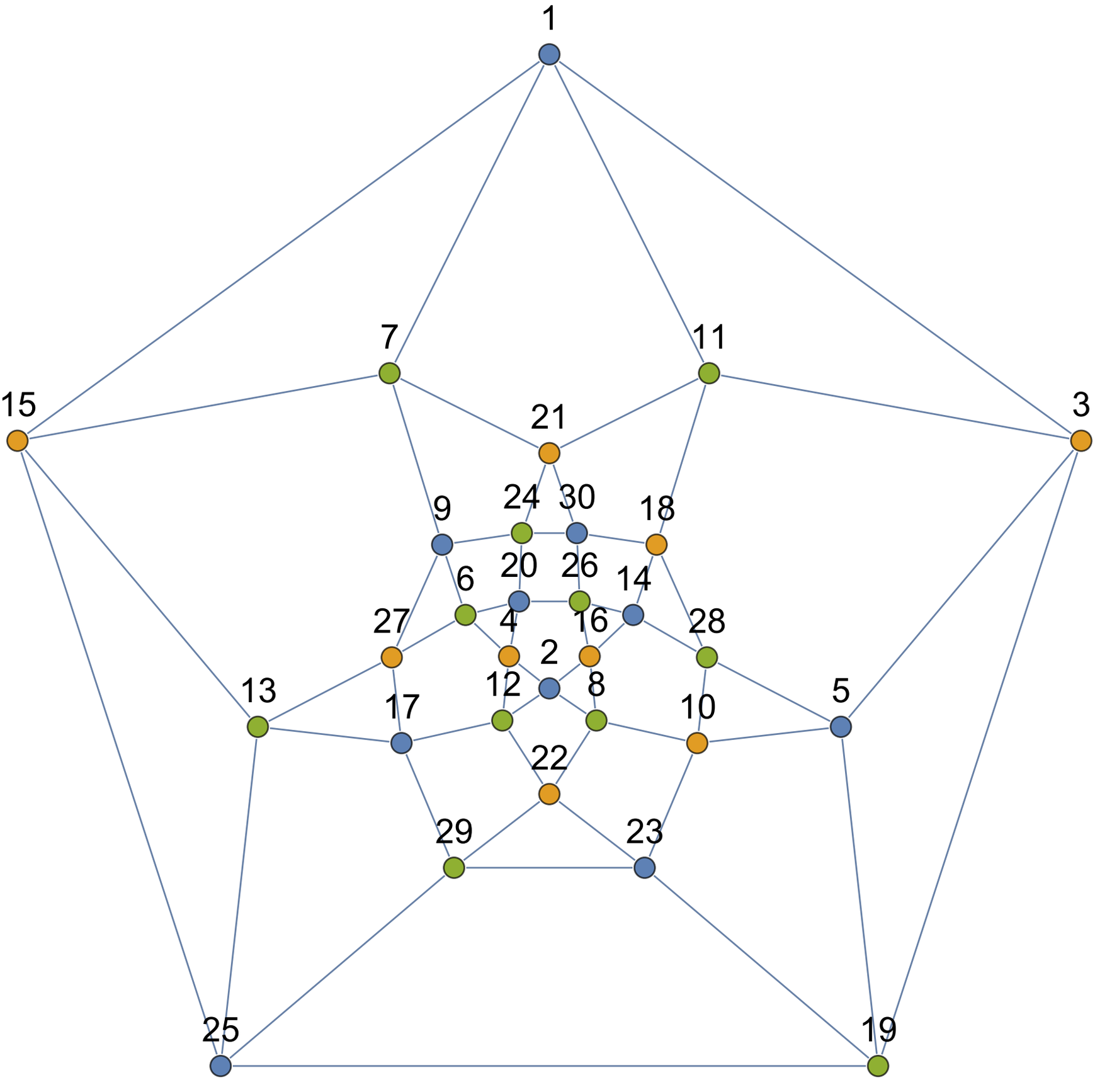
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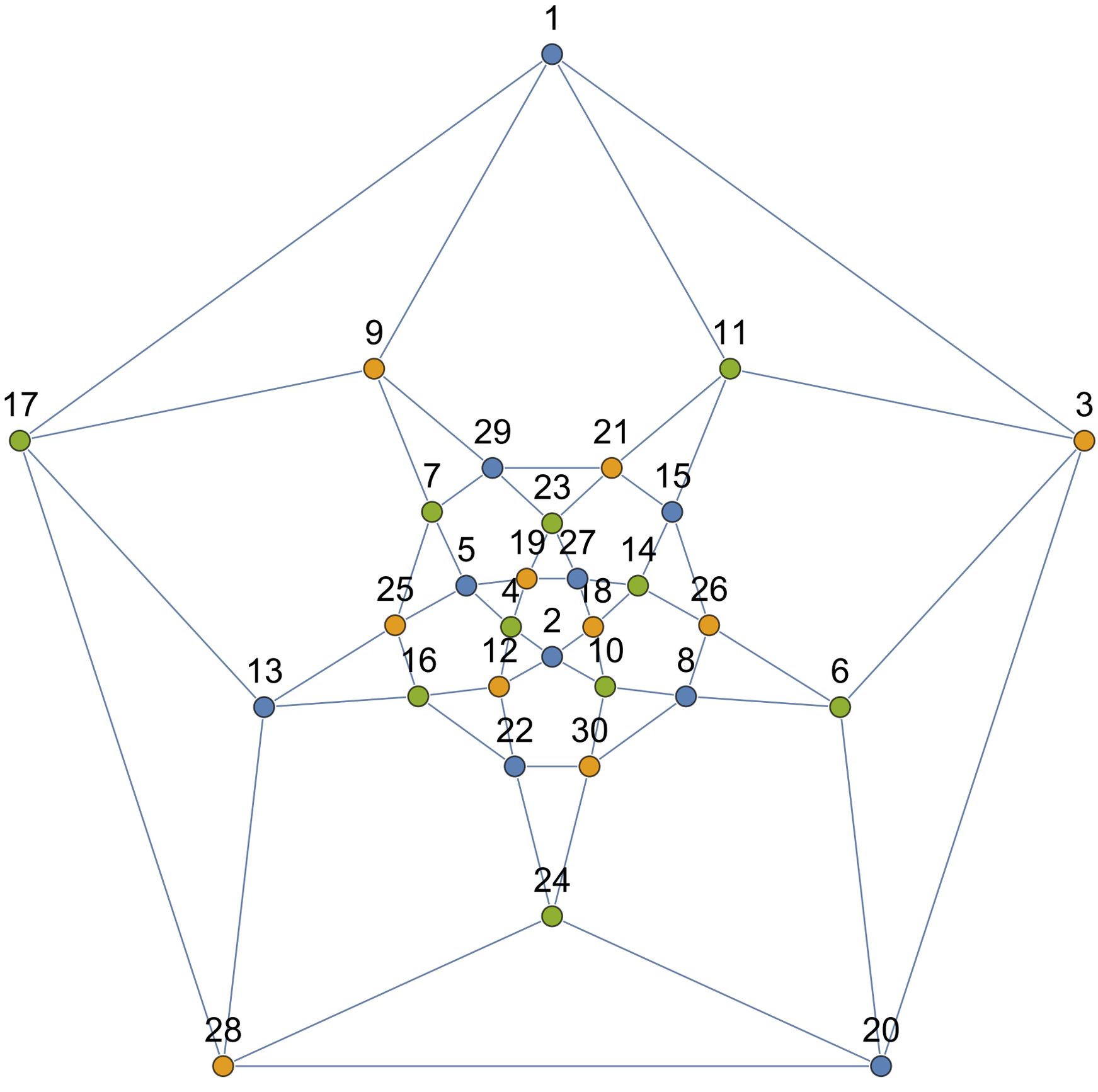
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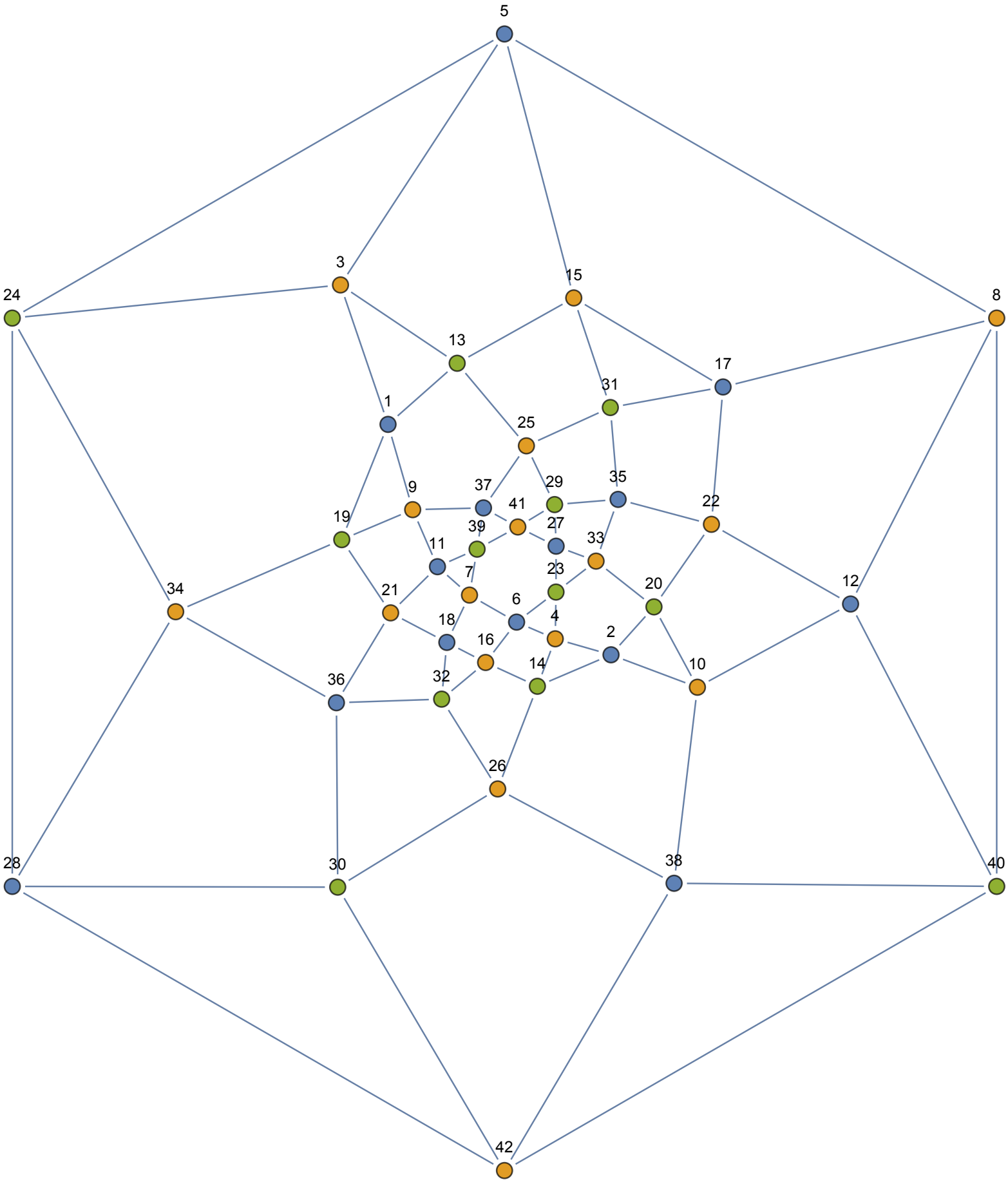
Non-isomorphic graphs made by 7 great circles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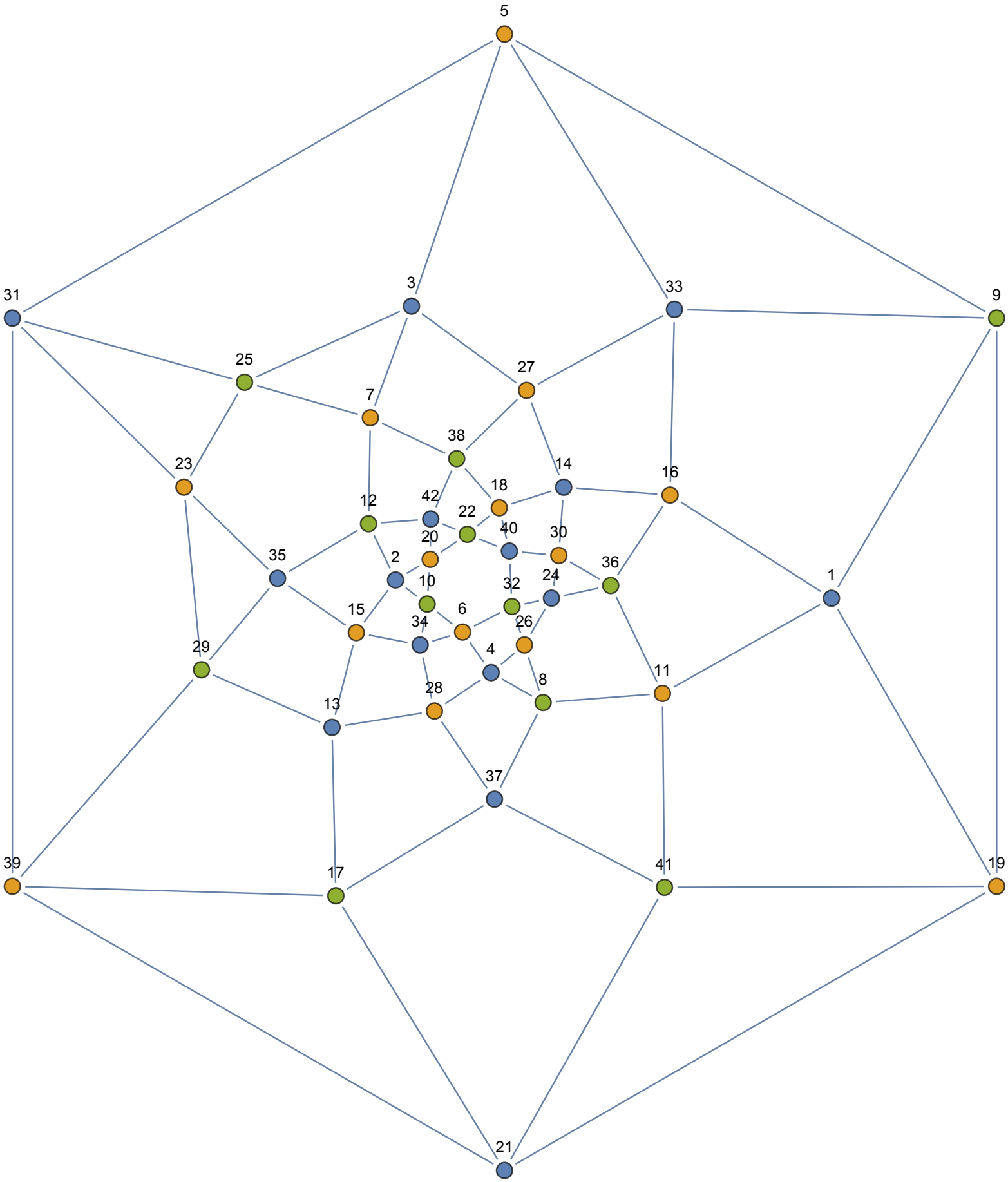
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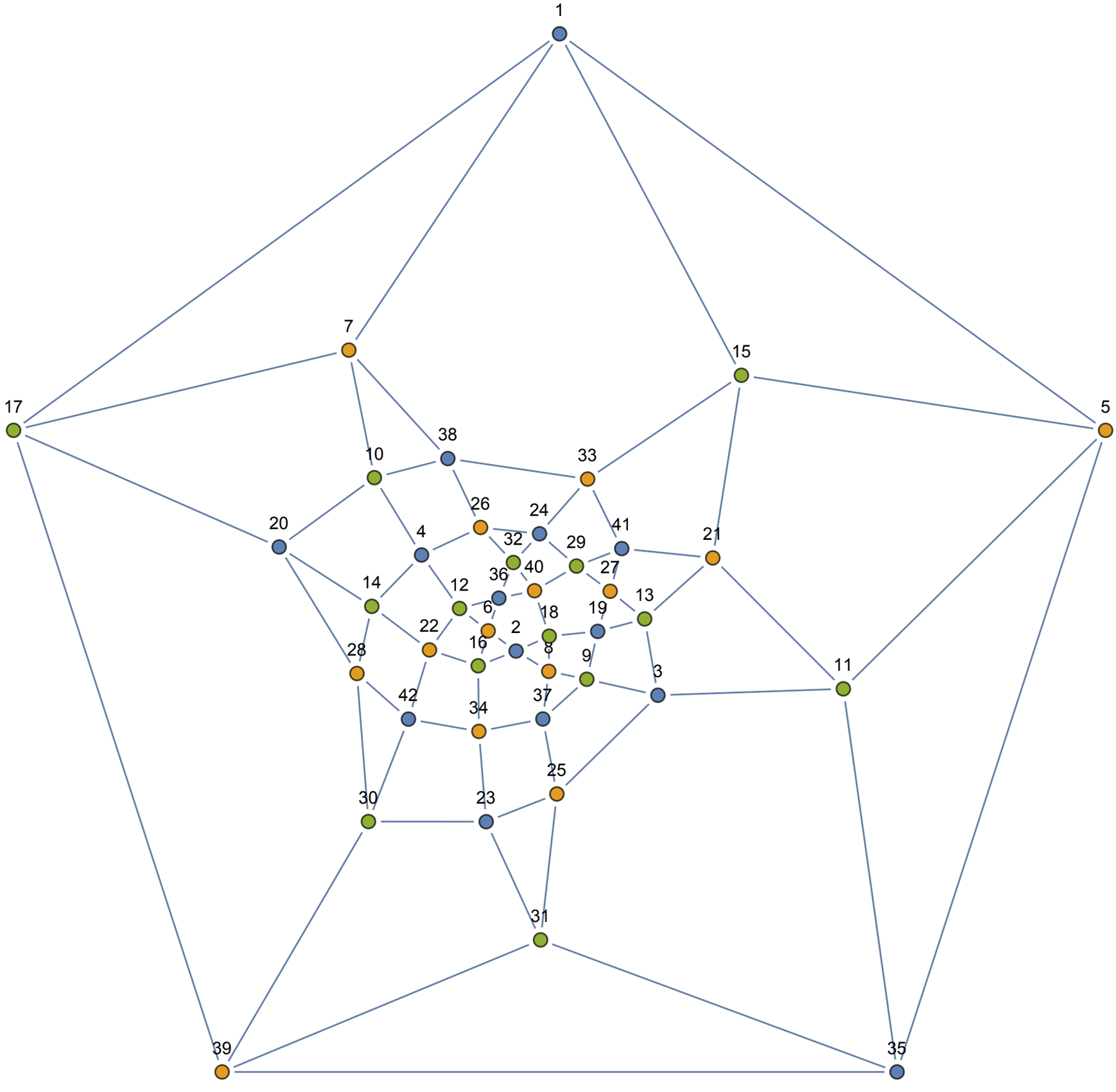
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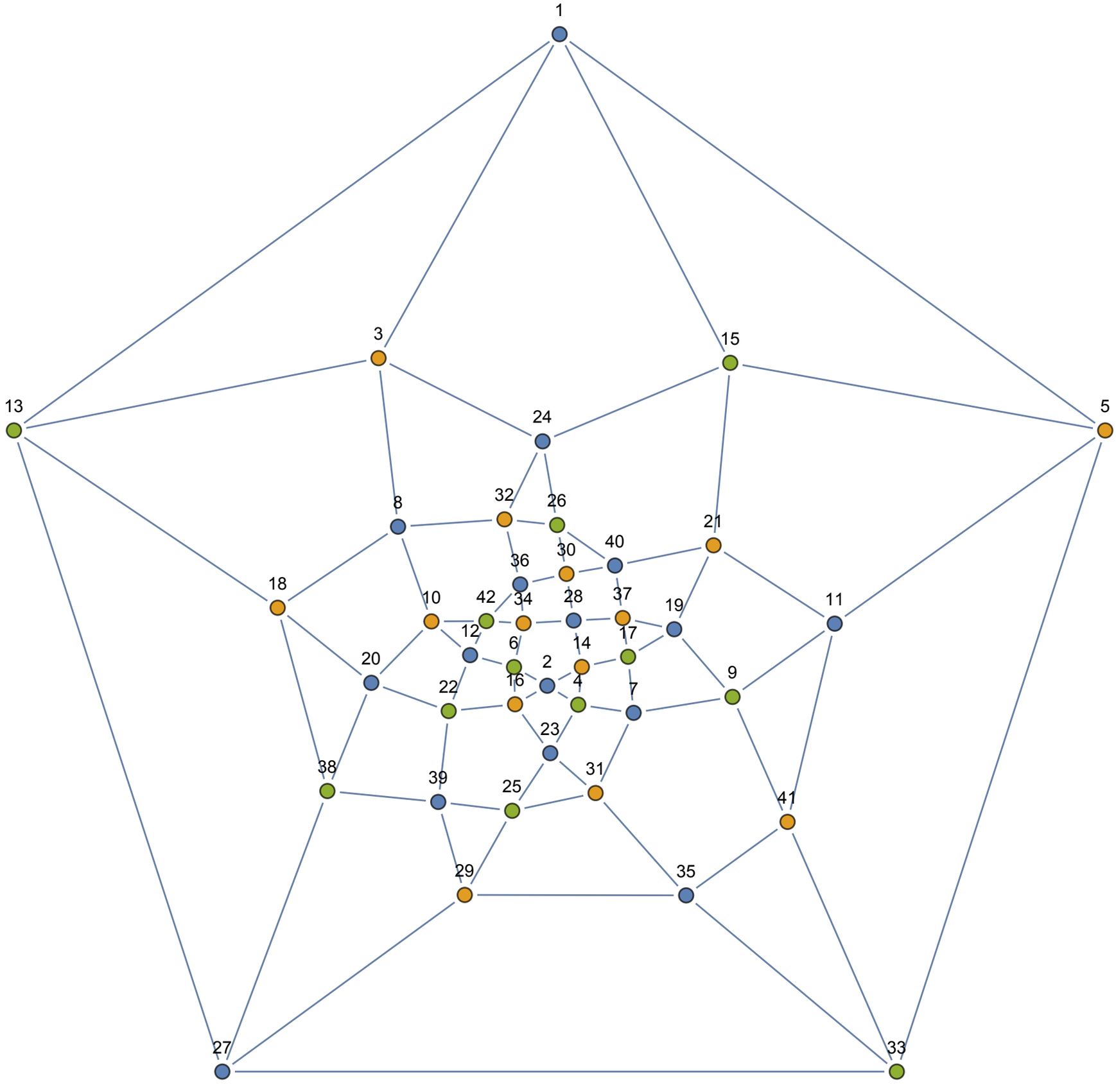
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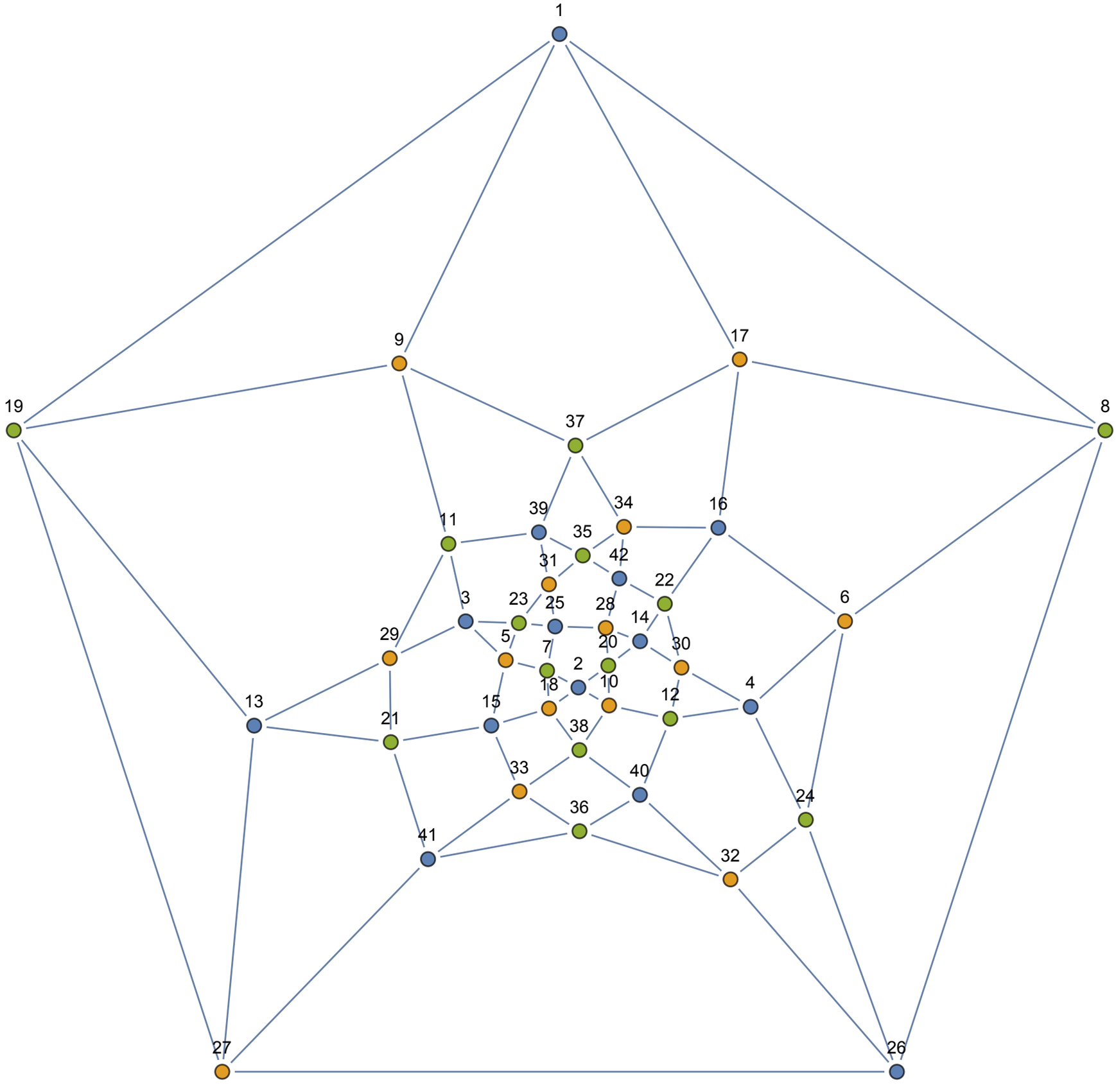
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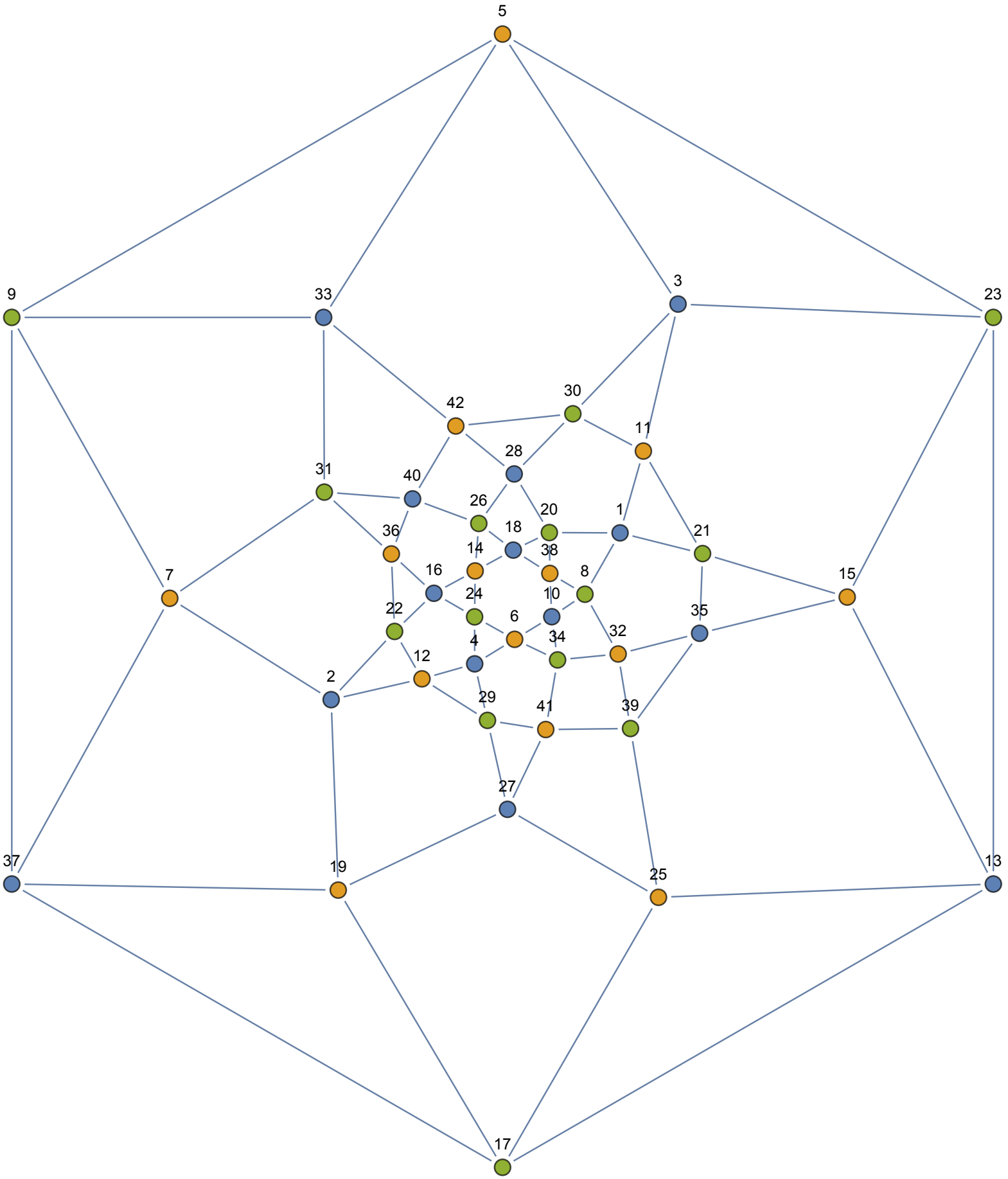
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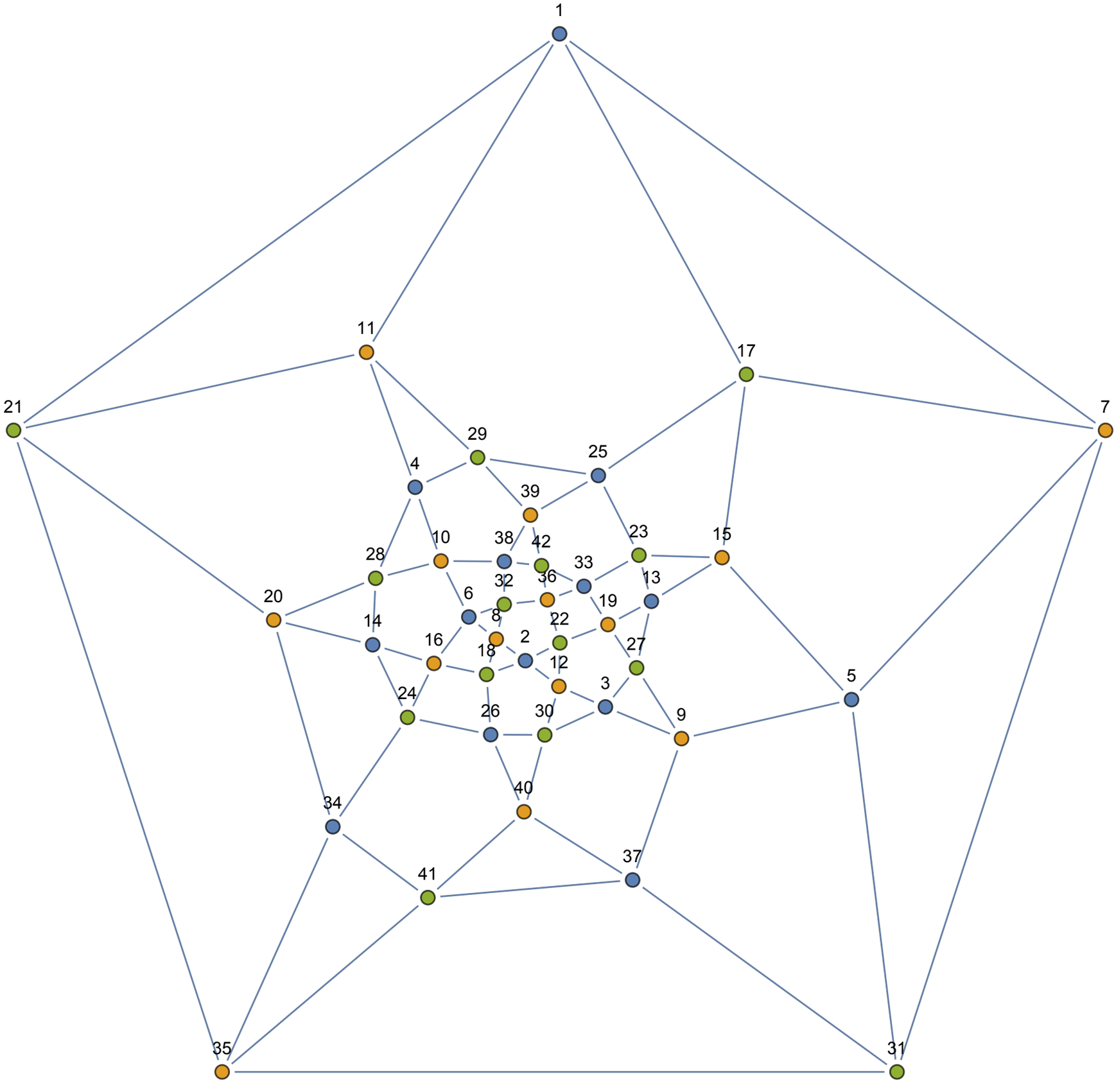
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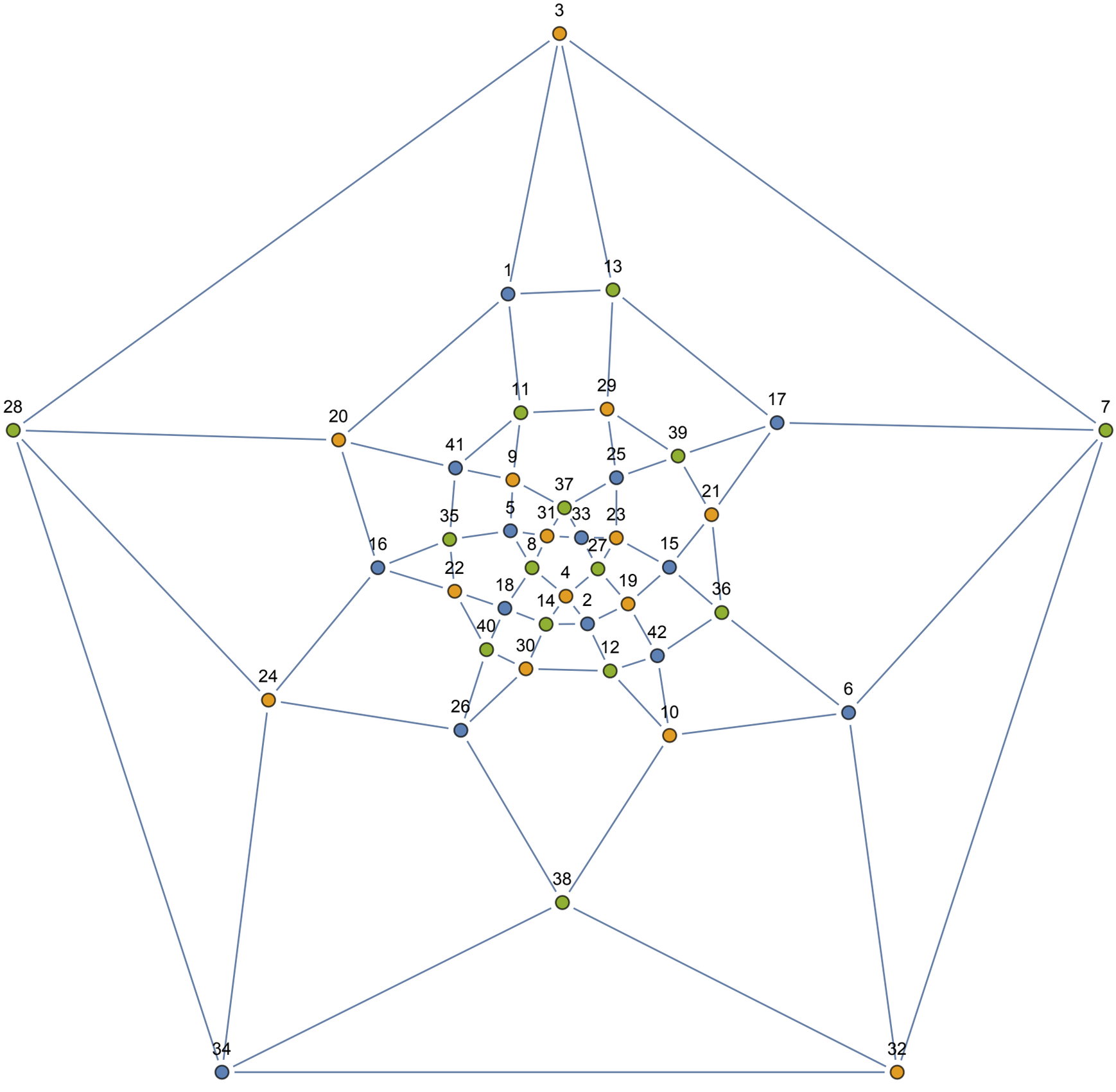
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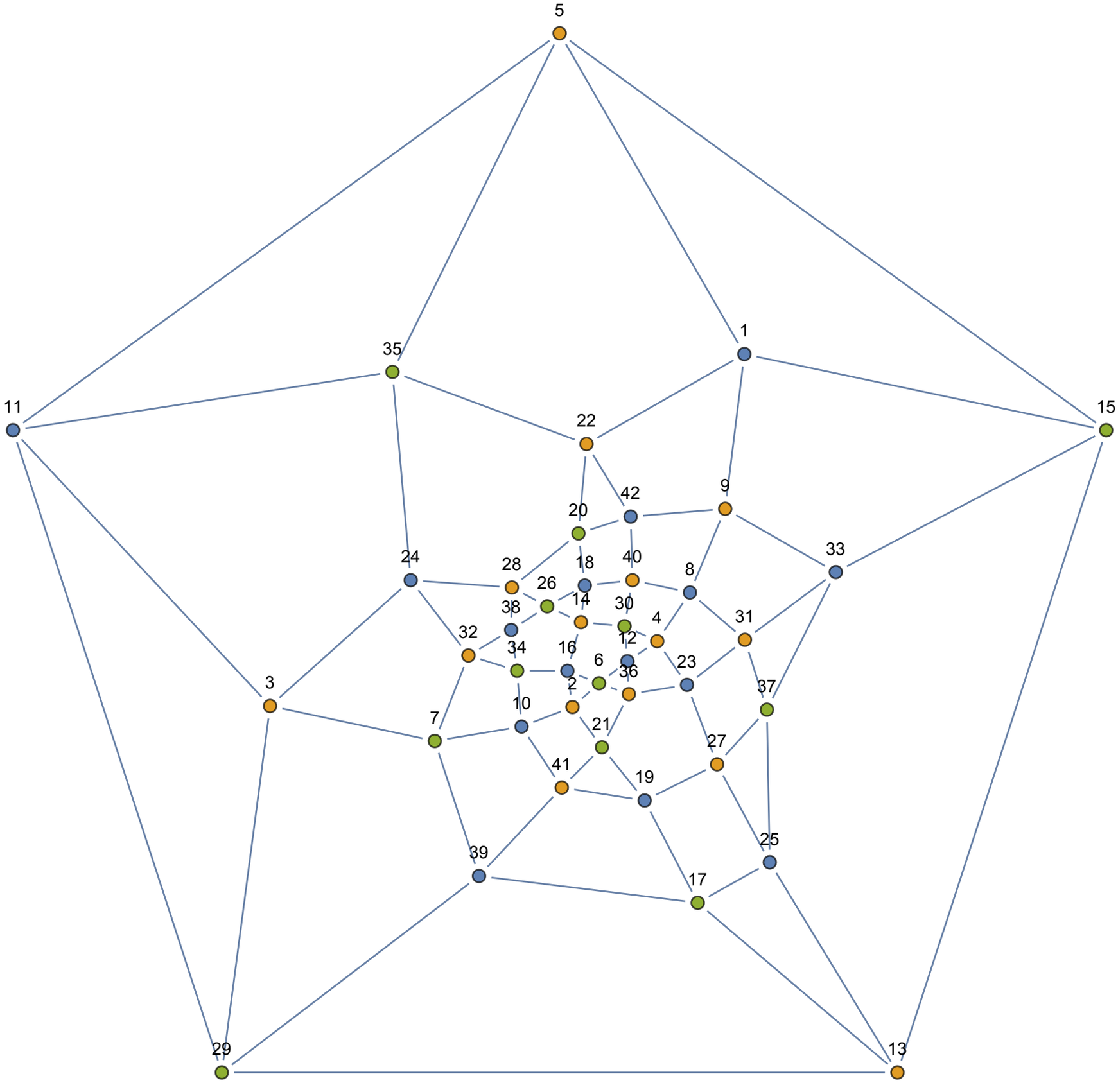
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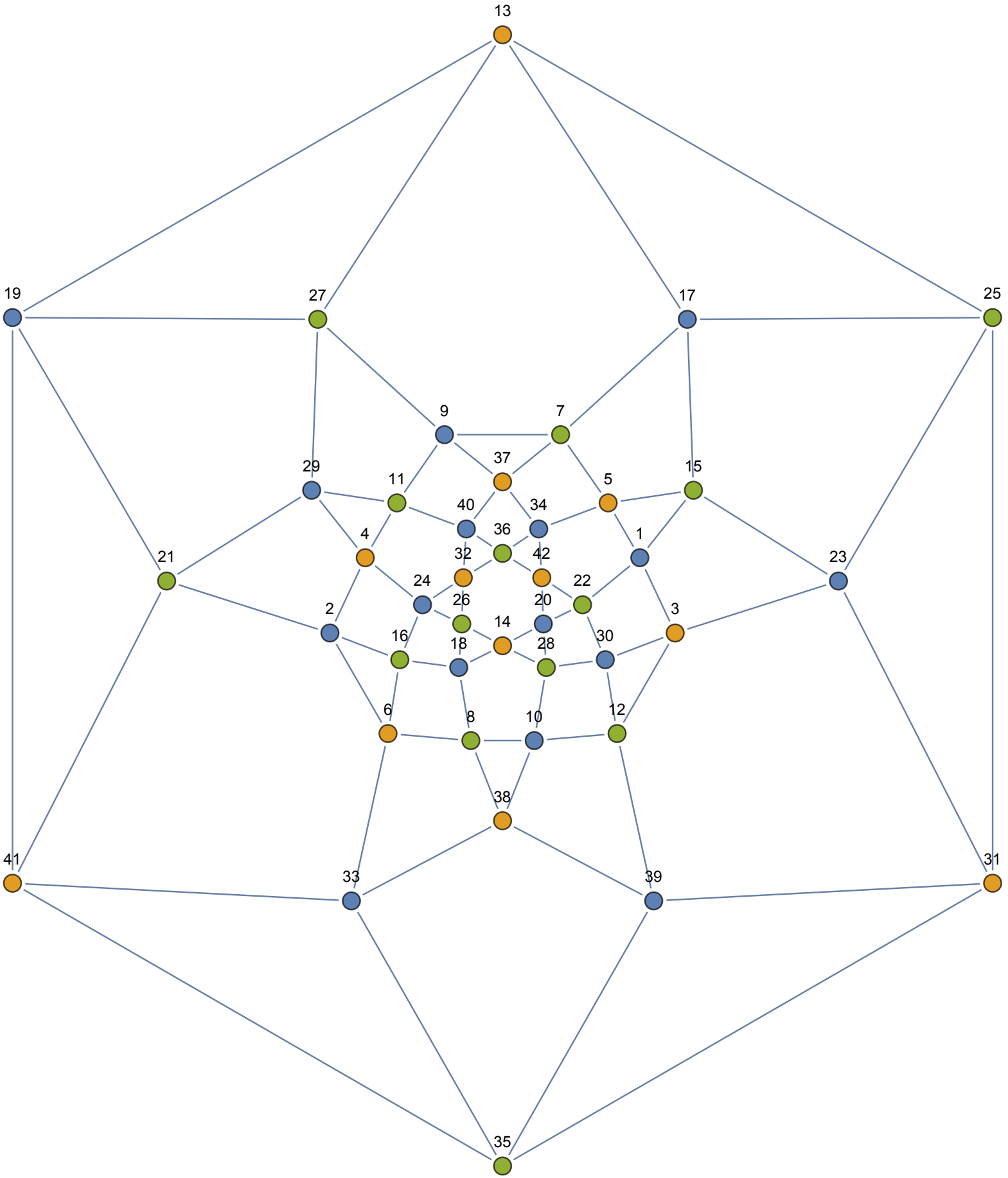
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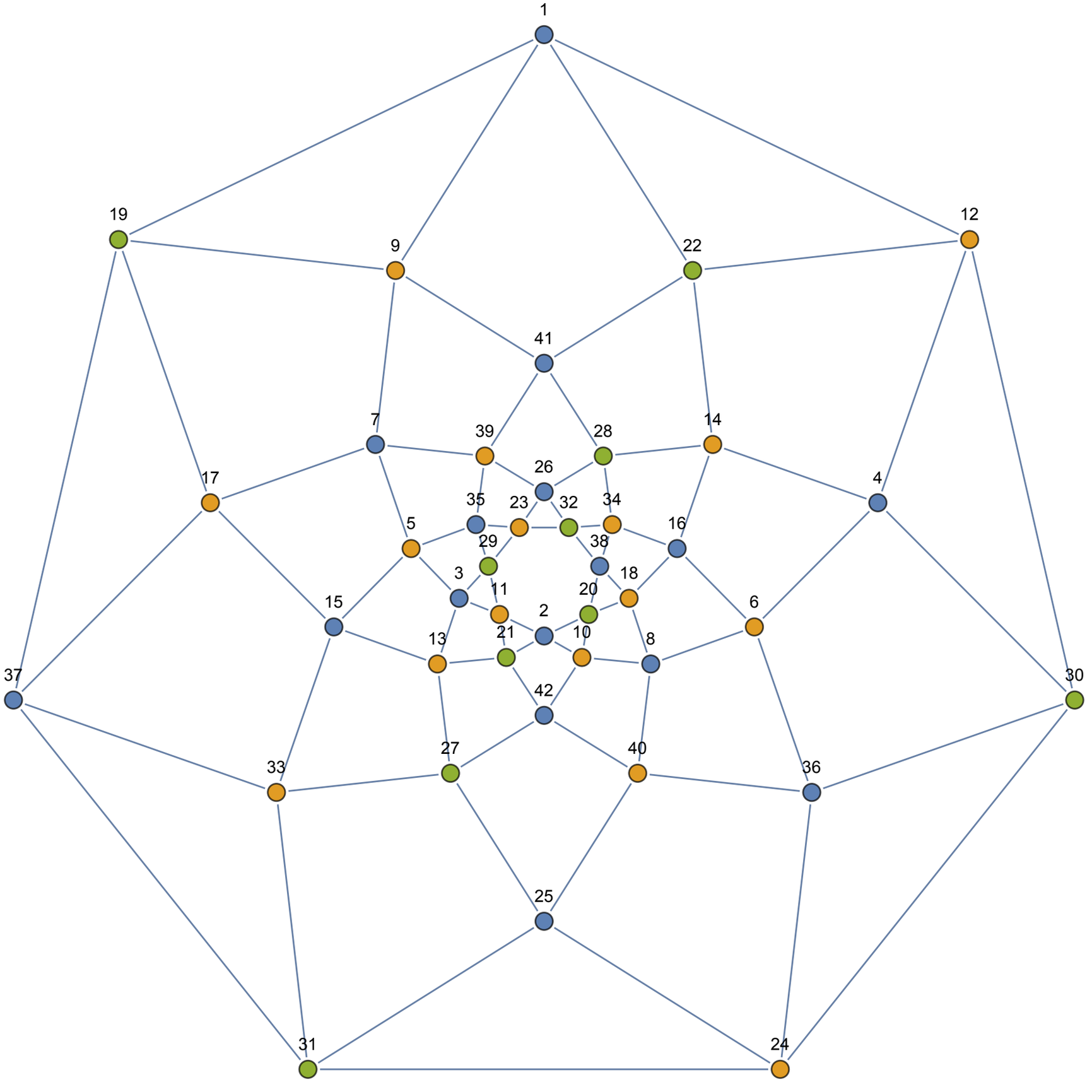
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1 Conclusion

- How many types of polygons can be made in this problem?
  - There is no limit for this since if I’m having a polygon bounded by the greatest finite chain of straight line segments, I can add 1 additional great circle to build a polygon that is bounded by (the greatest finite chain of straight line segments + 1)