Open problems in Graphs Guessing Games

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In the past I introduced a guessing game that can be played on any simple directed graph. It is a variant of the "guess your hat" game. For each digraph, there exists a unique guessing number associated with its guessing game. For undirected graphs we consider each edge as bi-directed. As an example, we consider the famous Higman-Sims graph and show that it has a remarkably high guessing number that is at least 77 and at most 78. As another example, we consider a particular graph with ten nodes that were found by extensive computer search. It has guessing number, at least, $20/3 \approx 6.666$ and at most $9767/8929 \approx 6.693$. What is particularly interesting about this example is that the best upper bound that follows from Shannon's classical Information Inequalities is $114/17 \approx 6.705$ which is suboptimal. This fact links the topic directly to recent results on non-Shannon Information Inequalities.

I will illustrate the basic ideas, motivating applications and proof techniques with simple examples, accessible to all mathematicians.