Reviewer 1:

1. TREMOR – thanks for the reference. This is indeed very relevant and we need to discuss similarities and differences.
2. Straightforward approach – we agree, but it is beneficial to study simple approaches in a new setting before moving to more complex ideas (as in TREMOR).
3. Dec-POMDP algorithms - we consulted with leading Dec-POMDP experts (Amato, Spaan, Oliehoek) and they suggested these algorithms. The code for FB-HSVI is not currently available, but it is optimal, and is not expected to scale up better than DICEPS. In general, we can run any method that reads Cassandra (Dec) format.
4. All other algorithms failed (Sagi – ensure) on the problems in Table 3 (even the smallest Rover). Table 4 is a specific example for IMAP – not relevant for other algorithms.
5. Quality of the results - we will try to squeeze some discussion in concerning the quality of solution. A major source for non-optimality in IMAP is the underlying classical planner (FF), which seems to be making sub-optimal choices. We are investigating moving to an optimal classical planner, such as SymBA\*-2.
6. Applying an optimal planner to our method results:

**IMAP - SymBA\*:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| problem | Runtime | Makespan | Expected Cost | # Plannings |
| S1 | **6.206** | **4** | **2.833** | **4** |
| S2 | **38.022** | **4** | **2.833** | **4** |
| B3 | **78.82** | **11** | **6.102** | **3** |
| B3.1 | **186.23** | **6** | **4.11** | **5** |

**IMAP – Metric FF (as in paper):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| problem | Runtime | Makespan | Expected Cost | # Plannings |
| S1 | **7.45** | **5** | **3.29** | **4** |
| S2 | **7.77** | **8** | **4.77** | **4** |
| B3 | **14.27** | **20** | **10.3** | **3** |
| B3.1 | **31.87** | **21** | **12.24** | **5** |

Reviewer 2:

1. Class of domains where IMAP is complete – we believe that in Ergodic domains (with no deadends) IMAP is complete, but do not have a proof yet, so we did not want to make such claims.
2. runtime complexity – we do not expect IMAP to have better formal gurantees than the results in the original QDec paper, only better empirical performance.
3. belief during execution – plan trees (or graphs, or FSCs) allow you to execute a policy without maintaining a belief. Beliefs are needed during planning, and maintained using regression, but this is a part of the underlying contingent solver.
4. Algorithm 1 – we agree that algorithms 1 is very short. Fitting everything into 6 pages is very difficult.
5. Knowledge-based policies – this is a very interesting paper, suggesting an efficient method for representing beliefs, but no algorithm for computing such beliefs. Hence, comparison with them at this point is impossible. On the other hand, this is an excellent example that papers on relatively unexplored problems, such as QDec, do not adhere to the standards in more explored domains, such as Dec-POMDPs. It is difficult to see, e.g., a paper suggesting a new policy representation for Dec-POMDPs with no algorithm accepted to AAAI.
6. Difficult to judge significance of incomplete algorithms – It is not uncommon to suggest incomplete algorithms for difficult problems (e.g. “approximate” methods for Dec-POMDP). IMHO, incomplete methods that scale up are more useful in some settings than complete algorithms (the compilation approach) that do not scale up. That being said, we agree that identifying sub classes of problems where IMAP is complete is important.

Reviewer 3:

1. There seems to be a misunderstanding – the only thing deterministic about our QDec are the action effects. The initial state is uncertain and unknown.
2. We are close to standard MA planning - We strongly object to this comment. Deterministic QDec maintains the major difficulty of having to consider the joint observations of agents. That is, agent 1 must consider all possible observations that agent 2 has seen. This is the major difference between fully observable MA planning, or single agent partially observable planning, and QDec.
3. one can predict those observations - this is not true, the observations reflect the unknown initial state, not just the actions.
4. deterministic QDec-POMDPs are equivalent to standard multi-agent path-finding - QDec are very different than MA path finding (e.g. the work of Sharon, Stern, and Felner), where everything is fully observable, and there is no uncertainty concerning the initial state, and hence control is typically centralized.
5. Jonsson and Rovatsos – they work on fully observable MAP, which is indeed very similar to MA path finding, but very different than QDec, where the distributed partial observability is the key source difficulty.
6. one and only one standard benchmark - This is not true. We also adapted an MA planning problem, Rovers, to QDec, and report results on this benchmark as well. We agree that additional benchmarks are needed, but in new settings, such as QDec, it takes time to develop interesting benchmarks.

Reviewer 4:

1. Theoretical contributions – you seem disappointed by the lack of theoretical contributions in our paper. This is indeed not a theoretical paper, but rather an empirical paper suggesting an algorithmic approach and empirically showing its properties (scaling up in this case). Such papers are very common in the planning / MDP / POMDP / Dec-POMDP communities, and are typically welcome at AAAI and IJCAI. Some theoretical properties of QDec were analyzed in the original paper.
2. Agent ordering – Better ordering may surely result in computing solutions faster, and we are experimenting with such ideas, but had no place for this in the paper. We cannot fit everything into a 6 page paper.
3. We thank you for spotting the inaccuracies.
4. Game theory – in general, games are not cooperative, while (Q)Dec-POMDPs are fully cooperative (joint rewards). As such, results and algorithms from general games typically do not apply here.
5. Model checking - There are obviously links between model checking and planning under partial observability, and intuitions may be drawn from one field to another, but using theoretical results and algorithms from verification for QDec is far from being straight forward. It is unclear, without a thorough investigation, whether model checking algorithms would work well for QDec. Rejecting a planning paper for not using model checking tools does not seem reasonable to us.
6. Control theory - Indeed, there are related topics in planning and OR. These are not sufficiently explored in all planning literature (and OR literature for that matter). It is unclear to us why the specific referenced paper, dealing with systems with discrete events, where there is centralized control through disabling events is deemed particularly relevant to our line of work, except in the very broad terms.