Key developments in the field of AI planning and Search

Partial-order Planning
Anthony Barrett and Daniel S. Weld made a paper called Partial-order planning: evaluating possible efficiency gains [Ant94] which makes several major contributions, characterizing the types of domains that offer performance differentiation and the features that distinguish the relative overhead of three planning algorithms:

- **Partial order casual links (POCL)** - It represents plans with a partial order and uses tagged pointers, called "casual links" to mark protections.
- **Total order casual links (TOCL)** - Represents plans as totally ordered sequences of steps and also use casual links.
- **Total order prior-insertion (TOPI)** - it dispenses with casual links and only adds steps prior to the existing steps of an incomplete plan.

And conclude that the total-order planners never performed significantly better than the partial-order planner, and in domains with complex ordering interactions the partial-order planner performed exponentially better than either total-order planner. In conclusion they prove that the partial-order (POCL) planner renders a strictly greater number of problems trivially serializable.

Heuristic Estimator for Means-Ends Analysis in Planning
The paper [McD96] of Drew McDermott presented a new way of thinking about means-ends analysis, in which an exhaustive subgoal analysis, based on greedy regression-match graphs, is repeated at each search state, rather than being spread over a number of search steps. Concluded that the fact that a search space is exponential matters less if the searcher can avoid looking at most of it.

Fast planning through planning graph analysis
Avrim L. Blum and Merrick L. Furst presented a paper [Avr97] that introduced a new a approach to planning based on constructing and analyzing a compact structure called *planning graph*. They described a planning algorithm that uses ideas from standard total-order and partial-order planners, but that differs most significantly by taking the position that representing the planning problem in a graph structure. The algorithm achieved a significant improvement efficiency.

References

[Ant94] Daniel S. Weld Anthony Barrett. "Partial-order planning: evaluating possible efficiency gains". In: (1994).

[McD96] Drew McDermott. "A Heuristic Estimator for Means-Ends Analysis in Panning". In: (1996).

[Avr97] Merrick L. Furst Avrim L. Blum. "Fast planning through planning graph analysis". In: (1997).