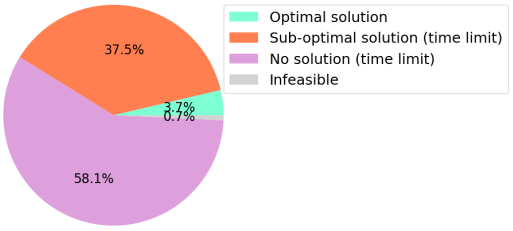
SKATE : Successive Rank-based Task Assignment for Proactive Online Planning (supplementary materials)

Primary Keywords:
Multi-Agent Planning;

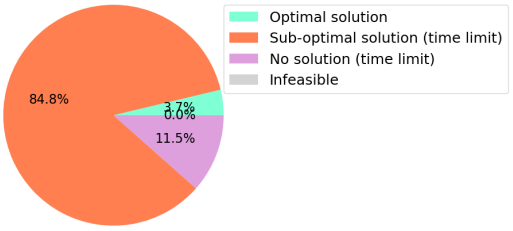
A Appendices

A.1 ILP and $R_\tau = 50$: solution status analysis

In the synthetic benchmark experiment for $R_\tau = 50$, we analyzed in deep the results when using ILP and concluded that if all agents were unavailable for two subsequent decision time steps, the solver is not able to handle the accumulated buffer of requests anymore. However, we could see an improvement for ILP when using the proactive approach: anticipating the availability of the agents allows to delay or even not encounter the problem of getting stuck. This is even more apparent when we compared the solution status given back by the Gurobi solver for $H(0)$ and $H(v)$ in Figure 1.



(a) Solution status for $H(0)$



(b) Solution status for $H(v)$

Figure 1: Solution status for $H(0)$ and $H(v)$

With the limited computation time, optimal solutions are only found 3.7% of solver calls for both $H(0)$ and for $H(v)$. For $H(0)$, in majority, the solver could not find the solution since with a reactive approach, the agents can quickly become unavailable. Whereas when we use anticipation, (illustrated here for $H(v)$), we have more agents available and the solver manages to find a sub-optimal solution in 84.8% of calls.

A.2 Requests arrival in the New York dataset

Here, we represent the average number of requests arrival of the real-life dataset (New York taxi calls) in Figure 2. Each bar represents the number of requests registered in the time window. The value of the bar is the average number of requests between January 7th and January 9th 2013 from 12:00AM to 7:00AM.

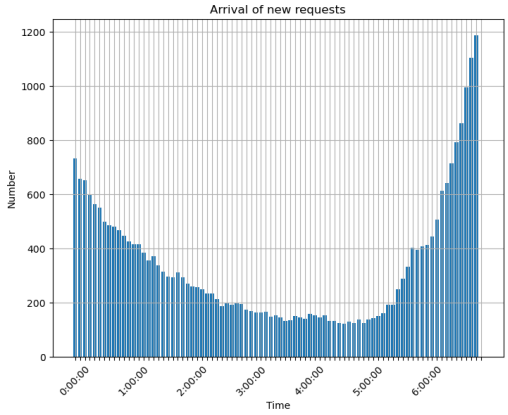
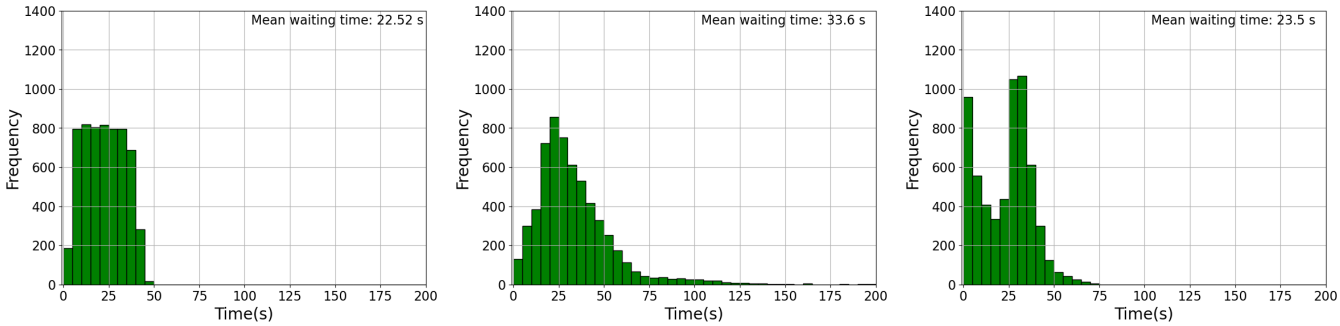


Figure 2: Average number of requests for 3 nights between January 7th to January 9th 2013 from 12:00AM to 7:00AM.

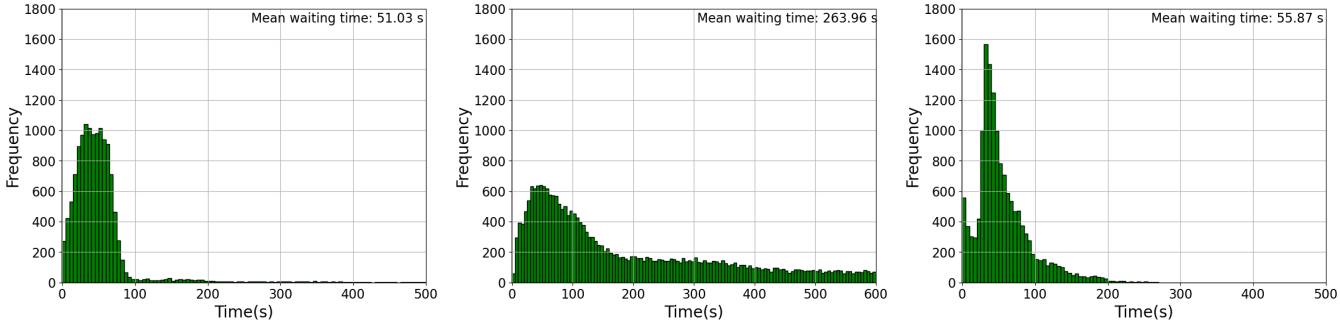
A.3 Waiting time for the synthetic benchmark and for the real-life data experiments

For sake of simplicity in the synthetic benchmark and real-life data experiments, we summarized the results for waiting time only putting the average values for ILP, GA, and SKATE in Table 1 in the paper. Here, we include the entire waiting time distribution results for $R_\tau = 20$ with $H(v)$ in Figure 3, and for $R_\tau = 50$ with $H(v)$ in Figure 4. Real-life data distribution results with $H(v)$ are shown Figure 5. In general, we notice across the three methods that GA is the more spread out. SKATE follows GA being more spread out than ILP (see figures 3 and 4). When we look at the horizontal axis, the peaks for ILP and SKATE have similar coordinates. This illustrates that SKATE achieves a competitive performance in terms of waiting time compared to ILP which gives (sub-)optimal solutions.



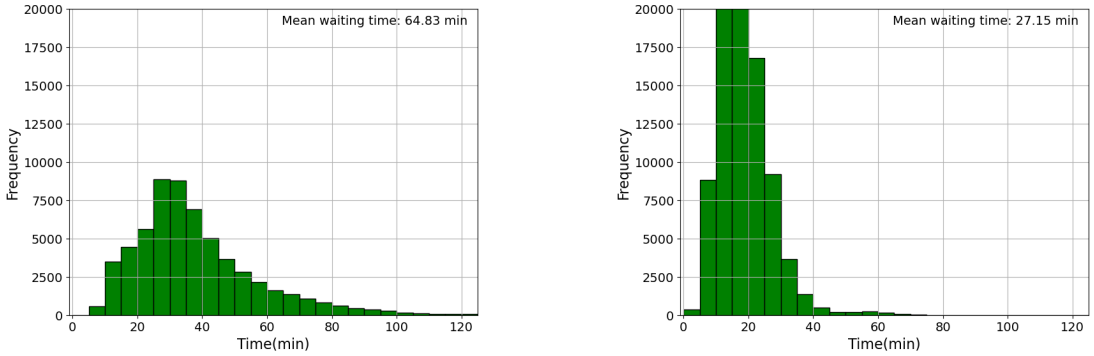
(a) Waiting time for LP. (b) Waiting time for GA (c) Waiting time for SKATE.

Figure 3: Comparison of the distributions of the waiting time for ILP, GA, SKATE for $R_\tau = 20$ with $H(v)$.



(a) Waiting time for LP. (b) Waiting times for GA. (c) Waiting time for SKATE.

Figure 4: Comparison of the distributions of the waiting time for ILP, GA, SKATE for $R_\tau = 50$ with $H(v)$.



(a) Waiting time for GA. (b) Waiting time for SKATE.

Figure 5: Comparison of the distributions of the waiting time for GA and SKATE with $H(v)$ for real-life data experiment.