

Figure 1: Detailed maps for Experiment 1.  $\lambda_2$  is annotated on x-axis and the smallest  $\lambda_2$  map is at the top left corner. Maps from the MovingAI benchmark dataset are marked in red. All other maps are generated using our fractal and QD instance generator.

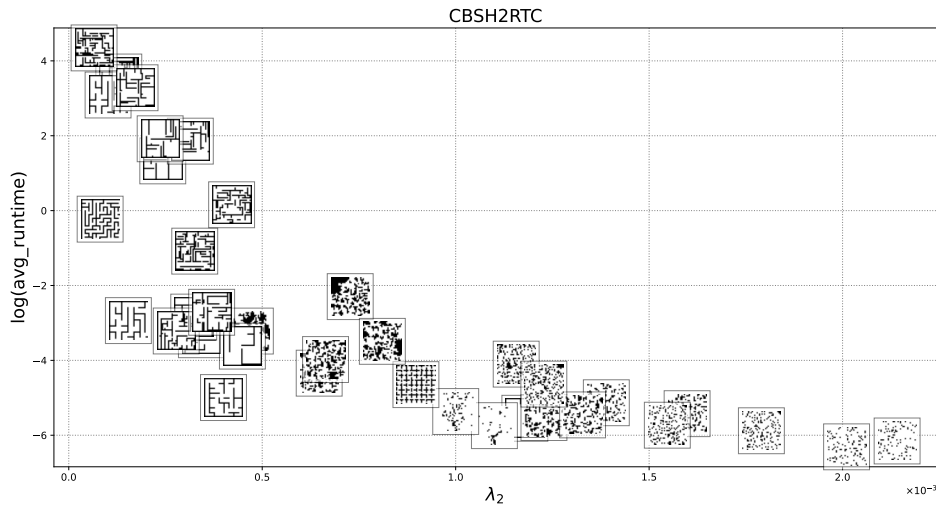


Figure 2: Relationship between average runtime for 100 instances and the  $\lambda_2$  of the maps shown in Figure 1. Tested using CBSH2-RTC algorithm.

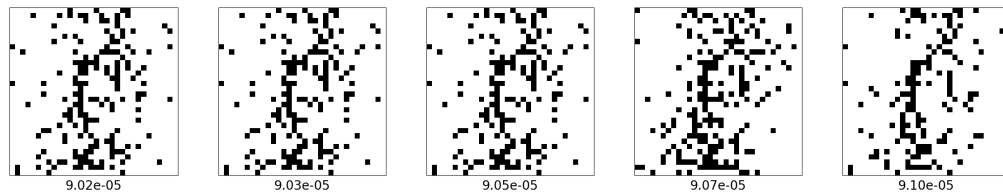


Figure 3: Map topology for the *hard* maps generated by the QD map generator,  $\lambda_2$  is shown under each map (around  $9 \times 10^{-5}$ ). Although these maps look like random environment in Figure 1 at first glance, the empirical hardness is much harder than the maps in the last row of Figure 1. Even though there are plenty free space in the maps shown in Figure 3, the left and right side are actually poorly connected. For the agents traveling from one side to the other side, more conflicts will happen at the choke points, thus making more challenging MAPF instances.