Pipesworld: Planning of Pipeline Oil Transportation

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One of the challenges in oil industry is how to transport and store different kinds of oil products. One of the most commonly used is pipelines. The transportation is made just pumping the different products in the line so that the liquid is pushed into the tanks. To avoid wasting resources, the number of pipelines is as reduced as possible, meaning that different products (oil derivatives) must share the same pipelines. However, products that are adjacent in the same pipeline must be compatible so that they are not mixed during the transportation. Figure 1 shows an example of an oil transportation net.

This problem was been introduced as a benchmark problem for domain-independent planning tools [2]. We will follow (and possibly extend) their formalization of the problem. Finding solutions under this formalization has been proven to be an NP-hard problem [1], making it a good application for heuristic search methods.

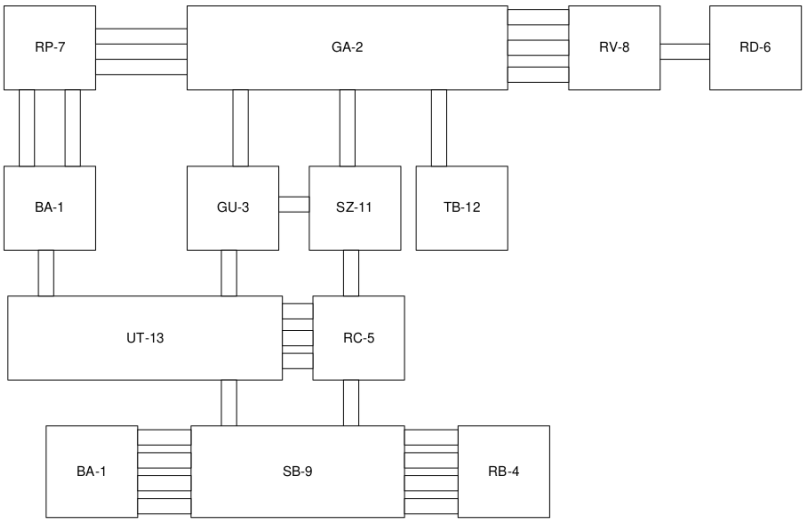

Figure 1: Example of a pipeline network operated by Transpetro (taken from [2]).

Your task will be to implement a solver that can plan how to push the oil batches to reach their destination minimizing the total number of push actions. Your solver will receive as input the structure of the network, as well as the initial sources of oil available. Then, it will have to automatically determine the sequence of push actions that will allow to distribute the oil, while satisfying the constraints.

To evaluate your solver, you will compare its performance against domain-independent planners. You will perform a scalability analysis to find out how the performance of your solver is influenced by different parameters like network size, network structure, or amount of liquid batches.

References

[1] Helmert, M. New complexity results for classical planning benchmarks. In *Proceedings of the 16th International Conference on Automated Planning and Scheduling (ICAPS'06)* (Ambleside, UK, 2006), D. Long and S. Smith, Eds., AAAI Press, pp. 52–61.

[2] Milidiu, R. L., dos Santos Liporace, F., and de Lucena, C. J. Pipesworld: Planning pipeline transportation of petroleum derivatives. In *Proceedings of Workshop on the Competition: Impact, Organization, Evaluation, Benchmarks, at ICAPS'03* (Trento, Italy, Jun 2003), S. Edelkamp and J. Hoffmann, Eds., AAAI Press.