

— GUIDE —

Assignment 1: Find the best train connection

AI-1 Systems Project (Winter Semester 2024/2025)

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This document is intended to help you solve the assignment “Assignment 1: Find the best train connection” [AS]. You do not have to read it, but we do recommend to at least take a look at the tips and common issues.

1 A few tips

1. Consider using Dijkstra’s algorithm.
2. Think about what the search graph should be for each cost function. An obvious choice is to have train stations as nodes and adjacent stops of trains as edges. But for some cost functions, a slightly different graph may be more suitable.
3. Some cost functions are much simpler than others.
4. You get half-points for non-optimal solutions, which means that you can get half of the points for just finding any valid connection from `FromStation` to `ToStation` and correctly computing the cost.
5. If your code finds a non-optimal solution for an example problem, you can compare it with the example solution to try to understand why your algorithm did not find the better solution.
6. The `arrivaltime` cost function is much trickier because of the change time, at least if you want to ensure that you find optimal solutions. If you cannot find optimal solutions, you could instead settle for “probably optimal” solutions, which could still give you almost all of the points.
7. If debugging becomes too difficult, you could consider creating test cases and/or making a small test schedule.
8. You will notice that efficiency matters for this problem. Nevertheless it is not necessary to use a fast programming language (e.g. everything can be solved in Python – it may

just take a while to find all the connections). Tip: You can use a profiler to find potential bottlenecks in your implementation.

9. Make sure you can access the relevant connections very efficiently (e.g. without a database lookup each time). In the past, this was a serious bottleneck for some students.
10. Make sure you get the handling of times (arrival and departure) right, possibly by implementing unit tests.

2 Common issues

1. Ill-formed CSV files. You can solve the example problems and check your solutions with the script from the assignment repository [AR] to see if your CSV is correct. This is a good way to check if your solutions are correct too.

References

- [AR] *Repository for Assignment 1: Find the best train connection.* URL: <https://gitlab.rrze.fau.de/wrv/AISysProj/ws2425/a1.1-find-train-connections/assignment>.
- [AS] *Assignment 1: Find the best train connection.* URL: <https://kwarc.info/teaching/AISysProj/WS2425/assignment-1.1.pdf>.