

42886 Optimisation of Operational Transport
Systems
Project 3 - Dynamic Dispatch Systems

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1 The Ambulance Service

You have been given control of an ambulance service covering a cluster of cities. A number of *sites* have been setup for the ambulances to stay at when they are not in operation. You now need to acquire a set of ambulances, assign them to sites, determine a dispatch and a relocation strategy.

There are 7 cities in the area to be covered. One main city, three big and three small satellite cities. Each city has a site conveniently located at its center, but the range of the ambulances from the different sites will overlap.

The calls have been divided into three categories: Priority 1 calls requiring an ambulance on site within 10 minutes, priority 2 requiring an ambulance on site within 20 minutes and priority 3 requiring an ambulance on site within 25 minutes. There are 53%, 33% and 14% priority 1, 2 and 3 calls respectively. The calls are assumed to arrive uniformly distributed during an 8 hour day.

You aim to service at least 95% of all priority 1 calls on time, and 80% of the remaining calls on time.



You are allowed to relocate ambulances, but doing so will make the ambulance unavailable during the driving time between the sites.



1.1 Objective Function

Each minute between a call and it being serviced is penalised with one unit of cost. If the time exceeds the deadline of 10, 20 and 25 minutes respectively, the cost will *furthermore* incur a cost of $3t^5$, $2t^4$ and t^3 for tardiness of priority p of 1, 2, and 3 respectively.

The number of ambulances needed to service the area should also be minimised.

2 Tasks



The overall task will be for you to decide on a suitable number of ambulances to use for the scenario defined in the supplied framework. To accomplish this, a set of subtasks will have to be done:

- Define a strategy of distributing ambulances among a given set of possible

sites.

- Implement a dispatch strategy deciding for each call what ambulance should service it.
- Implement a relocation strategy. (You may select not to relocate, but document it.)
- Decide through simulation on one or more suitable numbers of ambulances needed to attain a reasonable level of service.

The scenarios and tasks in this project differ from the models presented at the lectures. Reflect on and document the different assumptions you encounter.

You will *not* be required to use the math models from the lectures, but help is available if you want to use math models instead of heuristics/policies.

3 Formalia

Your project must be done in a group of 2 unless otherwise agreed¹, and must be handed in no later than *25/11 - 2016* on CampusNet. You must hand in a zip containing the entire project as an attachment to your report. The report may be no longer than 12 pages excluding visualisations, tables, front page etc. Do however limit the use of visualizations to a sensible amount.

¹You may continue in your previous groups.