Ambulance service

Changes to the setup introduced by the simulation project:

1. The accident rates are as follows:
   - $\alpha_1 = 150$ acc/h morning (8AM to 4PM).
   - $\alpha_2 = 250$ acc/h afternoon (4PM to 12AM).
   - $\alpha_3 = 50$ acc/h night (12AM to 8AM).
2. We introduce operating costs for the ambulances:
   - 20 euro cents per km for all ambulance types.
   - 100 euro per hour for a basic ambulance; 120 euro per hour for a standard ambulance, and 200 euro per hour for a complete ambulance.
   - Both types of operating cost are only charged when an ambulance is in service, i.e. not waiting at the depot.
3. The rest of the monetary values are subject to the following changes:
   - There is no limit on the available budget.
   - The expected lifespan of an ambulance is 5 years, and of a hub is 10 years. Since your simulation is for a single day, and in order to have a meaningful combination of fixed and operating costs, the fixed costs for constructing a hub and purchasing an ambulance need to be discounted for a single day using a 0% interest rate.
4. Returns to the hub after serving an accident are changed in the following way:
   - A mild accident can be served on the spot, after which the ambulance can continue on its way without returning to the hub.
   - A moderate accident can be served on the spot by a complete ambulance after which the ambulance can continue on its way without returning to the hub. However, if it is served by a standard ambulance, a return to the hub is required.
   - A severe accident always requires a return to the hub.
   - A return to the hub is required in all cases where there is no other accident immediately assigned to the ambulance. In other words, waiting at the accident spot is not permitted.

Optimization and
Simulation
Spring 2016

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Project 3, Group 3: Ambulance service

Tasks:

1. The objective is to minimize the total discounted daily cost subject to service level. The service level requires that at least 95% of accidents should be served within a given amount of time. Test for 30 and 15 minutes.

2. Identify the decision variables.

3. Design an optimization algorithm and apply it to solve the problem. The value of the objective function is evaluated by discrete event simulation.

4. Like in the simulation project, the objective function can reflect various policies of the decision maker: whether they want to optimize over the average, best, worst, or certain percentile of the objective function distribution. Decide what your position is and justify it, or present results for several alternatives.

5. Use your creativity and design a new dispatching strategy that leads to a lower cost solution.

   Bonus question: Design a series of what-if scenarios of the impact of the demand parameters given in your problem on the value and structure of the best solution. Interpret the results.