Uppsala universitet, 2022
1TD184 Optimisation

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Assignment 3 – basic option
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Assignment 3: Linear programming in staff planning

Background

The Munich public transport company has decided to extended their subway network in the metropolitan area. The traffic planning department has estimated that at least the following number of staff is needed each four-hour interval throughout a standard 24-hour period:

Time period	Staff
06–10	700
10–14	500
14–18	600
18–22	300
22–02	100
02–06	50

All staff work in 8-hour shifts. There are six possible shifts that start on the hour in the beginning of each 4-hour period in the table. All staff have the same hourly salary, except that the hourly salary is 100 % higher during the night between 22.00 and 6.00.

Tasks

1. Find how many employees are needed for each of the six shifts in order to minimize the salary costs for MVG, while at the same time satisfying the staffing requirements.

   Note: When solving the resulting LP in Matlab, use the following command before calling `linprog`:

   ```
   options = optimset('Simplex','on','LargeScale','off');
   ```

   and call `linprog` with `options` as the last argument (see `doc linprog` for more information).

2. The company is considering to halven the number of tours between 10 and 14. For this, they would need 250 workers for this shift. Run the resulting optimization problem and report the change in labor costs. Explain your result!

3. Try running problem (1) with the default large-scale algorithm (a so-called interior-point method) instead of the algorithm of simplex type which is used by setting options as in (1). To use the large-scale algorithm, set

```
options = optimset('LargeScale','on');
```

and call `linprog` with `options` as the last argument. Compare with the result you obtained in (1). Can you think of any reason for the difference?