# CAS 781 Assignment 1

1. This question involves the TACOMA paper. We would like to consider the problem of determining the appropriate active set of servers and their utilizations, for the following problem setting. There are 16 servers, and we would like to look at three settings, where the arrival rates are 2 per second, 8 per second and 14 per second. In each case, we would like the mean response time to be 1.5 seconds (you can assume that all underlying distributions are exponential). The servers are all identical, with processing rate 1 per second, redline temperature of 25 degrees and power consumption (in Watts) of $150+100u$, where $u$ is the server's utilization. The cooling CoP is $0.0068T_{sup}^2 + 0.0008T_{sup} + 0.458$. The heat recirculation matrix $D$ is given by (entries are in degrees per watt):

$$\begin{bmatrix} .015 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ .0015 & .015 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & .0015 & .015 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & .0015 & .016 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & .0015 & .016 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & .0015 & .016 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & .0015 & .017 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .017 & .003 & .002 & .001 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .017 & .003 & .002 & .001 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .017 & .003 & .002 & .001 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .016 & .003 & .002 & .001 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .016 & .003 & .002 & .001 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .016 & .003 & .002 & .001 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .015 & .003 & .002 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .015 & .003 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & .0015 & .015 \end{bmatrix}$$

Determine the optimal active set of servers and their utilizations through (i) doing an exhaustive search for the optimal solution, (ii) solving an appropriate MIP problem, and (iii) using the TASP-LRH heuristic in the paper.

2. Read the paper by Zapater et al. Contrast their approach and results with the TACOMA paper. You should discuss the data that is required to perform workload optimization, the approaches to solving the problem, and what you feel are the pros and cons of the two approaches.