Homework

1. (Problem 7.1) (i) Consider a three-node fully–connected network. Thus there are three classes, with each class having one direct and one alternative route. Suppose that each link has C circuits; suppose that each class has offered load ρ and average revenue 1. Find the max–flow bound for the average revenue by considering the case $\rho \leq C$ and $\rho > C$. (ii) Now suppose that the offered load for one class is $C + \epsilon$ and that the offered load for the two other classes is $C - \epsilon$. Again find the max–flow bound.

2. (See page 265.) Consider a symmetric network, i.e., $C_j = C,\ t_j = t,\ \lambda_j = \lambda$ for all $j \in \{1, \ldots, J\}$, with a sequential routing. Assume the routing scheme also symmetric: the number of mth choice routes that use link j is equal to 2 for all j and m. Using the reduced load approximation show that if $R \in \mathcal{R}_j$ is the mth choice route for some call, then the expected call establishment rate on the route R is

$$\mathbf{E_q}\left(\lambda_R(\mathbf{U}) \,|\, U_j = c\right) = \begin{cases} \lambda\ q(C)\ [1 - \bar{q}(C - t - 1)^2]^{m-1}\ \bar{q}(C - t - 1) & c < C - t \\ 0 & c \geq C - t. \end{cases}$$

Using the above result and the symmetric routing assumption show that

$$\alpha(c) = \begin{cases} 0 & c = C \\ \lambda & C - t \leq c < C \\ \lambda + \frac{2\ \lambda\ q(C)\ \{1 - [1 - \bar{q}(C-t-1)^2]^M\}}{\bar{q}(C-t-1)} & 0 \leq c < C - t. \end{cases}$$