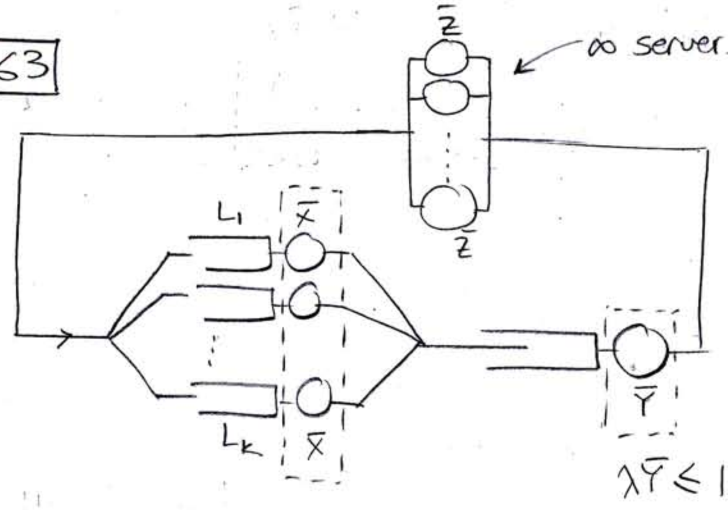
$\boxed{3.63}$



$\lambda\bar{X} \leq K$

(avg no of "customers" in the servers is no more than K)

we have $\lambda\bar{X} \leq K$ and $\lambda\bar{Y} \leq 1$

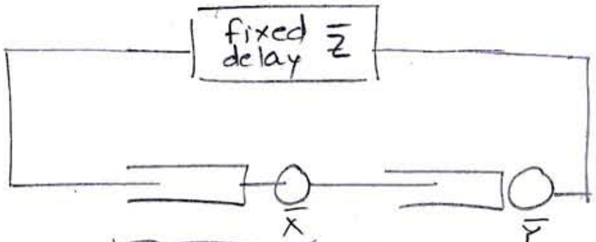
Since the total number of "customers" in the system is N at most

Therefore : $\lambda\bar{X} + \lambda\bar{Y} + \lambda\bar{Z} \leq N$

So we have $\lambda \leq \min\left\{ \frac{K}{\bar{X}}, \frac{1}{\bar{Y}}, \frac{N}{\bar{X}+\bar{Y}+\bar{Z}} \right\}$

To obtain lower bounds, we consider worst case delay scenarios

(a) under general routing method, the worst case delay case is that of the routing method that routes packets through one transmission line only :

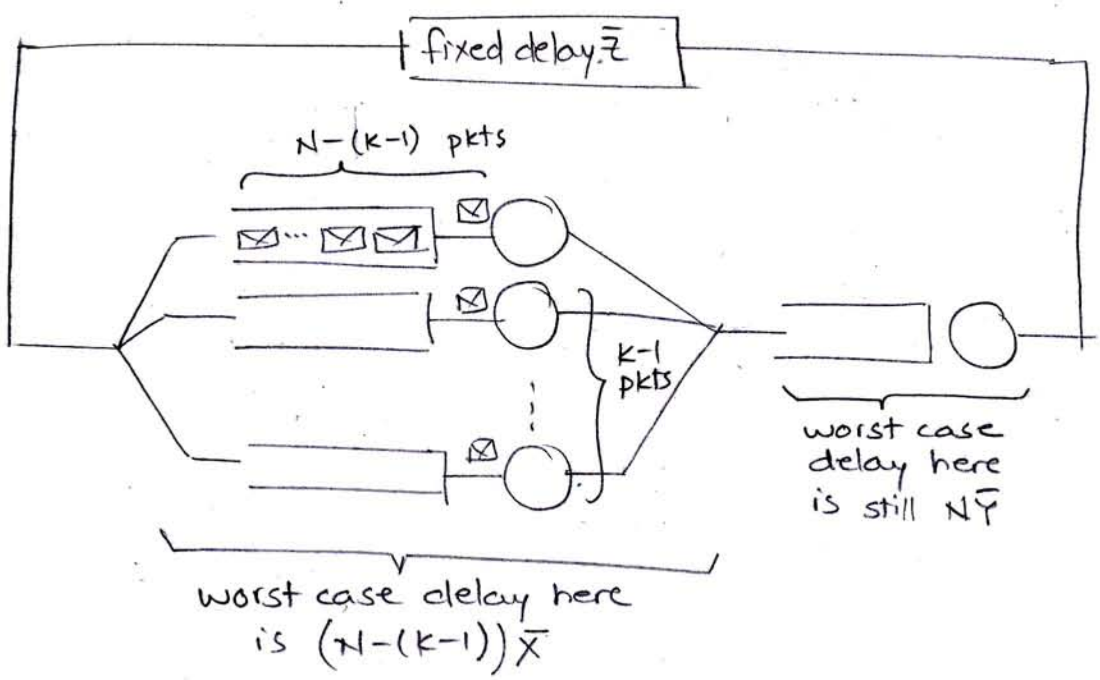


$\underbrace{\qquad}_{\text{the avg delay here is at most } N\bar{X}}$ $\underbrace{\qquad}_{\text{the avg delay here is at most } N\bar{Y}}$

$\therefore$ worst case avg. delay $= N\bar{X} + N\bar{Y} + \bar{Z}$

$N = \lambda T$ & $T \leq N\bar{X} + N\bar{Y} + \bar{Z} \Rightarrow \frac{N}{N\bar{X}+N\bar{Y}+\bar{Z}} \leq \lambda$

(b) If the routing method is such that whenever one of the K lines is idle there is no packet waiting at any of the other lines, then the worst case delay scenario is :



$\therefore$ worst case delay $= (N-K+1)\bar{X} + N\bar{Y} + \bar{Z}$

$N = \lambda T$ & $T \leq (N-K+1)\bar{X}+\bar{Y}+\bar{Z} \Rightarrow \dfrac{N}{(N-K+1)\bar{X}+N\bar{Y}+\bar{Z}} \leq \lambda$