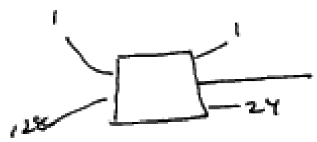
Solutions to
Network Performance Homework
EECS 663



1. $C = 64\,kb/s$

$L = 128$ bytes $= 1024$ bits

$\bar{T}_h = \frac{1024}{64 \times 10^3} = 16\,ms$

$P_L = 1\%$ $\quad N = 24 = \#$ output Lines

From table

$A = 15.3 = \lambda \bar{T}_h$

$\lambda = 15.3/.016 = 956$ packets/sec

$M = 128 =$ Input Lines

$\lambda_i = 956/128 = 7.4$ packets/sec

2.

$M = 24$ $\quad \lambda_i = 10$ packets/sec

$\lambda_T = 24 \cdot 10 = 240$ packets/sec

$l = 100$ bytes $= 800$ bits

$c = 56\,kb/s$

$\bar{T}_h = 800/56{,}000 = 14\,ms$

$B = 20\%$

$A = 240 \cdot 0.014 = 3.4 \Rightarrow N = 5$ from table

3. $P_B = 1\%$ $M = 120$ phones

.05 Erlang / phone

$A = .05 \cdot 120 = 6$ Erlangs

from table $N = 13$

Traffic 6 → 9 Erlangs

$N = 13$ → ~6% from table

4.

$\bar{L} = 125$ bytes = 1000 bits

$\lambda_i = 10$ packets /sec

$M = 25$ terminals

$\lambda_T = 250$ packets /sec

Design stat mux such That

$E[T] = 100ms$

$$.1 = \frac{1}{\mu - \lambda_T} = E[T]$$

$10 = \mu - \lambda_T \Rightarrow \mu = 260$ packets /sec

$C = (1000 \text{ bits/packet})\, 260$ packets/sec

$= 260$ kb/s

5. Design stat mux

$P_B < 2\times10^{-4}$

$E[T] < 512ms$

given

$\lambda = 10$ packets/sec

$L = 1024$ bits/packet

$$.512 = \frac{1}{\mu-\lambda} = E\{T\}$$

$1.95 = \mu - \lambda \rightarrow \mu = 11.95$

$\rightarrow C = 12,236$ b/s

now use $\rho = {}^{10}/_{11.95} = .84$

$$P_b = \frac{(1-\rho)\rho^N}{1-\rho^{N+1}} \rightarrow N = 41 \text{ so}$$

M/M/1/N buffer size = 40

6. M = 50 VBR sources

$L = 2000$ bits

$\lambda_i = 1000$ packets/sec

$C = 150$ Mb/s

$\lambda_T = 50,000$ packets/sec

$$\rho = \frac{(2\times10^3 \text{ bits/packet})\ 50,000 \text{ packets/sec}}{150\times10^6 \text{ b/s}}$$

$= .667$

$$E[N] = \frac{\rho}{1-\rho} = 2$$

$$E[T] = E[N]/\lambda_T = 40\mu s$$