**EECS 148 Homework 2**

1. A) Avg = (L/R + 2L/r + … + (N-1)\*L/R)/N

= L/RN (1 + 2 + … N-1)

= L/RN \* N(N-1)/2

**= L(N-1)/2R**

B) **L(N-1)/2R** because all N packets will leave the queue before the next N packets arrive

1. A) The maximum throughput will be the path k that has the largest minimum transmission rate.

MAX{MIN{path k=1 transmission rates},…, MIN{path k=M transmission rates}}

B) Maximum throughput will be the summation of all path’s minimum transmission rate:

Summation of {MIN{path k=1 transmission rates},…, MIN{path k=M transmission rates}}

1. Total delay = dprop + d­­­trans + d­­­proc + d­­­queue = ?

d­­­trans = L/R = 100TB/120Mbps = (100 \* 10^12 \* 8) bits / (120 \* 10^6) bits/sec = 6666666.667sec

= 1852 hours = 77.17 days

Because the transmission delay is so large, we can omit the other types of delay because **FedEx overnight delivery will be faster** regardless or the processing, propagation and queue delay.

1. A) R \* dprop  = R \* Space/Speed = (1.5Mbps \* 25,000 \* 10^3 m)/( 2\*10^8 m/s) = **.1875Mb**

B) Maximum number of bits will be **.1875Mb**

C) Space/# of bits in link = 25,000 \* 10^3 m / .1875 \* 10^6 = **133.33m, Yes longer than a**

**football field**

D) Space/# of bits in link = Space/R \* dprop = Space/R\*(Space/Speed) = Speed/R = **s/R**

1. For reference: using distance from Earth to Satellite as 36,000km
2. dprop = Space/Speed = 36,000 \* 10^3m/ (2.5 \*10^8 m/s) = **.144sec**
3. bandwidth delay = R \* dprop = 8Mbps \* .144s = **1.152Mb**
4. d­­­trans = L/R = T/R. Solving for T we get: T = d­­­trans \* R = 60sec \* 8Mbps = 480Mb

**480Mb is the minimum value of T of the microwave link to continuously transmit**